Gleneden Sanitary District

LINCOLN COUNTY, OREGON

Wastewater Treatment Plant Facility Plan

June 2023

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Gleneden Sanitary District

LINCOLN COUNTY, OREGON

Wastewater Treatment Plant

Facility Plan

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TABLE OF CONTENTS

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0 EXECUTIVE SUMMARY

0.01 Purpose

This Executive Summary is a quick synopsis of the content included in the larger report. References have been made to the respective sections where additional detail can be found.

0.02 Background

The Gleneden Sanitary District (GSD) owns, operates, and maintains a wastewater collection system that serves unincorporated communities within Lincoln County along the central Oregon coast. The system was first placed into service in 1976 and covers the area between Salishan and Fogarty Creek.

The wastewater from the collection system is conveyed south to the Fogarty Creek State Recreational Area. A pump station within the state park parking lot pumps wastewater to the City of Depoe Bay collection system for treatment at the Depoe Bay Wastewater Treatment Plant. The District and City use these shared facilities according to an intergovernmental agreement (IGA) last updated in 1998 (Appendix A). The IGA requires GSD and the City to share financial responsibility for the joint facilities in proportion to the equivalent dwelling units served by each party. On March 1, 2022 the City of Depoe Bay issued a letter to the GSD enacting the termination clause in the IGA (Appendix B). Consequently, GSD must find an alternative means to treat wastewater beginning 5-years from the date of the IGA notice of termination, March 1, 2027.

GSD contracts with the Kernville-Gleneden Beach-Lincoln Beach (KGBLB) Water District to operate and maintain the wastewater collection system. This arrangement allows the two Districts to share staff, offices, vehicles and some materials, thereby controlling costs by avoiding unnecessary duplications. The Water District covers the area served by GSD, plus the Salishan Resort and private community, the Siletz Keys neighborhood, and the Kernville neighborhood areas.

0.03 Need for Planning Effort

Depoe Bay has made it clear that they are not interested in continuing to treat wastewater from GSD in the future. Several attempts have been made at negotiating with Depoe Bay to continue treating GSD wastewater without success. Although it is the desire of the District that the IGA with Depoe Bay can be renewed, they have acknowledged the need to prepare for developing an alternative means of wastewater treatment. This facility plan for wastewater treatment is intended to identify options for the District to develop alternative treatment means, support long-term planning for the District's wastewater treatment and collection systems, and provide guidance to the District by identifying the steps necessary for developing alternative treatment options.

The District will require funding support to design and construct any new treatment alternatives identified in this report. In order to meet the criteria of several of the most common funding agencies, including DEQ, Business Oregon, US Department of Agriculture (USDA) and the Rural Community Assistance Corporation (RCAC), it is necessary to develop a wastewater facility planning document to confirm that the proposed project protects public health and maintains a high quality of life, is environmentally sound, and is an efficient use of public funds. This document is being prepared to satisfy those requirements and has been developed to conform with *Preparing Wastewater Planning Documents and Environmental Reports for Public Utilities* (Business Oregon, USDA, RCAC, DEQ, 2019).

0.04 Purpose and Scope of Study

The purpose of this study is to identify and evaluate feasible wastewater treatment options to meet the District's projected service needs. This report builds upon the A*nalysis of Wastewater Options, Phase 1* (Harper Houf Peterson Righellis, Inc., 2020) (Appendix E), and, to avoid duplication of effort, draws upon information in that previous report.

0.05 Requirements for Wastewater Treatment Facilities

05.1 National Pollutant Discharge Elimination System (NPDES) Phase 1 Permit

A permit must be obtained from the Oregon Department of Environmental Quality (DEQ) to construct and operate a wastewater treatment plant in Oregon and to discharge treated effluent from the facility. DEQ issues two types of permits: 1.) an NPDES permit is required for wastewater treatment plants that discharge into surface waters, and 2.) a WPCF permit is required for facilities that recycle effluent according to DEQ regulations.

DEQ's authority to issue these permits is established in OAR 340-045. The permits are required to keep wastewater facilities in compliance with the Federal Water Pollution Control (Clean Water) Act and related State statutes. The conditions of operation described in the permits generally fall into the following categories:

- discharge flow rate limits
- pollutant concentration and total load limits
- biosolids pollutant concentrations and load limits for land application
- effluent monitoring and reporting
- biosolids monitoring and reporting
- minimum required training level for operators
- other general conditions of operation

The Depoe Bay wastewater treatment plant has been issued National Pollutant Discharge Elimination System (NPDES) Permit No. 101383 (Appendix D). GSD does not have its own NPDES permit but rather operates under the authority of the Depoe Bay permit. The IGA between the District and Depoe Bay obligates the District to construct and operate the District's collection system in accordance with DEQ rules and regulations.

05.2 Treatment Requirements

NPDES permits for a surface-water discharge contain effluent quality limitations that are either based on the receiving water body water quality standards or a minimum required treatment level. The effluent limits in the permit determine required wastewater treatment plant design criteria.

05.3 Effluent Water Quality Criteria

Current water quality standards for Oregon waters are published in OAR 340-041 and include both state-wide and basin-specific water quality criteria. GSD and the surrounding vicinity are located in the Mid-Coast Basin. This basin encompasses watersheds and near-shore ocean waters from the Salmon River north of Lincoln City, to streams in the Oregon Dunes National Recreation Area south of Florence.

Wastewater effluent quality criteria for each specific water body are impacted by the designated beneficial uses identified in the water quality standards for the respective water body. The beneficial uses DEQ has designated for water bodies in the Mid Coast Basin are summarized in Chapter 6.

05.4 Projected Population Methodology

Per Oregon Administrative Rule 660-032-0020, communities outside the Metro boundary must apply the most recent final forecast issued by the Portland State University Population Research Center (PSU PRC) to develop population projections. As an unincorporated area of Lincoln County, population estimates within the District boundaries were not specifically defined during the decennial census process conducted by the U.S. Department of Commerce (U.S. Census Bureau, 2021) or in the annual population estimates calculated by the PSU PRC as reported in the *Proposed Coordinated Forecasts for Lincoln County, its Urban Growth Boundaries (UGBs), and the Area Outside UGBs* dated March 2021 (PSU, 2021).

The 2021 calculated population of the District is 4,770 people considering residential EDUs only. The residential equivalent population served by the District is estimated to be 4,886 people including all EDU's. This population was determined by multiplying the total number of EDUs by the average number of persons per household in unincorporated areas of Lincoln County (2.2 Persons Per Household) as reported in the 2010 U.S. Census (U.S. Census Bureau, 2021). This population estimate is slightly higher than the population estimates presented in the District's *2018 Wastewater Collection System Facilities Plan Update* which estimated the 2022 population for the District at 4,428 persons (Harper Houf Peterson Righellis, Inc., 2018).

The HHPR report assumed that the growth rates and the average persons per household was a blend between the two neighboring communities of Depoe Bay and Lincoln City. Consequently, their projections used the District's 2017 EDU count, an average number of persons per household of 2.0 persons, and an AAGR of 0.9% to estimate the 2022 population.

Depoe Bay's average persons per household is the lowest in all of Lincoln County and likely underrepresents the District. Therefore, we have chosen to use the average Lincoln County

TABLE 05-1 LINCOLN COUNTY POPULATION ESTIMATES

	Historical			Estimates		Forecast			
Location	**2000**	**2010**	**AAGR (2000-2010)**	**2020**	**AAGR (2010-2020)**	**2045**	**2070**	**AAGR (2020-2045)**	**AAGR (2045-2070)**
Lincoln County (Overall)	44,479	46,034	0.3%	48,304	0.5%	53,500	53,858	0.4%	0.0%
Outside UGBs	17,036	17,216	0.1%	17,064	-0.1%	17,649	16,041	0.1%	-0.4%
Larger Sub-Areas									
Lincoln City	8,752	8,987	0.3%	9,671	0.7%	10,827	10,835	0.5%	0.0%
Newport	9,971	10,431	0.5%	11,882	1.3%	12,223	11,082	0.1%	-0.4%
Smaller Sub-Areas									
Depoe Bay	1,107	1,337	2.7%	1,450	0.8%	3,602	6,602	3.6%	2.4%
Siletz	1,150	1,322	1.4%	1,302	-0.1%	1,542	1,676	0.7%	0.3%
Toledo	3,698	3,783	0.2%	3,782	0.0%	3,827	3,422	0.0%	-0.4%
Waldport	2,229	2,258	0.1%	2,373	0.5%	2,810	3,014	0.7%	0.3%
Yachats	626	701	1.1%	780	1.1%	1,020	1,187	1.1%	0.6%

Sources: U.S. Census Bureau; PRC Estimates; Forecast by Population Research Center (PRC).

persons per household of 2.2 people. Similarly, the AAGR of Depoe Bay was the highest in all of Lincoln County and does not correspond well with the observed growth rate of the District. However, all of the Lincoln County communities along the coast showed positive growth over the past decade, while the non-coastal areas of the County showed no-growth or negative growth. We have therefore chosen to use an AAGR that corresponds to the District observed growth of 0.2% which is higher than the Outside UGBs AAGR of -0.1% but lower than the Depoe Bay AAGR during the same period of 0.8%. Therefore, the projected residential equivalent population of the District at the end of the planning period in the year 2040 is 5,085 people, corresponding to 2,335 EDUs. The 2021 PSU PRC forecast for Lincoln County is shown in Table 03-1 and the District population and EDU forecast through the planning period is summarized in Table 05-2.

TABLE 05-2 DISTRICT POULATION AND EDU FORECAST THROUGH PLANNING PERIOD

Forecast for District EDUs and Average Population				
Year	Total EDU's (1)	Residential Equivalent Estimated Population (2)	Residential EDUs	Estimated Population (3)
2020	2,221	4,886	2168	4,770
2025	2,243	4,935	2,190	4,817
2030	2,266	4,985	2,212	4,866
2035	2,289	5,035	2,234	4,915
2040	2,312	5,085	2,256	4,964
2045	2,335	5,136	2,279	5,014

(1) EDU and population projections based upon 0.2% AAGR and 2020 EDU count compiled by District

(2) Residential Equivalent Pop. Based on all EDUs in District with 2.2 PPH

(3) Residential EDUs only with 2.2 PPH

For the purposes of this study, the 2045 equivalent estimated population is 5,136 people. This is the population number that will be used for future flow projections.

0.06 Design Criteria

06.1.1 Hydraulic Design Criteria

Hydraulic design criteria have been determined by analyzing historical flow rates from the District as measured by the flow meter at the Depoe Bay Wastewater Treatment Facility (WWTF), year 2021 and 2045 projected populations, and corresponding equivalent dwelling units (EDU's).

Wastewater from Gleneden Sanitary District (GSD) is pumped to the Depoe Bay WWTF via the Fogarty Creek Pump Station. Incoming flows are tracked at the at the Depoe Bay WWTF by a flow meter and documented as part of Depoe Bay's Daily Monitoring Report (DMR). Flow data from GSD was compiled from 2016 through 2021 to develop a 5 year dry weather, wet weather, and composite flow average, then the existing condition flow rates were determined according to the methodology established in the *Guidelines for Making Wet-Weather and Peak Flow Projections for Sewage Treatment in Western Oregon: MMDWF, MMWWF, PDAF, and PHF* (Oregon DEQ). The existing existing-condition flow rate analysis is discussed in detail in

Chapter 2, Section 2.6.1 *Existing Flow Rates*.

Using EDU projections for the end of the year 2045 planning period developed in Chapter 2, and existing flow rates per EDU developed in Chapter 3, projected flow rates at the end of the planning period were determined and are shown in Table 06-1 below.

The treatment facility is required by DEQ to be able to treat the Ten-Year Maximum Month Dry Weather Flow Rate ($MMDWF_{10}$) of 0.318 MGD and the Five-Year Maximum Month Wet Weather Flow Rate ($MMWWF_5$) of 0.443 MGD.

DEQ guidelines for wastewater conveyance and treatment require critical system components to be designed to convey the 5-year Peak Instantaneous Flow (PIF) which represents the highest flowrate over the course of an hour that the plant may experience in a 5-year period. The PIF corresponding to the 5-year, 24-hr storm was calculated from a plot of flow rate versus recurrence probability. The determination of the present day PIF and PFW are detailed in Chapter 2, Section 2.6.1.3. The peak instantaneous flow for the end of the planning period was calculated to be 1.235 MGD.

TABLE 06-1 GSD EDU FLOWRATE PROJECTIONS

Parameter	Current Flow Rates (MGD)	Flow per EDU (gal/EDU)	Estimated 2045 Flow Rates (MGD)
Annual Flow Rates			
AAF	0.270	121	0.283
Dry Weather Flow Rates			
ADWF	0.239	107	0.251
Base Sewerage	0.239	107	0.251
$MMDWF_{10}$	0.318	143	0.334
Wet Weather Flow Rates			
AWWF	0.305	137	0.320
$MMWWF_5$	0.443	199	0.465
Peak Week (PWF)	0.558	251	0.585
Peak Day ($PDAF_5$)	0.919	413	0.964
Peak Instantaneous Flow $(PIF)_5$	1.178	529	1.235

06.1.2 Loading Design Criteria

Projected total pollutant loads at the end of the planning period were determined by comparing sampling data collected from the Fogarty Creek Pump Station with standard loading data from Metcalf & Eddy (Metcalf & Eddy, 2014). Existing loading data is analyzed and discussed in detail in Section 3.6.2, *Existing Pollutant Loading Rates.* Assuming that pollutant loads measured in pounds per capita day (ppcd) will remain the same, future loading can be predicted by multiplying this loading by the projected future equivalent population of the district at the end of the planning period. The maximum monthly dry weather flow is typically the controlling flow rate in establishing design loading for secondary treatment. Although flow rates may increase during winter months as a result of inflow and infiltration, loading for the District is highest in the summer during peak occupancy.

The sampling time frame was relatively short and produced a correspondingly small data set. The sampling information was compared to typical per capita loading rates from literature. In all instances, sampling loading rates were less than typical loading rates from literature. Therefore, the literature loading rates were selected as the design criteria because they are more conservative. Design loading and process sizing will be refined during preliminary design. A comparison of the sampled loading rates with typical loading rates is shown in Table 06-2 below.

TABLE 06-2 LOADING RATE COMPARISON

Constituent	Loading Rate (ppcd) Measured	Loading Rate (ppcd) Literature[1]	Loading Rate for Analysis (ppcd)
BOD5	0.08	0.20	0.20
COD	0.29	0.50	0.50
TSS	0.066	0.19	0.19
TKN	0.025	0.31	0.31
Ammonia-N	0.016	0.017	0.017
Total Phosphorous	0.0033	0.0048	0.0048

[1]Typical per capita loading rate with ground up kitchen waste from Table 3-13 (Metcalf & Eddy, 2014).

Total projected daily loading at the end of the planning period is shown in Table 06-3 below.

TABLE 06-3 ESTIMATED DAILY LOADING RATE

Parameter	Per Capita Loading Rate (ppcd)	Estimated Peaking Factor	Estimated Loading Rates (ppd) 2021	Estimated Loading Rates (ppd) 2045
Five-day Biochemical Oxygen Demand				
Annual Average	0.20	1.00	980	1,027
Max Month	0.27	1.33	1,303	1,366
Total Suspended Solids				
Annual Average	0.19	1.00	931	976
Max Month	0.25	1.33	1,238	1,298
Ammonia				
Annual Average	0.017	1.00	83	87
Max Month	0.024	1.40	117	122

Notes:
1. Annual Average per capita loading rates are taken from Metcalf & Eddy, Table 3-13 (column 4) due to lack of long term analytical data specifically for the District.
2. Max Month per capita loading rates were estimated by multiplying the annual average per capita loading rate by the typical 30-day sustained peak peaking factor shown in Metcalf & Eddy, Figure 3-3. Given the limited number of non-residential EDUs in the District, those EDUs were assumed to have wastewater constituent compositions similar to residential EDUs.

06.1.3 Redundancy and Reliability Design Criteria

Equipment Redundancy and Reliability

The EPA classifies wastewater facilities into one of three classes depending upon the level of redundancy and reliability that are needed to protect the receiving waters. Those classifications are defined in the EPA Technical Bulletin, *Design Criteria for Electrical, Mechanical, and Fluid Systems and Component Reliability* (EPA, 1974).

The Gleneden Wastewater Treatment Plant will likely be classified as a Class II facility since the proposed outfall is in the Pacific Ocean. The facility will have to comply with the requirement of this technical bulletin which dictates what the facility must contain and be able to do to prevent failures. This document requires a Class II treatment facility must include backups or redundancy to ensure continued operation without environmental harm if part of the system fails.

Design Flow Compliance Probability

The treatment facility is required by DEQ to be able to treat the Ten-Year Maximum Month Dry Weather Flow Rate (MMDWF10) of 0.318 MGD and the Five-Year Maximum Month Wet Weather Flow Rate (MMWWF5) of 0.443 MGD. DEQ also requires critical system components to be designed to convey the Peak Instantaneous Flow (PIF) of 1.235 MGD.

0.07 Alternatives Analysis

Several alternatives have been considered to provide wastewater treatment for the District including:

1. Do nothing: this alternative implies that the District will make no changes and maintain status quo by sending their wastewater to Depoe Bay. The District has made every reasonable attempt to retore the status quo relationship with no success. Therefore, this alternative must now be considered unfeasible.
2. Contract with an alternative wastewater district or municipality to treat the District's wastewater. Because none of the reasonably close facilities have the willingness nor capacity to accept wastewater from GSD this option is considered unfeasible.
3. Develop a Centrally Managed/Decentralized System: this alternative means to convert the District customers to on-site treatment facilities (septic systems) or develop several smaller wastewater treatment systems throughout the District all managed by the District. Implementing decentralized facilities is not considered a feasible option.
4. Develop an optimum combination of Centralized and Decentralized Systems: this alternative means to combine partially on-site treatment (usually solids settling or septic tanks) with a centralized treatment plant managed by the District. There is no operation value to removing solids early, therefore this option is not considered a viable alternative.
5. Optimize the current facilities. This alternative, although required to be included in the report, is not currently feasible because the District does not have its own WWTF and the City of Depoe Bay has presented the District with a termination notice. Even if the notice is rescinded or suspended, no current planning information is available regarding what is needed to maintain the Depoe Bay WWTF in service over the planning period.
6. Construct a new wastewater treatment facility. Based on the lack of other viable alternatives, the District is forced into a position of constructing a new wastewater treatment facility. The alternatives analysis for this facility are broken into three sections:
   a. Site Alternatives Evaluation. This analysis is completed in Chapter 6.
   b. Outfall Alternatives Evaluation. This analysis is completed in Chapter 5.
   c. Wastewater Treatment Process Alternatives Analysis. This analysis is completed in Chapter 7.

07.1 Alternatives Analysis: Treatment Plant Discharge

There are several discharge options that can be considered including:

1. Underground Injection. Because of the very restricted infiltration capacity of the soils, underground injection is not a viable alternative for the District.
2. Water Reuse. With the exception of irrigation, water reuse options are minimal. Since the majority of rainfall takes place in the season when vegetation is dormant, the District would not be able to irrigate during this period, which requires the District to have an alternative discharge location.
3. Inland surface water outfall to a river or creek. The only surface water with sufficient volume to accommodate an outfall year round is the Siletz River.
4. Ocean outfall. Many communities along the coast utilize ocean outfalls for their wastewater plants including the Cities of Florence, Yachats, Newport, Depoe Bay and Otter Crest. Lincoln City is planning to change their current outfall to Schooner Creek to an ocean outfall. There are several locations where ocean access is available where an ocean outfall can be extended.

The type and level of treatment that the District will need is highly dependent upon where the treated effluent is discharged. Discharges to waterbodies will require a regulatory mixing zone within which the effluent must meet water quality standards to protect beneficial uses and to prevent impairing the water quality of the receiving water.

Types of Permit Limits

Effluent limitations serve as the primary mechanism in NPDES permits for controlling discharges of pollutants to receiving waters. Effluent limitations can be based on either the best technology available to control the pollutants or limits that are protective of the water quality standards for the receiving water including beneficial uses and compliance with anti-degradation policy. These two types of permit limits are referred to as technology-based effluent limitations (TBELs) and water quality-based effluent limits (WQBELs) respectively. When a TBEL is not restrictive enough to protect the receiving stream, a WQBEL must be placed in the permit. (OR DEQ, 2018)

Water Quality Requirements of Discharges – Regulatory Mixing Zones

Wastewater effluent must be treated to a sufficient water quality standard so that residual pollutants will not have a detrimental effect on beneficial uses of the receiving water body and will not further degrade already impaired waters. Discharges are allocated a regulatory mixing zone (RMZ) by permit, and applicable water quality standards must be met at the edge of this zone before entering the receiving body. The mixing zone is the area within which the effluent is diluted with water from the receiving water body to reduce concentration levels of pollutants to an acceptable level. Consequently, the ability of a mixing zone to effectively dilute wastewater effluent is a function of the amount of water within the receiving water, the size of the mixing zone, and the initial concentration of the effluent.

Beneficial Uses

Wastewater effluent water quality standards are established to protect beneficial uses of the state's waters. Beneficial uses are designated for all waters of the state in the Oregon

Administrative Rules for water quality standards (Chapter 340, Division 41). In some cases, beneficial uses vary by waterbody or reach. In other cases, uses are designated for all waters in a basin or sub-basin.

The Mid-Coast Basin, of which the District is a part, has designated beneficial uses for all streams, estuaries and adjacent coastal waters per the Table 07-1 Mid-Coast Beneficial Uses below. More specific beneficial uses for fish, salmon and steelhead, shellfish, and recreational uses within the District are more specifically discussed in Section 6.1.3.

TABLE 07-1 MID-COAST BENEFICIAL USES

OAR 340-041-0220
Table 220A
Designated Beneficial Uses - Mid Coast Basin

Beneficial Uses	Estuaries & Adjacent Marine Waters	All Steams & Tributaries Thereto
Public Domestic Water Supply[1]		X
Private Domestic Water Supply[1]		X
Industrial Water Supply	X	X
Irrigation		X
Livestock Watering		X
Fish & Aquatic Life[2]	X	X
Wildlife & Hunting	X	X
Fishing[3]	X	X
Boating	X	X
Water Contact Recreation[3]	X	X
Aesthetic Quality	X	X
Hydro Power		X
Commercial Navigation & Transportation	X	

[1] With adequate pretreatment (filtration & disinfection) and natural quality to meet drinking water standards.
[2] See also Figures 230A and 230B for fish use designations for this basin.
[3] For coastal water contact recreation and shellfish harvesting uses, see also Figures 220C (Salmon River Estuary), 220D (Siletz Bay), 220E (Yaquina Bay), 220F (Alsea River Estuary), 220G (Yachats River Estuary), and 220H (Siuslaw River Estuary)

Anti-Degradation

Wastewater effluent must also comply with the State's anti-degradation policy. *A fundamental premise of the Clean Water Act is the maintenance and restoration of the chemical, physical, and biological integrity of the Nation's waters. This concept forms the basis for what is referred to as antidegradation. Antidegradation policy is an integral component of DEQ's water quality standards. The antidegradation policy complements the use of water quality criteria. While* *criteria provide the absolute minimum values or conditions that must be met in order to protect designated uses, the antidegradation policy offers protection to existing water quality, including instances where that water quality equals or is better than the criteria. Antidegradation policy prohibits degradation of water quality in some circumstances and provides for exceptions to this prohibition in others; however, degradation of water quality is allowed only after a systematic decision-making process considering many factors. These factors include the classification of the waterbody, consideration of alternative treatments to the proposed activity, and comparison of economic and social benefits with environmental costs. In addition, the antidegradation policy requires the involvement of the public through direct notice and through coordination with other government agencies. In this way, decisions to maintain or to change current water quality are made only after a deliberate and inclusive process*. (OR DEQ, 2001)

Within the District, only three waterbodies are currently listed per the DEQ's 2022 approved Integrated Report (OR DEQ, 2022):

1. Gleneden Beach: The beach and waters immediately adjacent to the beach from Fogarty Creek to Siletz Bay is listed as impaired for shellfish toxins.
2. Siletz Bay and Estuary: The bay and estuary are listed as impaired for temperature- (year round), and toxic substances for both aquatic life and human contact.
3. Siletz River: The river is listed as impaired for temperature (year round).

A summary of the costs of various outfall locations and site development costs is included in Table 07-2.

07.2 Alternatives Analysis: Treatment Plant Site

The Gleneden Sanitary District (GSD) collection system currently moves wastewater from north to south via a combination of gravity sewers and pump stations. Consequently, without significant infrastructure changes and modifications to the collection system, the logical area for a future wastewater treatment plant is toward the south end of the District. Another influencing factor in selecting a preferred site is where the treated effluent outfall will be located. If the outfall was to the Siletz River, which is to the north of the District, either the untreated wastewater or the treated effluent would need to be pumped back to the north end of the District. An ocean outfall could be located anywhere north to south within the District based upon the availability of an east-west corridor between the plant and the Ocean. Finally, the site must accessible, must be flat and large enough to construct a multi-acre facility, and must be available for procurement by the District. For evaluation purposes it was decided that 4 acres is a reasonably sized property to accommodate the initially needed processes and activities at the plant and was used as the size to compare various site development costs. Sites were also evaluated on their growth potential, and development costs for expanded the sites to 8 acres were also considered.

Three sites were chosen for further evaluation and meet the criteria described above. Existing owners were queried and all sites are potentially available for purchase by the District. The three possible site locations are also shown in Figure 7-1. Cost analysis for the various site alternatives include the following cost components:

- site access and utility extension to the site
- site grading to level the site in preparation for construction of the treatment facility
- site utilities, roads, sidewalks, site lighting and pavement
- modifications to the Fogarty Creek Pump Station and extension of the new forcemain to the site

- construction of the outfall pipeline to direction drilling pit at the beach
- Land acquisition costs. Cost per acre is based upon Lincoln County appraised land value for 2022.

A summary of the costs of various outfall locations and site development costs is included in Table 07-2.

TABLE 07-2: OUTFALL AND SITE ALTERNATIVES COST SUMMARY

	Site Option No. 1			Site Option No. 2		Site Option No. 3	
	4 acres	8 acres	4 acres Alt. Access	4 acres	8 acres	4 acres	8 acres
Ocean Outfall	$24,055,734	$26,229,993	$17,369,154	$18,640,588	$19,640,572	$16,474,535	$18,047,218
Siletz Outfall - Opt 1	$38,441,391	$40,615,650	$31,754,811	$28,340,396	$29,340,380	$29,486,097	$30,486,082
Siletz Outfall - Opt 2	$37,444,201	$39,618,459	$30,757,621	$27,343,205	$28,343,190	$28,488,907	$29,488,892
Siletz Outfall - Opt 3	$36,372,274	$38,546,533	$29,685,694	$26,271,279	$27,271,263	$27,416,981	$28,416,965

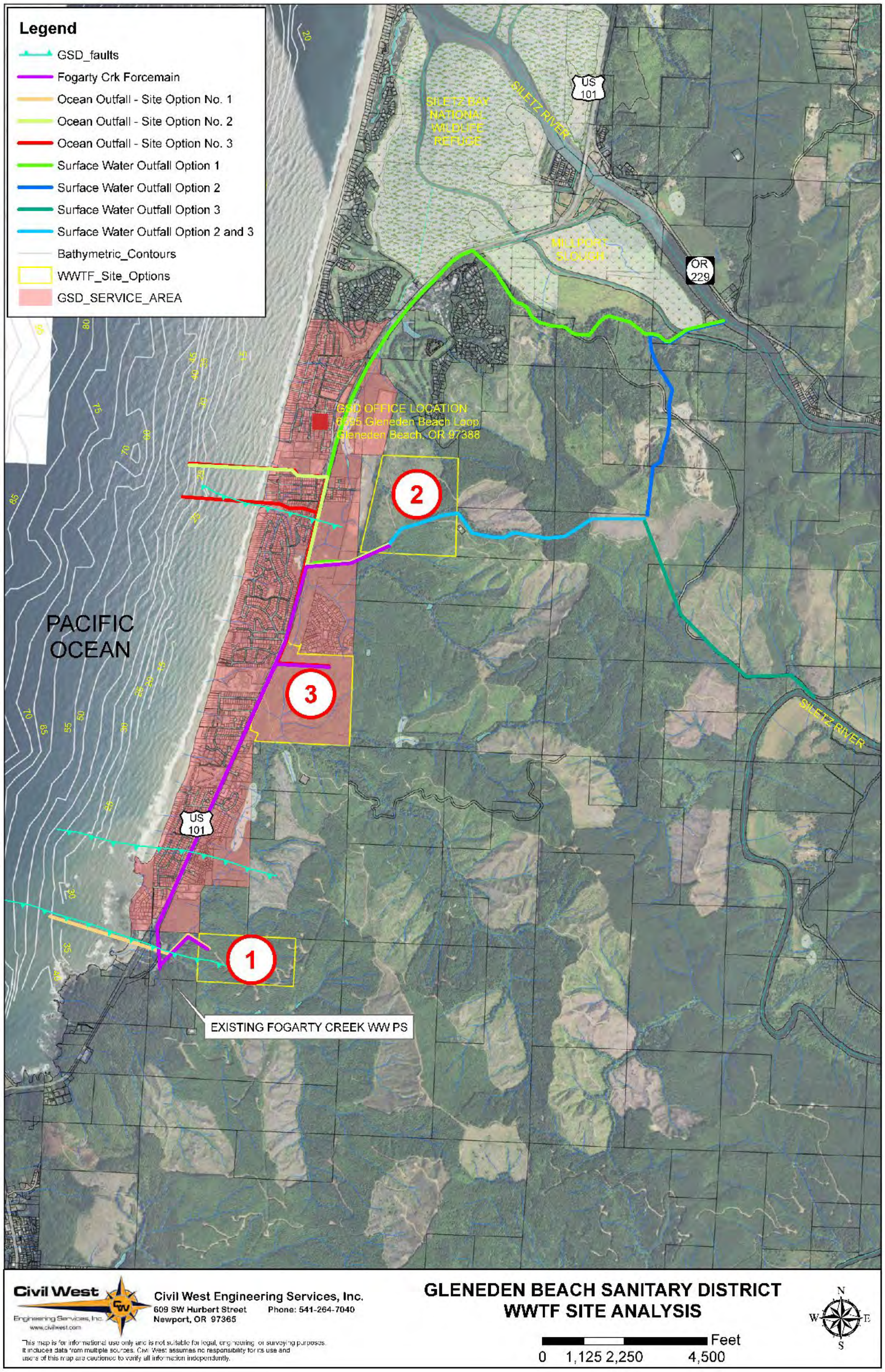

FIGURE 07-1 - GSD ALTERNATIVES MAP

07.3 Alternatives Analysis: Treatment Process

The process of selecting the appropriate size and type of treatment equipment is dependent upon many factors. The primary considerations for equipment analysis and recommendations are based upon the following:

- Projected flow and loading through the planning period
- Expected water quality effluent limits determined by the outfall location
- Redundancy and Reliability Requirements
- Site constraints (size, topography, climate, proximity to other uses, etc.)
- Solids processing and handling constraints

The Loading Projections Summary developed in Chapter 4 and used in treatment system analysis are summarized in Table 07-3 below.

TABLE 07-3: LOADING PROJECTIONS SUMMARY

Parameter	Per Capita Loading Rate (ppcd)	Estimated Peaking Factor	Estimated Loading Rates (ppd)	
			2021	2045
Five-day Biochemical Oxygen Demand				
Annual Average	0.20	1.00	980	1,027
Max Month	0.26	1.30	1,274	1,335
Total Suspended Solids				
Annual Average	0.19	1.00	931	976
Max Month	0.25	1.33	1,238	1,298
Ammonia				
Annual Average	0.017	1.00	83	87
Max Month	0.022	1.30	108	114

Notes:
1. Annual Average per capita loading rates are taken from Metcalf & Eddy, Table 3-13 (column 4) due to lack of long term analytical data specifically for the District.
2. Max Month per capita loading rates were estimated by multiplying the annual average per capita loading rate by the typical 30-day sustained peak peaking factor shown in Metcalf & Eddy,
3. Given the limited number of non-residential EDUs in the District, those EDUs were assumed to have wastewater constituent compositions similar to residential EDUs.

Expected Water Quality Limits

Based upon the challenges and costs associated with developing an inland surface water outfall, the analysis of wastewater equipment was premised upon developing an ocean outfall. Refer to Chapter 6 for more information on outfall analysis. An ocean outfall would likely result in effluent water quality limits being driven by a combination of water quality based and technology based effluent limits. Ocean beneficial uses include shellfish harvesting and recreation contact for which water quality based limits will apply. All other limits will be technology based limits. Estimated effluent limits are listed below in Table 07-4.

TABLE 07-4: ESTIMATED EFFLUENT WATER QUALITY LIMITS FOR AN OCEAN OUTFALL

Parameter	Units	Average Monthly	Average Weekly	Daily Maximum	Basis
BOD_5 (May 1 - Oct. 31)	mg/L	20	30	-	Applies the dry season and wet season effluent requirements for the Mid-Coast Basin (OAR 340-041-0225(4)) as they were applied in the Depoe Bay STP NPDES Permit (No. 101383). Note: OAR 340-041-0225(4)(b) appears to only require direct ocean discharges to implement secondary treatment; however, the more restrictive effluent requirements were imposed on the Depoe Bay STP and have been retained here for conservative planning.
	lb/day*	114	170	230	
	% Removal	85			
BOD_5 (Nov 1 - April 30)	mg/L	30	45	-	
	lb/day**	200	300	400	
	% Removal	85			
TSS (May 1 - Oct. 31)	mg/L	20	30	-	
	lb/day*	114	170	230	
	% Removal	85			
TSS (Nov 1 - April 30)	mg/L	30	45	-	
	lb/day**	200	300	400	
	% Removal	85			
Fecal Coliform	#/100 mL	A median concentration of 14 organisms per 100 mL. No more than ten percent of the samples may exceed 43 organisms per 100 mL.			Numeric criteria for designated shellfish harvesting areas for bacteria per OAR 340-041-0009(1)(c).
Enterrococci Bacteria	#/100 mL	A monthly geometric mean of 35 enterococcus organisms per 100 mL. No more than ten percent of the samples may exceed 130 organisms per 100 mL.			Numeric criteria for designated coastal water contact recreation areas for bacteria per OAR 340-041-0009(6)(a).
pH	S.U.	Shall be within the range of 6.0 - 9.0.			Review of other Mid-Coast Basin Municipal WWTP NPDES discharge permit requirements for facilities with ocean outfalls.
Excess Thermal Load	million kcal/day	No limit anticipated			
Ammonia	mg/L	No limit anticipated			
Residual Chlorine	mg/L	Reasonable potential analysis should be completed if chlorine-based disinfection process is proposed as an effluent limit may be imposed. Provisions for dechlorination should be considered during planning in the event a residual chlorine effluent limit is imposed.			Review of other Mid-Coast Basin WWTP NPDES discharge permit requirements for facilities with ocean outfalls. NPDES permits for the City of Newport STP and the Otter Crest Water Treatment Facility include residual chlorine effluent limit.

*Ten-Year Maximum Month Dry Weather Flow Rate ($MMDWF_{10}$) of 0.318 MGD and the Five-Year Maximum Month Wet Weather Flow Rate ($MMWWF_5$) of 0.443 MGD. Mass loads will be individually assigned based on what the plant can reasonably achieve and the highest monthly average discharge flow with a two year recurrence at the 20 year design of the facility (MMWWF5).

Cost Estimating

Assuming the District will use an ocean outfall, cost estimating has been limited to process equipment that will handle the projected flow and loading through the planning period, meet the expected water quality effluent limits determined by the outfall location, provide required redundancy and reliability, conform with the site constraints (size, topography, climate, proximity to other uses, etc.), and handle the solids processing and handling constraints.

Construction costs have been analyzed and reported by three levels of detail. The most general, called First Order costs, is for complete treatment plants of various types. All construction costs are included. The second level of detail, the Second Order costs, is for specific unit processes, such as clarifiers, chlorination, etc. The last level, the Third Order costs, is for the costs of various components required: excavation, electrical, instrumentation, etc. It is necessary to add associated non-construction costs to each cost order.

Details on First and Second order costs can be found in Chapter 7. For purposes of brevity, only Third order costs are discussed here. A summary of process equipment costs is included in Table 07-5 below.

TABLE 07-5: PROCESS SYSTEM COSTS SUMMARY

	Max.	Min.	Median
Activated Sludge	$11,312,180	$10,170,563	$10,707,887
Oxidation Ditch/Activated Sludge	$12,510,152	$10,179,830	$11,311,506
Sequencing Batch Reactor (SBR)	$11,389,146	$8,396,258	$9,780,144
Rotating Biological Contactor	$12,567,792	$11,426,175	$11,963,499
Trickling Filter	$12,130,570	$10,988,953	$11,526,277
Membrane Bioreactor	$12,713,679	$10,990,746	$11,852,213

07.4 Evaluation of Alternatives

The initial cost of the proposed improvements is an important consideration, however other factors should also be given careful consideration before settling on a site, outfall location, or treatment process. Operating costs, equipment sophistication, and the ability of a process to adapt to changing influent conditions, among other considerations, may influence the decision making process.

A summary of the costs to develop the various sites considered in this report are included below in Table 07-2. The three least costly sites are highlighted in green. Details on outfalls and site alternatives are included in Chapters 6 and 7 respectively. Since the cost to develop an outfall to the Siletz River is so high, the higher water quality standards that would be required with an inland discharge to the Siletz were not given significant consideration when evaluating treatment processes. Water quality standards associated with an ocean outfall would likely be met by a variety of treatment process options.

A summary of the costs to develop the various treatment processes considered in this report are included in Table 07-5. The three least costly treatment processes are highlighted in green. Details on process alternatives are included in Chapter 7. Depoe Bay currently uses an activated sludge process, while many of the neighboring wastewater systems employ SBR's.

Non-Monetary Factors

Several non-monetary issues were reviewed to compare various outfall and plant site locations. Each site was rated on a scale of 1 to 3, with a 1 indicating that the proposed location has relatively low difficulty in addressing that issue, and a 3 indicting that it will be difficult to overcome that issue with the proposed location. The option that scores the lowest will, in theory, be the easiest to permit and construct. Figure 07-2 evaluates various outfall locations while Figure 07-3 evaluates the various treatment plant site locations.

FIGURE 07-2: OUTFALL NON-MONETARY CONSIDERATIONS

	Environmental Implications/ Permitting	Cultural/ Historical/ Archeological Impact	Available space for construction	Land Acquisition	Public Impact During Construction	Water Quality Requirements	Total
Ocean Outfall Option No 1: Fogarty Beach Outfall	2[a]	1	1	2[f]	1	1	**8**
Ocean Outfall Option No 2: Wesler St Outfall	1	1	1	2[f]	3[h]	1	**9**
Ocean Outfall Option No. 3: Bella Beach Dr	1	1	2[d]	3[g]	3[h]	1	**11**
Siletz River Option 1: West to Hwy 101, north to Immonen Rd, east to Millport Slough Rd	3[b]	3[c]	2[e]	1	3[i]	3[k]	**15**
Siletz River Option 2: High point N. to Siletz at Millport Slough Rd	3[b]	3[c]	2[e]	1	2[j]	3[k]	**14**
Siletz River Option 3: High point S. to Siletz at Immonen Rd	3[b]	3[c]	2[e]	3g	2[j]	3[k]	**16**

severe/high difficulty	3
moderate difficulty	2
low difficulty	1

a: pipeline crosses creek and is installed in wetland area.
b: permitting discharge to Siletz will be lengthy and challenging
c: Siletz River has significant cultural/historiacl/archeological significance
d: Beach access is privately owned and space is tight
e: Outfall location is within ROW between prvately owned properties
f: property owned by State Parks
g: privately owned property
h: parking/beach access closed during const./work required within Hwy 101
i: work required within Hwy 101 and County Rd.
j: work required within County Rd.

FIGURE 07-3: SITE LOCATION NON-MONETARY CONSIDERATIONS

	Environmental Implications/ Permitting	Cultural/ Historical/ Archeological Impact	Available space for construction	Land Acquisition	Public Impact During Construction	Land Use Requirements	Total
Option 1: E. of Fogarty Creek State Park Site	2[a]	1	1	1	1	1	7
Option 2: E. of Airport Site	1	1	1	1	1	1	6
Option 3: S. of Seagrove Site	3[b]	2[c]	2[d]	2[e]	2[f]	2[g]	13

severe/high difficulty	3
moderate difficulty	2
low difficulty	1

a: access to site crosses stream and wetland
b: site and access bounded by wetland
c: unknown/undeveloped land
d: wetlands limit space available for development
e: privately owned/not investment forestry
f: immediately south of developed neighborhood
g: currently zoned residential - WWTF may not be considered compatable use to adjacent zoning

Treatment plant processes are evaluated in Figure 07-4 below. Only processes considered within this report are reviewed.

FIGURE 07-4: TREATMENT PROCESS NON-MONETARY CONSIDERATIONS

TREATMENT PROCESS	PERFORMANCE				OPERATIONAL CONSIDERATIONS			
	BOD	TSS	AMMONIA	PHOSPHORUS	PRO'S	CON'S	FOOT PRINT	OPERATING COST
ACTIVATED SLUDGE (AS)	Good	Require separate system (Clarifiers)	Good	Poor	• Well known technology	• Requires high efficiency aeration system • Continuous flow mode requires external stage following the AS unit • Requires closely controlled operational conditions	medium	$$
OXIDATION DITCH	Good	Require separate system (Clarifiers)	Good	Poor	• Low energy for aeration	• Requires aeration system • Requires external clarification stage following aeration • Requires closely controlled operational conditions	medium	$$
SEQUENCING BATCH REACTOR (SBR)	Good	Good	Good	Poor	• Flexibility • Does not require external clarification stage	• Requires high efficiency aeration system • Requires closely controlled operational conditions • Changes in loading require intervention • Requires skilled operator	medium	$$
ROTATING BIOLOGICAL CONTRACTOR (RBC)	Good	Require separate system (Clarifiers)	Variab le	Poor	• Low energy for aeration	• Requires external clarification stage following the RBC unit • Requires electrical supply for shaft motor • Requires closely controlled operational conditions • Sensitive to environmental conditions and fluctuations in influent quality (e.g., temperature, pH, flow, concentrations, etc.)	medium	$
TRICKLING FILTER	Good	Require separate system (Clarifiers)	Poor	Poor	• Minimal operation and maintenance requirements	• Requires pre-treatment (primary settling) • Sensitive to cold climate issues	medium	$
MEMBRANE BIOREACTOR (MBR)	Good	Very Good	Good	Good	• Tertiary quality effluent • Operation easily followed remotely • Retain bacteria such as E. Coli	• Requires pre-treatment • Requires aeration system • Performance closely linked to maintenance quality • Risk of membrane fouling (redundancy required)	small	$$$

(Mabarex Technologies, 2023)

Wastewater Treatment Process Evaluation

The least cost alternative of developing each site was added to the cost to develop the two least costly treatment processes and is shown in Table 07-6 below. The two least cost options are highlighted in green.

TABLE 07-6: LEAST COST OPTION COMPARISON

	Site Comparision Rating	Outfall Location Comparison Rating	Activated Sludge	Sequencing Batch Reactor
Site Option No. 1	7	8	$28,077,041	$27,149,298
Site Option No. 2	6	9	$29,348,475	$28,420,732
Site Option No. 3	13	11	$27,182,422	$26,254,679

$ range:	$3,093,796
% range:	12%
median:	$27,738,775

The least costly option is Site No. 3 using a Sequencing Batch Reactor (SBR). However, Site 3 and the associated outfall location are also the most difficult to develop. The second least costly option is Site No.1 also using an SBR. This site and outfall location have less obstacles to development.

Activated sludge and SBR's processes are relatively equivalent in their ability to produce good water quality, respond favorably to variable influent conditions, and in their level of sophistication to operate. SBR processes, since they are running batches of wastewater through various treatment stages, by their nature require significant automation. Activated sludge systems don't necessarily require the same level of automation, but practically speaking modern activated sludge plants are extensively automated. Although sophisticated, Supervisory Control and Data Acquisition (SCADA) systems can reduce operator hours, improve reporting accuracy, reduce reporting time, and improve compliance due to continuous monitoring.

Based upon this evaluation, it is recommended that the District consider pursuing the development of a new treatment plant facility at Site No. 1 using a Sequencing Batch Reactor.

0.08 Proposed Alternative Cost Estimate

The 2022 cost to develop Site No. 1 with a Sequencing Batch Reactor is estimated to be $27,149,298. At this level of planning, it is recommended to include a 30% contingency. ***The 2022 development cost including 30% contingency is $35,295,000***. Knowing it will take several years for the District to develop this facility, Table 08-1 below shows the development cost change over time adjusted by the average annual change in the Engineering News Record Construction Cost Index since 2006. (Engineering New Record, 2023)

TABLE 08-1: DEVELOPMENT COST INFLATIONARY CHANGE

17-yr Average CCI change: 3.19%

	2022 Preferred Option development cost	$27,149,298
	30% Contingency	$8,144,789
	2022 Total Cost	**$35,294,087**
Year 1	2023	$36,419,969
Year 2	2024	$37,581,766
Year 3	2025	$38,780,624
Year 4	2026	$40,017,726
Year 5	2027	$41,294,291
Year 6	2028	$42,611,579
Year 7	2029	$43,970,889
Year 8	2030	$45,373,560
Year 9	2031	$46,820,977
Year 10	2032	$48,314,566

0.09 Financing and Capital Improvement Plan

The project cost used for this analysis is $35,295,000. As discussed in Section 9.4, costs will increase annually approximately in relation to the annual average increase in the Construction Cost Index. See Table 9-4.

09.1 User Rates

There are currently 2221 active services in the community. Present 2022 sewer user rates are:

- Single Family Dwelling: $54 per month flat rate
- Multi-family/Commercial: $54 per month for 1,000 gallons or less – overage is billed at $18 for each 1,000-gallon unit
- Out of District (1.5x above rates): $81 for 1,000 gallons or less – overage is billed at $27 per 1,000-gallon unit

09.2 Debt Service

The District currently only has one loan. Recently the District acquired a loan from Oregon Department of Environmental Quality's Clean Water State Revolving Fund Loan Program (CWSRF) for collection system improvements. Table 09-1 below summarizes the details of the loan. The debt payoff of this loan is accounted for in the current wastewater base rate of $54 per month.

TABLE 09-1: EXISTING DEBT

CWSRF LOAN NO. 1	
Original Loan Inception and Loan Term	2021/ 30-years
Original Loan Amount	$ 4,370,000.00
Annual Payment	$144,739
Remaining Time (years)	30
Remaining Balance	$4,370,000
Funding Agency	DEQ

09.3 SDCs

This District should consider establishing additional System Development Charges (SDCs) to recover costs associated with future growth. Additional details on SDC's is available in Section 10.3. The SDC improvement fee cost basis is the growth-allocable portion of planned wastewater system capital improvements. The total estimated project cost for a new wastewater treatment facility for buildout conditions in 2045 is estimated to be $35,295,000. The growth-allocable portion of the project was estimated by determining the percentage increase in EDUs over the planning period. The increase in EDUs is 114, representing an increase of 5.1%. Therefore, the estimated percentage of project costs attributed to growth is 5.1%, or $1,800,045.

The improvement fee unit cost is calculated by dividing the improvement fee cost basis ($1,800,045) by the anticipated growth through buildout (114 EDUs), resulting in an improvement fee unit cost of **$15,790 per EDU**. This SDC rate is for the improvements for the wastewater treatment plant only and will need to be added to the existing SDC rates if the District chooses to implement these additional SDC's.

The District has already employed an SDC schedule methodology for their existing SDC rates. This methodology is based upon meter size which generally corresponds to the amount of water that will be used by each connection. Single family homes, which represent one EDU, are typically served by a ¾" meter. The equivalent dwelling units associated with each meter size is based upon the ratio of the SDC fee compared to the SDC fee for a single EDU. This EDU ration is then multiplied by the single EDU SDC rate for the new wastewater treatment plant improvements for each meter size. The SDC schedule calculated for new wastewater treatment plant improvement is shown below in Table 09-2.

TABLE 09-2: NEW WWTF SDC SCHEDULE

Proposed Wastewater Treatment Plant SDC Schedule		
Meter Size	**SDC Fee**	**EDU's**
¾" Meter	$15,970.00	1.0
1" Meter	$39,155.22	2.5
1 ½" Meter	$77,801.20	4.9
2" Meter	$124,174.60	7.8
3" Meter	$247,836.99	15.5
4" Meter	$386,957.19	24.2

09.4 Wastewater Plant Improvements Rate Impacts

The information presented in the preceding sections has been used to develop a probable rate adjustment for the District based on the recommended wastewater treatment project. To proceed with the recommended project, the District will need to secure funding. Some grant funding may be available to the District; however, loans or the use of available cash reserves may be required for a significant portion of the cost. The final user rate will depend on the funding package secured by the District including interest rates, current construction costs, and other variables. Table 09-3 and Table 09-4 provide a summary of the potential rate impacts the proposed wastewater treatment plant project may have. Table 09-3 shows the annual Operation and Maintenance cost per EDU for a new wastewater treatment facility.

TABLE 09-3: ANNUAL OPERATING COSTS PER EDU

O&M Costs	
Annual Operating Cost:	$217,600
Number of EDUs (Current)	2221
Monthly O&M Cost per EDU	**$8.16**

Table 09-4 shows a series of potential funding scenarios depending upon the financing methodology and the impact to user rates. It may be possible, and advantageous, to combine multiple funding programs in order to leverage the most grant and/or loan forgiveness funds available. The following criteria were used in the user rate calculations:

- Connections = 2221
- Loan Interest Rate = 1.42%
- Loan Period = 30-years
- Estimated Project Costs: $35,295,000
-

TABLE 09-4: WATER TREATMENT PLANT FINANCING COSTS

Project Financing	100% Loan, No Grant	50% Loan	30% Loan
Capital Cost	$35,295,000	$35,295,000	$35,295,000
Loan Needed	$35,295,000	$17,647,500	$10,588,500
Interest Rate*	1.420%	1.420%	1.420%
Loan Period (yrs)	30	30	30
Annual Annuity	$1,453,043	$726,521	$435,913
Monthly Income Required	$121,087	$60,543	$36,326
Monthly Income Reqd' w/ 10% reserve	$133,196	$66,598	$39,959
Number of EDUs (Current)	2221	2221	2221
Monthly Financing Cost per EDU	**$59.97**	**$29.99**	**$17.99**
Monthly O&M Cost per EDU**	**$8.16**	**$8.16**	**$8.16**
Current Monthly WW Base Fee	$54.00	$54.00	$54.00
New Monthly Wastewater Fee	**$122.14**	**$92.15**	**$80.16**

*https://w w w .oregon.gov/deq/w q/cw srf/Pages/CWSRF-Rates.aspx (as of December 2, 2022)

** Activated sludge w /4 operators

09.5 Total Wastewater Improvements Rate Impacts

The 2018 Facilities Plan Update prepared by HHPR. (Harper Houf Peterson Righellis, Inc., 2018) has identified several capital improvement projects needed in the collection system that remain to be completed. Table 09-5 shows the probable user impact based on completing all the recommended collection system improvements combined with a new wastewater treatment plant.

TABLE 09-5: COMBINED WWTP AND COLLECTION SYSTEM CIP COSTS

Project Financing	100% Loan, No Grant	50% Loan	30% Loan
Capital Cost	$39,815,000	$39,815,000	$39,815,000
Loan Needed	$39,815,000	$19,907,500	$11,944,500
Interest Rate*	1.420%	1.420%	1.420%
Loan Period (yrs)	30	30	30
Annual Annuity	$1,639,124	$819,562	$491,737
Monthly Income Required	$136,594	$68,297	$40,978
Monthly Income Reqd' w/ 10% reserve	$150,253	$75,127	$45,076
Number of EDUs (Current)	2221	2221	2221
Monthly Financing Cost per EDU	**$67.65**	**$33.83**	**$20.30**
Monthly O&M Cost per EDU**	**$8.16**	**$8.16**	**$8.16**
Current Monthly WW Base Fee	$54.00	$54.00	$54.00
New Monthly Wastewater Fee	**$129.82**	**$95.99**	**$82.46**

0.10 Next Steps

Now that the Facility Plan has been completed, the District can begin taking steps toward implementing the project. Elemental steps to implementing a successful large value project include outreach, financing, and project planning. These three tasks are interwoven but must each be successfully planned and implemented to allow the project to move forward as efficiently as possible.

10.1 Outreach

Outreach may be the most important task at this point in the project. The Facilities Plan may have identified potential solutions, sites and costs but this information needs to be communicated to rate payers, local and state officials, permitting agencies, funding agencies, and the press.

- **Official adoption of the Facility Plan by the GSD Board**

  The Board will need to officially adopt the Facility Plan at a regular Board Meeting and it is recommended to do so in a Public Hearing format. In accordance with Public Hearing notification rules, the District should advertise the meeting to the rate payers through utility billings and other means. The advertisement should inform rate payers that the Board is considering the adoption of the Plan, describe the general content and conclusions of the plan, and invite people to attend the meeting to provide feedback or provide feedback via email or in writing to be submitted at the meeting for consideration. The Facility Plan document is very large, so the District will need to make provisions for members of the public to download the document from the District's website and have a hard copy available at the desk for public viewing. Adopting the Facility Plan at an advertised Public Hearing where public feedback is solicited and considered is an important and necessary step when pursuing public funding sources.

- **Establish a webpage where project documents can be accessed.**

  To maintain continuity and efficiency of the outreach effort, a portion of the GSD web page should be dedicated to the project and serve as a location where documents can be accessed and downloaded and the District can communicate the message that they want to convey regarding the project. The webpage should include a link for the public to provide comments and/or pose questions during the process. It is likely that hundreds of people will be touched during the outreach process for this project. The web page will provide easy access for rate payers, Legislators and other officials, and the press to acquire information and documents that may be necessary and timely for their work.

- **Submit Facility Plan to DEQ for review and comment.**

  DEQ does not require a Facility Plan to be completed and the document is primarily to satisfy the funding agencies that the applicant has done due diligence to ensure the project is feasible and cost effective. However, portions of the analysis completed as part of the facility plan are required by DEQ before they will issue a permit for construction. It is advised that the District send the Facility Plan to DEQ for their review then request an in-person meeting to discuss the plan and next steps to advance the project.

- **Meet with local Legislators to discuss the project and request support.**

  The District should schedule a meeting with State Representative David Gomberg, State Senator Dick Anderson, and County Commissioner Kaety Jacobsen to inform them of the project need, status and costs, and request support from them in securing funding and advocating the project.

10.2 Financing

The District can take many steps to advance the project without immediate financing, but the critical path to project completion with be acquiring funds.

- **Schedule One Stop Meeting With Financing Agencies**

  Constructing a new wastewater treatment plant is an expensive endeavor and can be overwhelming, particularly for a small system like GSD. Therefore, it is necessary to self-advocate and develop project partners to help secure stable funds. Financing may include several steps and various funding sources. The District has to pay for the total project costs, but will also need to have available cash to pay invoices for design and construction. This cash flow may be accommodated by a line of credit through a traditional bank, provided by District cash reserves, or funded through a bridge loan from one of the various funding agencies.

  The District should schedule a One Stop meeting with funding agencies, which will include at a minimum the US Department of Agriculture (USDA), OR Department of Environmental Quality (DEQ), Business Oregon, Rural Community Assistance Corporation (RCAC) and Regional Solutions. Typically, the one-stop can be scheduled with the Business Oregon regional representative who on the Central Oregon Coast is Melissa Murphy ((503) 983-8857; Melissa.Murphy@oregon.gov).

- **Request meeting with Mid-Coast Regional Solutions Team**

  Regional Solutions is part of the Governor's office. The Regional Solutions Program approaches community and economic development by recognizing the unique needs of each region in the state and working at the local level to identify priorities, solve problems, and seize opportunities to get specific projects completed. The following link is an overview of the Regional Solutions Program: https://www.oregon.gov/gov/regional-solutions/Documents/RegSol%20Program%20Overview%20FINAL.pdf

  The Mid-Coast Regional Solutions Team is comprised of representatives from Business Oregon, DEQ, Housing and Community Services, Department of Land Conservation and Development (DLCD), Oregon Department of Transportation (ODOT), and the Department of State Lands (DSL). Representatives from this group are often the same representative that will support the District in a one-stop meeting. However, Regional Solutions also has representatives that can provide guidance and advocacy with aspects of the project beyond funding including permitting and land use.

  The District should request that the Regional Solutions Team add the Gleneden Sanitary District Wastewater Treatment Plant Project as a project of regional significance to the Regional Solutions Workplan. This action will show other legislators and funding agencies the importance and priority of the project to the Governor's office and make the project eligible for Regional Solutions funding.

10.3 Planning

These next step planning tasks will inform the design and provide the design team with clarity regarding what to include in the design process and where project elements will be located.

- **Explore procurement of property for WWTF.**

  The District can begin to engage property owners to inquire about purchasing the land and easement necessary to construct the facility. This will allow the District to identify initial costs and acquire financing specifically for land procurement. Once the land is identified and procured, the District can begin other preliminary design and planning work including geotechnical exploration and survey.

- **Set up a meeting with Oregon State Parks.**

  Regardless of the plant location, an ocean outfall will involve Oregon State Parks since the outfall will cross the beach and many of the logical construction locations for setting up a drilling operation are on State Park owned properties. Since State Parks will be specifically impacted, it is recommended to schedule this meeting before and independently from other permitting agencies, and to include the local representatives that are responsible for managing the impacted parks.

- **Schedule a meeting with agencies that may have permit authority or will be impacted by the project.**

  Agencies that may be included in this meeting include, but may not be limited to, DEQ, DSL, Department of Fish and Wildlife, NOAA Marine Fisheries, ODOT, Oregon State Parks, and Lincoln County Public Works.

- **Conduct additional wastewater sampling to define loading parameters more closely for wastewater process design.**

  The wastewater samples collected to date are too limited to provide reasonable assessment of seasonal loading. It is recommended to implement a sampling program that tracks loading over an entire year.

- **Start preliminary design.**

  The above steps influence the design of the project by developing concurrence among stakeholders with the planned improvements, identifying funding sources and cash flow, helping the design team understand permit requirements that may influence design, and finalizing the project site. It is recommended that the District follow through on the above steps before beginning preliminary design. Once the design team has confidence that permitting agencies will permit the project, the project site is secured, and financing is available to pay for design, then the District should begin the design process immediately to prevent undue delays in meeting the 2027 project completion target. Initial tasks will include geotechnical evaluation of the site, outfall alignment and forcemain alignment and survey of the same locations.

0.11 References

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1 PROJECT PLANNING

1.1 Introduction

This section provides a detailed description of the area served by the Gleneden Sanitary District (the District), environmental resources in the District's service area, and population trends in the District and nearby areas of Lincoln County.

1.2 Location

1.2.1 Service Area and Geography

Gleneden Sanitary District is located in a coastal stretch of Lincoln County, Oregon between the cities of Lincoln City and Depoe Bay. The District provides wastewater collection service to the unincorporated areas of Gleneden Beach, Lincoln Beach, and Coronado Shores. As shown in Figure 1.1, this service area generally stretches from near the southern edge of Siletz Bay in the north to Fogarty Creek State Park in the south. Most of the District's services are confined to the section of land between the Pacific Ocean and Highway 101 except for the Siletz Bay Airport and limited developments located to the east of Highway 101.

1.2.2 Topography

The USDA NRCS soil survey for Lincoln County generally describes coastal areas of Lincoln County as follows:

> *The western edge of the survey area is characterized by dissected coastal marine terraces that extend nearly 2 miles inland in some areas. The elevation of the terraces and their soils ranges from 25 to 450 feet. Basaltic headlands interrupt the coast terraces at Cascade Head, Cape Foulweather, Yaquina Head, and Cape Perpetua. The altitude of the headlands and their soils ranges from 50 to 1,100 feet. Tidal flood plains and their soils are along the mouths of the Yaquina, Siletz, and Salmon Rivers; elevation ranges from nearly sea level to 10 feet* (USDA NRCS, 1997).

In the District, terrain generally slopes from the Pacific Ocean up to Highway 101. To the east of Highway 101, the terrain continues to rise into the upland areas. A topographic map of the region is presented in Figure 1.2.

1.2.3 Land Use and Zoning

A zoning map of the Gleneden Beach and Lincoln Beach areas of Lincoln County is presented in Figure 1.3. Most of the District's service area is zoned for residential use. Limited areas are zoned for commercial uses in the northern and southern ends of the District. Significant areas of the District are also zoned for public facilities. These areas are associated with the Siletz Bay Airport, Gleneden Beach State Park, and Fogarty Creek State Park. Land located immediately east and south of the District is zoned for Timber Conservation and is actively logged.

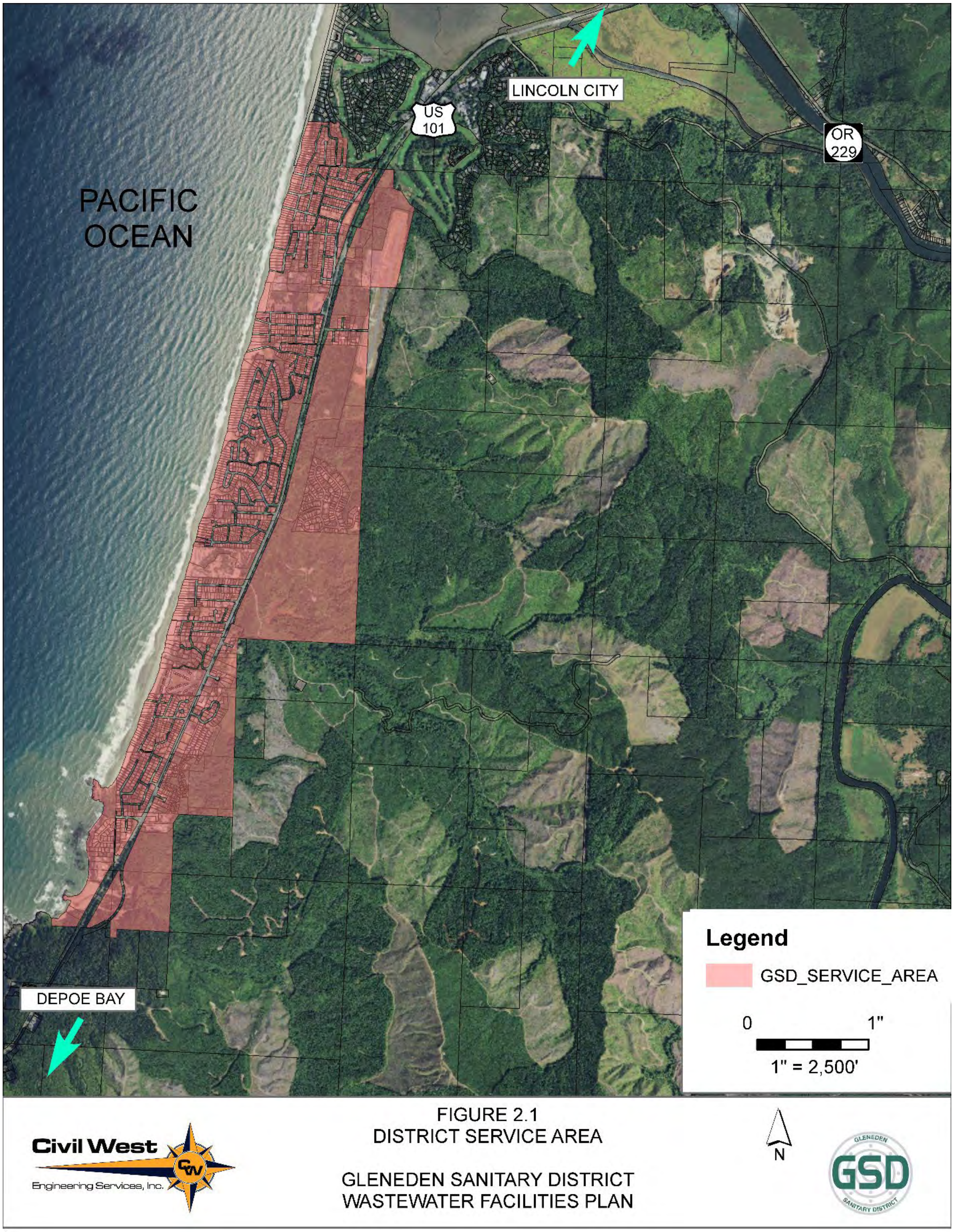

FIGURE 1.1: GLENEDEN SANITARY DISTRICT SERVICE AREA.

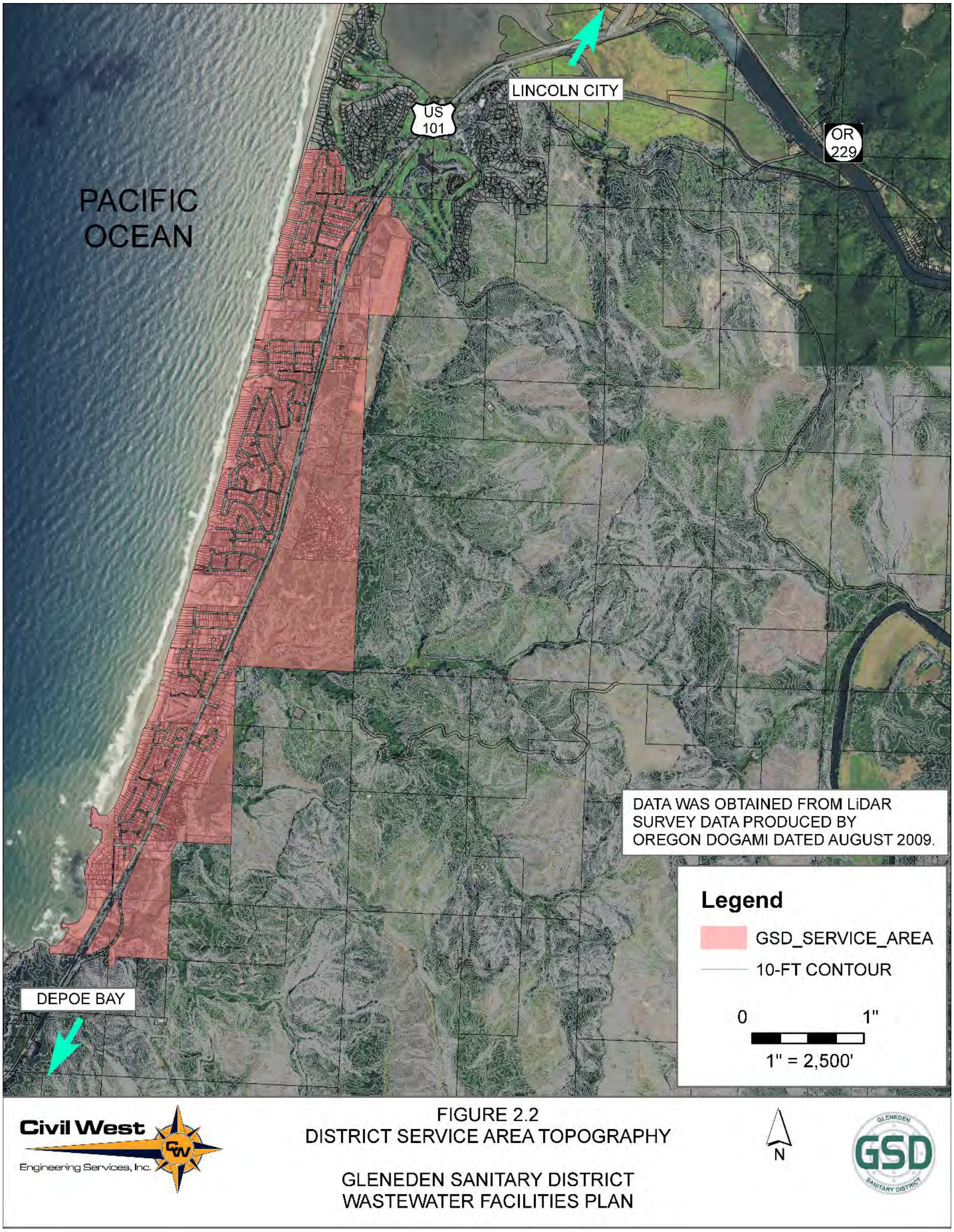

FIGURE 1.2: GLENEDEN SANITARY DISTRICT SERVICE AREA TOPOGRAPHY.

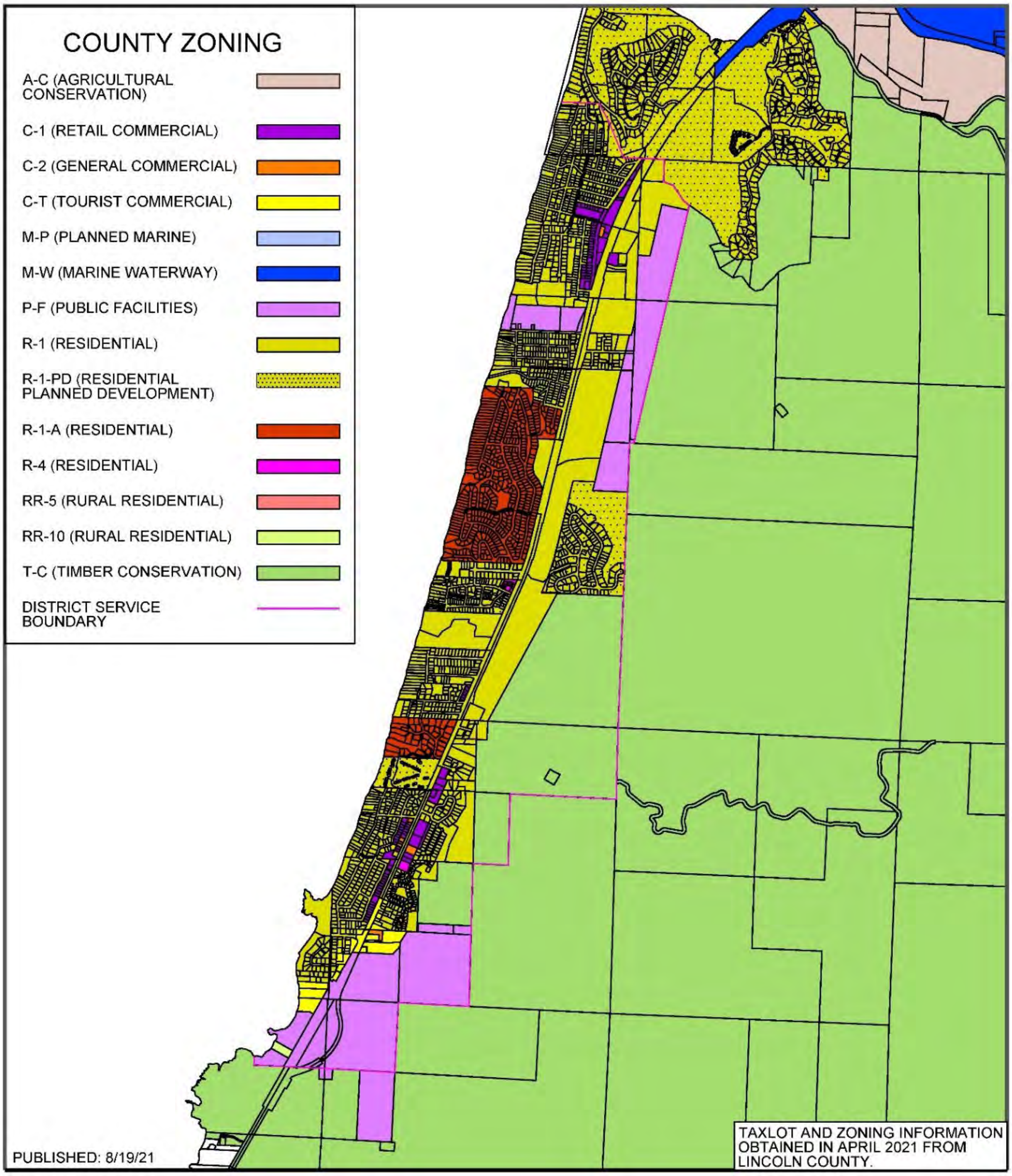

FIGURE 1.3: LINCOLN COUNTY ZONING.

1.3 Environmental Resources

1.3.1 Climate

No publicly available climate monitoring stations are in the District's service area. A weather station located in Otis, Oregon (approximately 11 miles north of the District) was assumed to provide a reasonable approximation of the climate in the District. Figure 1.4 shows average maximum and minimum temperature by month between 1981 and 2010. The average monthly minimum temperature is above freezing and generally ranges from 37°F to 51°F. As is typical for northern hemisphere locations, the highest maximum temperatures are observed during the summer months (July, August, September) and the lowest maximum temperatures are observed during the winter months (December and January).

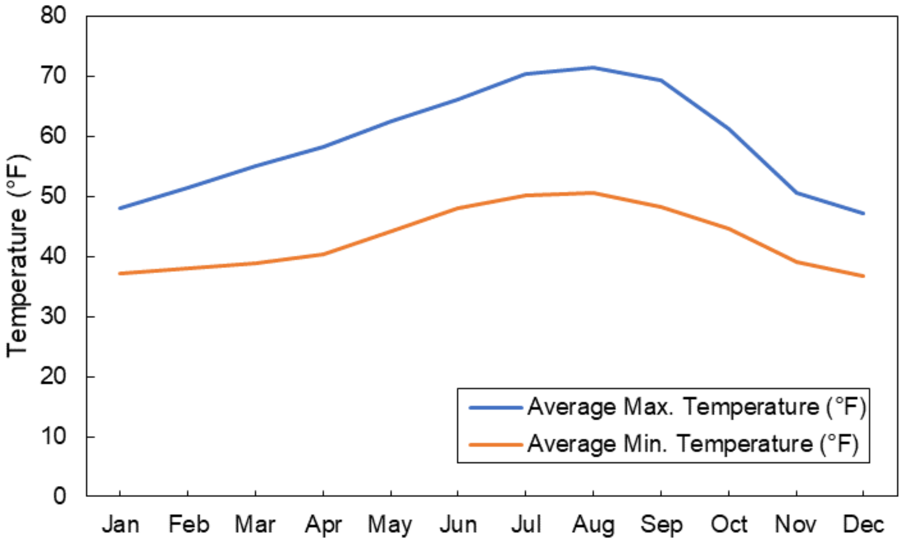

FIGURE 1.4: AVERAGE MONTHLY MAXIMUM AND MINIMUM TEMPERATURES REPORTED AT THE OTIS, OR MONITORING STATION (356366), 1981-2010.

Precipitation similarly exhibits a seasonal trend with high average precipitation levels observed during the winter and spring with little measured precipitation during the summer. Monthly average precipitation totals from the Otis, OR Monitoring Station are presented in Figure 1.5. Between the 1981 and 2010, the monitoring station recorded an annual average total precipitation of 95.54 inches. Most precipitation at the monitoring station is in the form of rain rather than snow. Between 1948 and 2012, the monitoring station measured total annual snowfall of less than 3 inches.

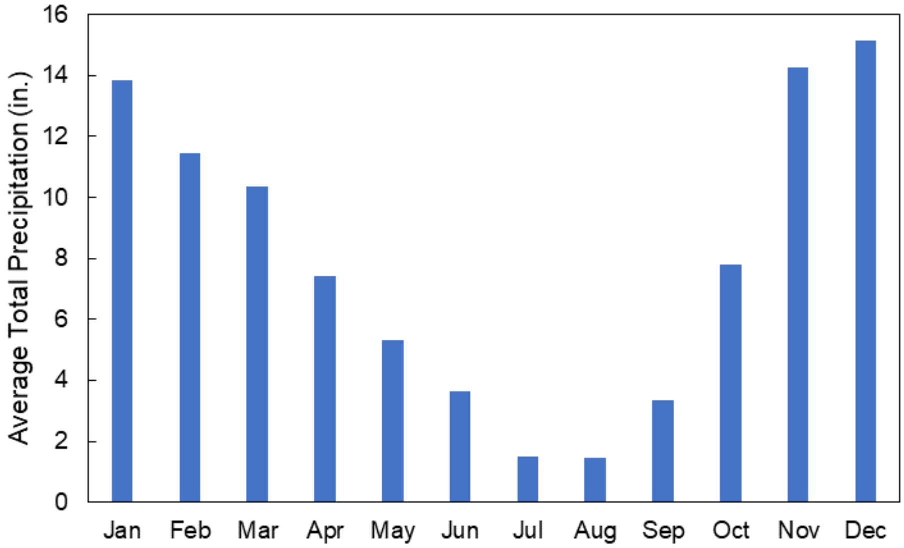

FIGURE 1.5: AVERAGE MONTHLY TOTAL PRECIPITATION REPORTED AT THE OTIS, OR MONITORING STATION (356366), 1981-2010.

1.3.2 Air Quality

Air quality in the District is likely to be influenced significantly by the interaction of weather systems from the Pacific Ocean. No air quality monitoring data is available for the District; therefore, it was assumed that air quality conditions would be comparable to the conditions at other coastal Oregon communities. Air quality is typically evaluated using several different parameters including nitrogen dioxide (NO_2), Ozone (O_3), lead (Pb), and airborne particulate matter. Figure 2.6 presents average daily particulate matter (PM 2.5) concentrations from air quality monitoring stations in Tillamook (Lat: 45.457347, Long: -123.802809) and Florence (Lat: 43.989668, Long: -124.109308) for the period of May 1, 2020, through April 30, 2021. Data was obtained from the Oregon DEQ Air Quality Monitoring Data map. Also shown on Figure 1.6 are the National Ambient Air Quality Standards (NAAQS) for PM 2.5. The large spike in PM 2.5 concentrations reported in September 2020 correspond to a period when significant wildfires occurred in Western Oregon.

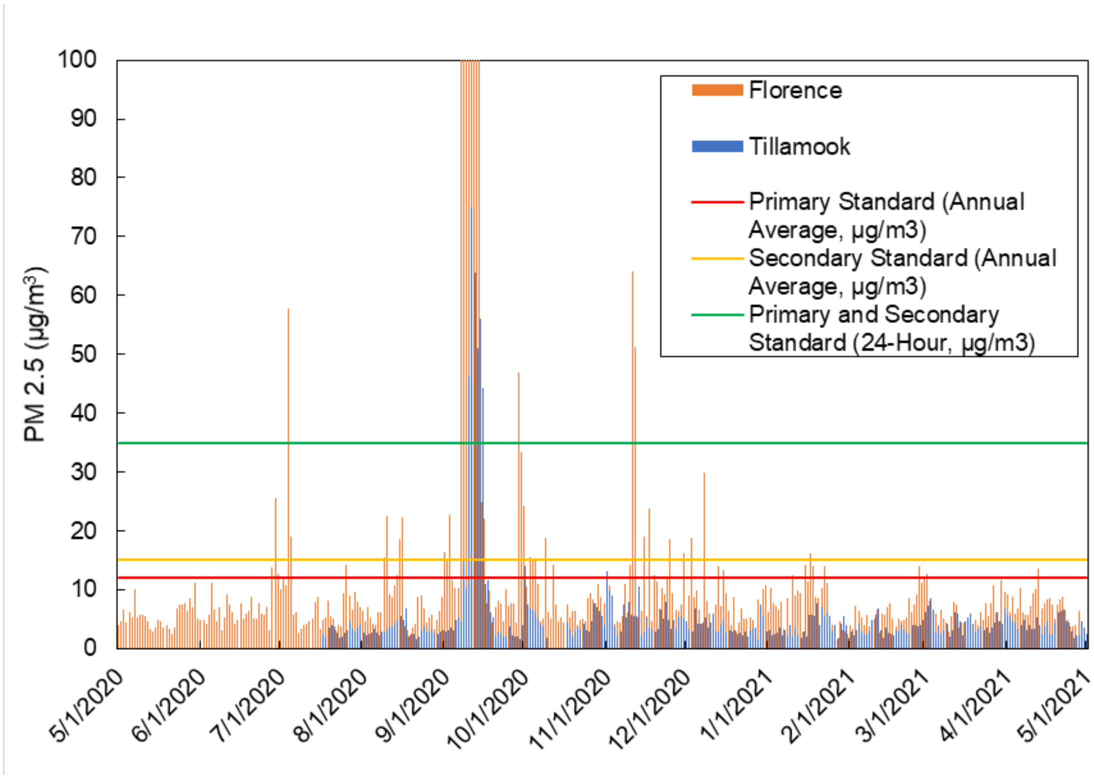

FIGURE 1.6: PARTICULATE MATTER (PM 2.5) MEASUREMENTS IN TILLAMOOK AND FLORENCE, OREGON.

1.3.3 Surface Water

The single largest waterbody impacting the District is the Pacific Ocean which forms the District's western boundary. Three creek networks are also present within the District's Boundary. Sijota Creek is in the northern section of the District and generally flows to the north and west. This creek eventually discharges into Siletz Bay. Sijota Creek currently receives treated effluent from the Salishan Sanitary District WWTP immediately upstream of its discharge into Siletz Bay. The Schoolhouse Creek network originates to the east of the District near the Siletz Bay Airport and flows west towards its discharge into the Pacific Ocean. The creek's point of discharge is approximately 1,000 ft south of the Gleneden Beach State Recreation Site. Fogarty Creek is in the southern portion of the District. The creek network forms in the hills to the east of the District and flows west towards its discharge into the Pacific Ocean at the Fogarty Creek State Recreation Area.

While potable water in the District is supplied by a surface water source, the water source is located outside of the District's boundary. Potable water in the District is supplied by the Kernville- Gleneden Beach- Lincoln Beach (KGBLB) Water District. KGBLB Water District provides water to the area served by Gleneden Sanitary District and several other areas north of Gleneden Sanitary District. Potable water supplied by the KGBLB Water District is drawn from Drift Creek which is located north of Gleneden Sanitary District on the north side of the Siletz River. Raw water is either drawn from an infiltration gallery in the streambed or from a surface intake. The KGBLB Water District can also draw raw water from an unnamed tributary to Drift Creek during storms. Raw water is treated by slow sand filtration and chlorinated for disinfection prior to being sent to the distribution system (CH2M Hill Engineers, Inc., 2017).

1.3.4 Floodplains

Several floodplains are present within the boundary of the District and are shown in Figure 1.7. The beach areas and adjacent low-lying areas are categorized as Zone VE on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) for the area. A small area adjacent to the mouth of Fogarty Creek in the southern portion of the District is also classified as Zone VE. Zone A flood areas are associated with Sijota Creek in the northern portion of the District and Schoolhouse Creek in the central portion of the District.

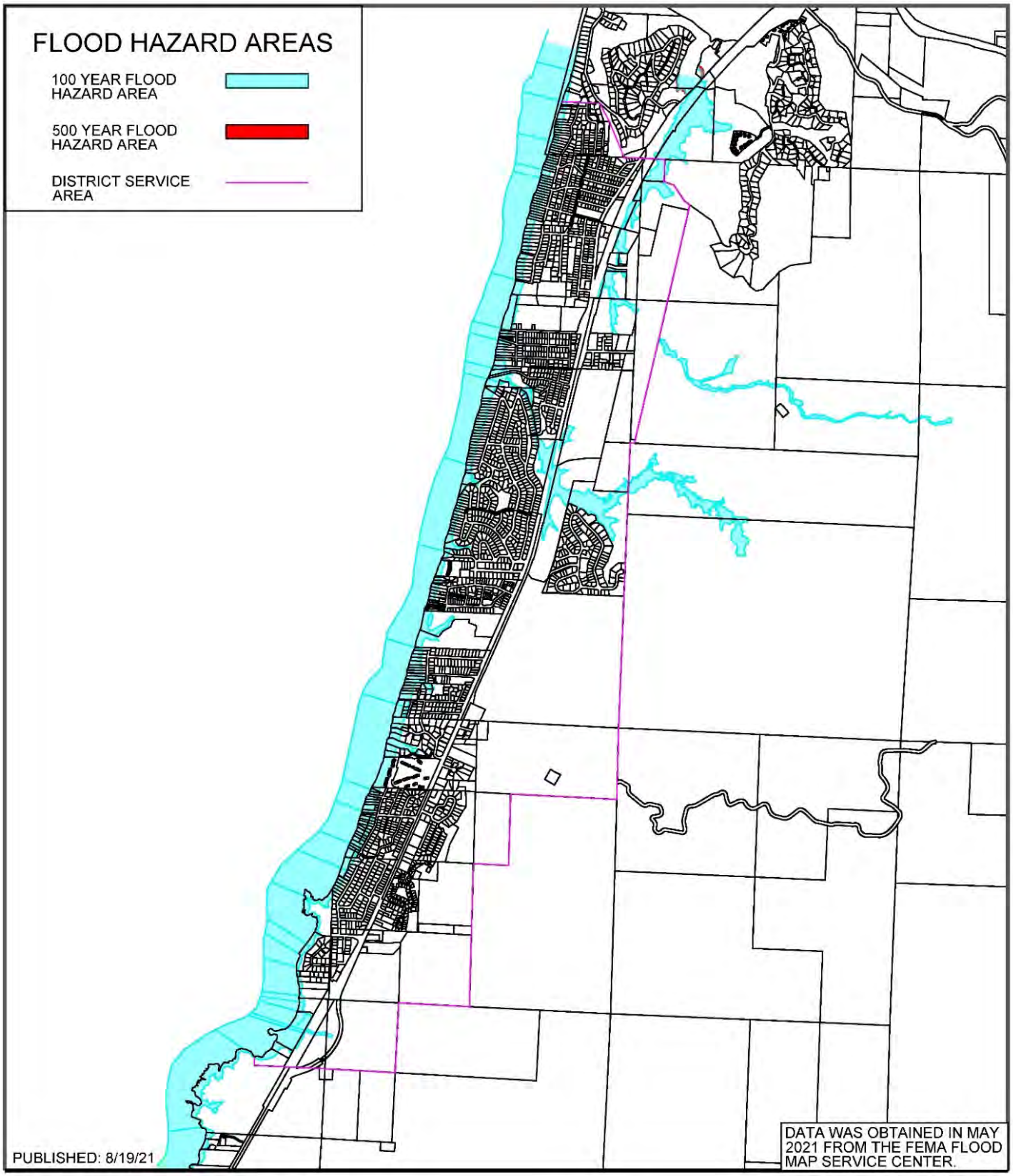

FIGURE 1.7: GLENEDEN SANITARY DISTRICT FLOOD HAZARD AREAS.

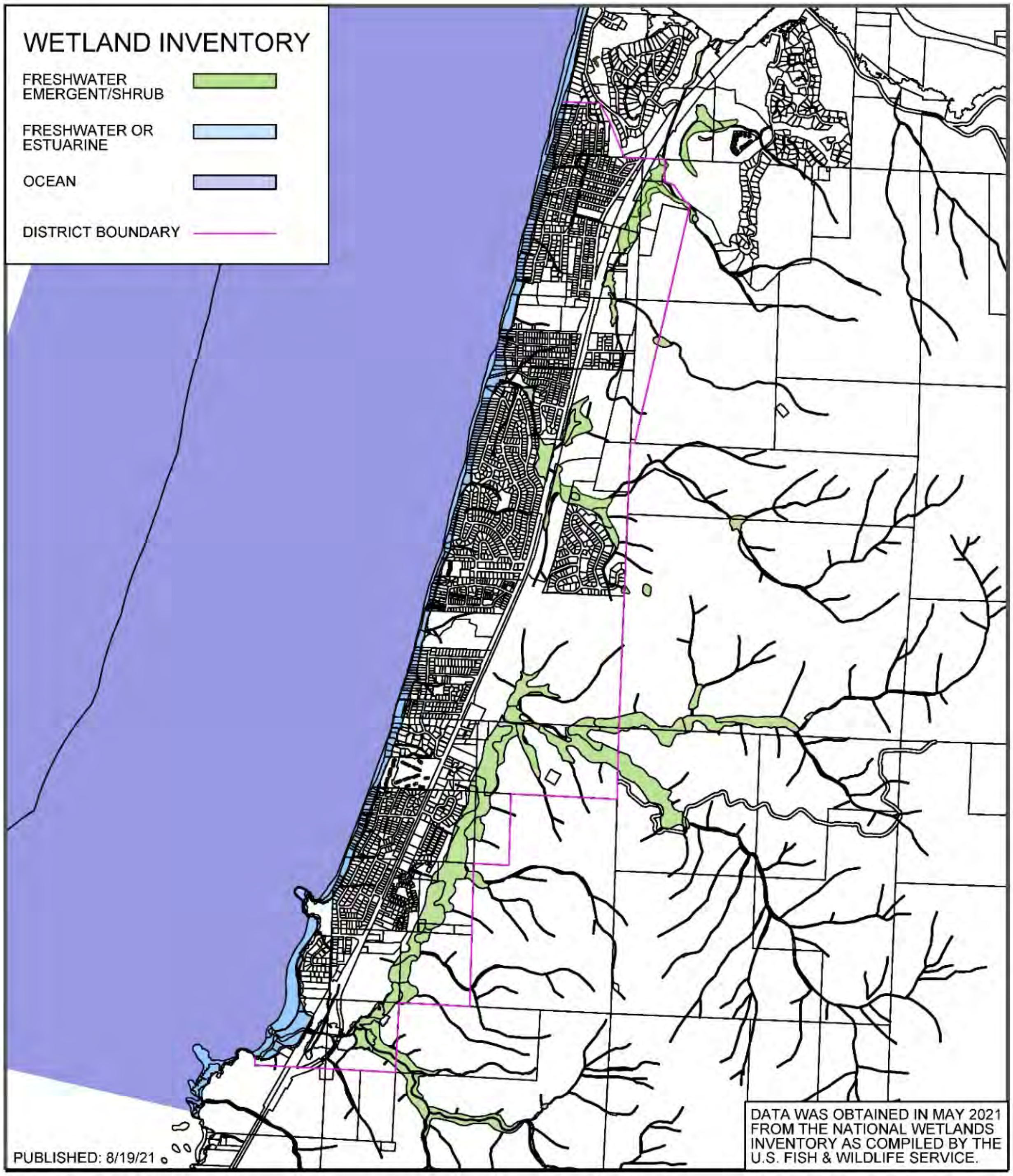

FIGURE 1.8: GLENEDEN SANITARY DISTRICT WETLAND AREAS.

1.3.5 Wetlands

The U.S. Fish and Wildlife Service manages the National Wetlands Inventory (NWI) for wetlands and other aquatic habitants potentially subject to regulation under Section 404 of the Clean Water Act. A map of wetland areas in the District is shown in Figure 1.8.

Wetland mapping information indicates that wetlands and emergent wetland areas are generally associated with the tributaries forming the larger creek networks described in Section 1.3.3. Wetlands associated with Sijota Creek are confined to the land between Highway 101 and the Siletz Bay Airport. Wetlands associated with Schoolhouse Creek have formed in the areas adjacent to the creek's crossing of Highway 101 near Coronado Shores. Wetlands associated with Fogarty Creek are the most extensive wetlands found in the District. These wetlands are located in the Fogarty Creek State Recreation Area and extend more than a mile north and ¾-miles east. Additionally, several areas along the coastal boundary of the District are defined as estuarine and marine wetlands.

1.3.6 Soils and Geology

A geological assessment was completed by GRI in 2020 as part of a feasibility assessment for the construction of a wastewater treatment facility in the Gleneden Beach-Lincoln Beach vicinity. The following geologic characterization is from that feasibility assessment (Harper Houf Peterson, Rhigellis, Inc., 2020). The complete geological assessment is included as Appendix E within the *HHPR Phase I - Analysis of Wastewater Treatment Plant Options* included in this document as Appendix E.

> ***Beach Deposits (Holocene).*** *The beach deposits consist of sand and gravel along the shoreline.*
>
> ***Alluvial Deposits (Holocene).*** *Silt, sand, and gravel along rivers and streams.*
>
> ***Coastal Terrace Deposits (Pleistocene).*** *Thin- to thick-bedded, planar to cross-bedded, and fine- to medium- grained marine and non-marine sand that locally contain cobble and gravel lenses and fossil wood. Locally covered by stabilized sand dunes. Older dunes are iron-stained and contain relic soil zones. Includes lenses of talus from basalt headlands.*
>
> ***Intrusive Basalt (Middle Miocene).*** *Thick long walls (dikes) and thick flat pools (sills) of basalt.*
>
> ***Depot Bay Basalt (Middle Miocene).*** *Isolated pillow lava and breccia, lapilli tuff, columnar-jointed basalt lava flows.*
>
> ***Astoria Formation (Middle Miocene).*** *Thin- to thick-bedded, very fine- to medium-grained micaceous and carbonaceous arkosic marine sandstone and massive sandy siltstone.*
>
> ***Nye Mudstone (Lower Miocene).*** *Massive to poorly bedded fossiliferous marine siltstone and very fine-grained silty sandstone.*
>
> ***Yaquina Formation (Upper Oligocene and Lower Miocene).*** *Thin- to thick-bedded, fine- to coarse- grained sandstone, conglomerate, and tuffaceous siltstone of delta origin.*

Alsea Formation (Oligocene). *Massive to thick-bedded, fossiliferous, tuffaceous marine siltstone and fine-grained sandstone* (GRI, 2020).

1.3.7 Seismic Hazards

The District is located along the Cascadia Subduction Zone, a boundary area between the Juan de Fuca and North American tectonic plates. Persistent concerns in the Cascadia Subduction Zone center on the potential for a significant seismic event to occur because of shifting tectonic plates. In addition to its location along the Cascadia Subduction Zone, three crustal faults were identified in the District (GRI, 2020). Figure 1.9 shows the locations of those fault lines per the USGS U.S. Quaternary Faults Database.

Seismic activity can trigger several simultaneous events with the potential to damage infrastructure including landslides, soil liquefaction, and tsunami inundation. The following sections review those hazard conditions.

1.3.7.1 Landslides

Landslides can be triggered by a variety of changes in environmental conditions including earthquakes, volcanic activity, and soil inundation due to heavy rainfall or poor drainage. The Oregon HazVu Statewide Geohazards Viewer was used to evaluate landslide hazards near the District. As shown in Figure 1.10, the areas with the highest landslide hazard potential are those located in the southern portion of the District to the east of Lincoln Beach in the upland areas along Fogarty Creek.

1.3.7.2 Soil Liquefaction

Soil liquefaction is a phenomenon involving soils losing strength because of seismic activity and behaving more similarly to a liquid than a solid. This behavior has the potential to destabilize structures built on these soils. The Oregon HazVu Statewide Geohazards Viewer was used to evaluate soil liquefaction potential in the District. As shown in Figure 1.11, most of the central and southern regions of the District have a moderate soil liquefaction hazard potential with northern coastal portions of the District have a low liquefaction hazard potential. Areas of high liquefaction potential are located to the north of the District near Siletz Bay.

1.3.7.3 Tsunami Inundation

A low-lying coastal community, the Gleneden Beach-Lincoln Beach service area is vulnerable to flooding from seismically induced tsunamis. DOGAMI has developed a collection of tsunami inundation maps that identify potential inundation zones for distantly triggered and locally triggered tsunamis. These tsunami inundation zones are shown in Figure 1.12. The distantly triggered tsunamis were assumed to originate from an earthquake near the Gulf of Alaska. In these events, the inundation zone is anticipated to be contained to those areas immediately adjacent to the ocean (DOGAMI, 2013). The local-source tsunamis evaluation modelled the potential impacts of five different seismic events. Under the two largest modelled seismic events, significant portions of the District would be inundated. The inundation zone is generally isolated to areas west of Highway 101; however, lands east of Highway 101 and near Fogarty Creek, Schoolhouse Creek, and Sijota Creek are also expected to be inundated (DOGAMI, 2013).

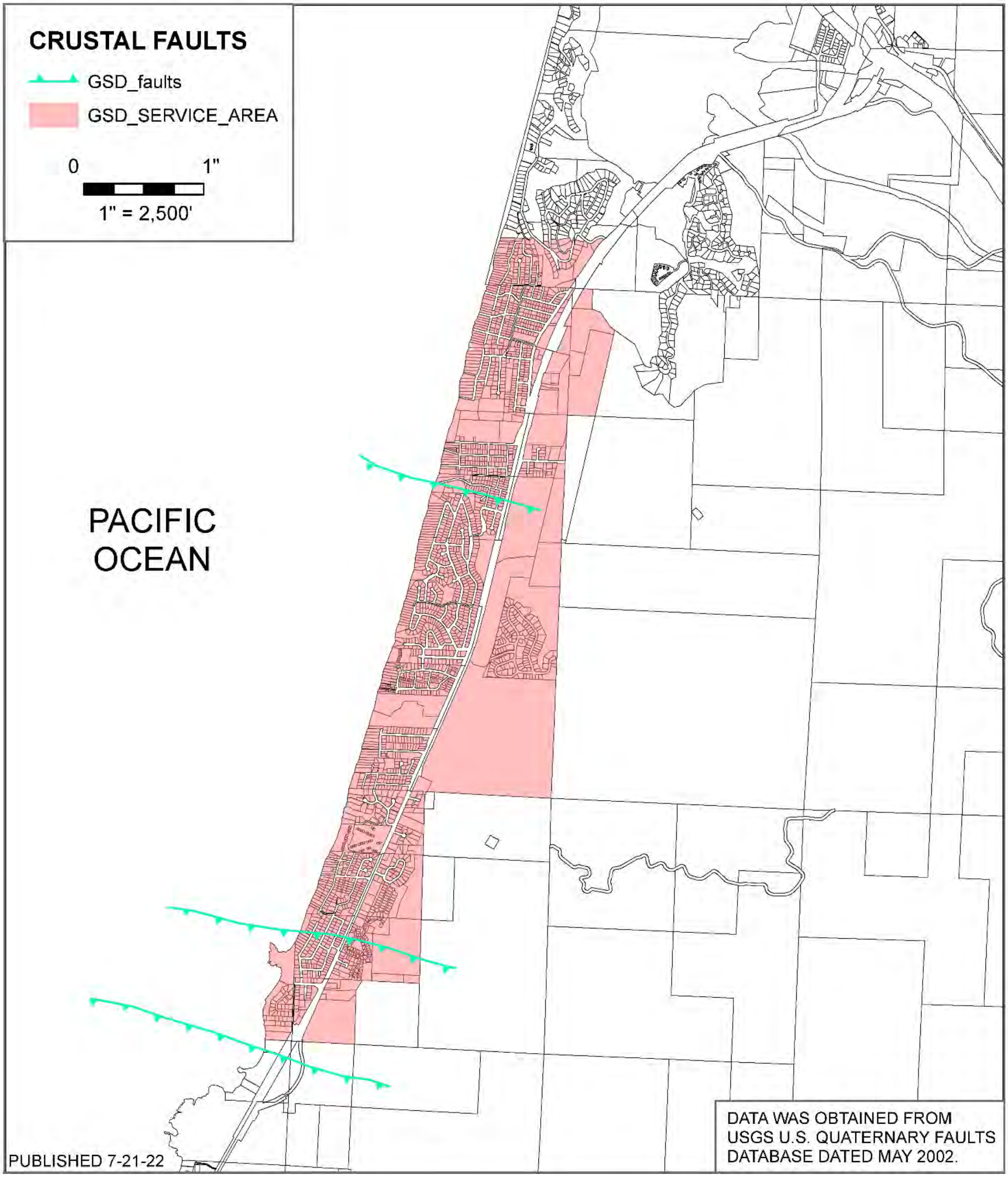

FIGURE 1.9: CRUSTAL FAULTS IN THE DISTRICT SERVICE AREA.

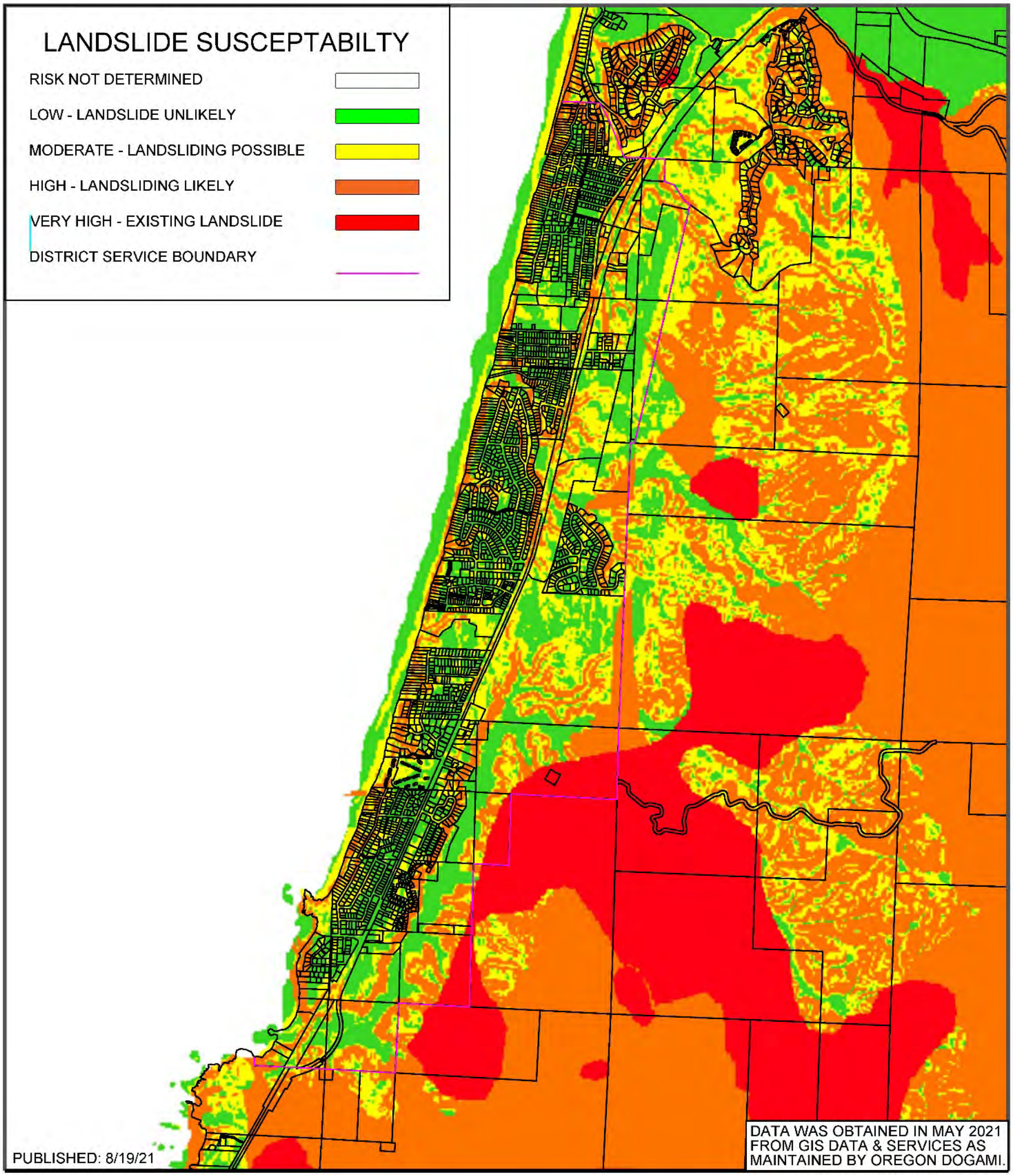

FIGURE 1.10: LANDSLIDE SUSCEPTIBILITY AREAS IN THE GLENEDEN SANITARY DISTRICT SERVICE AREA.

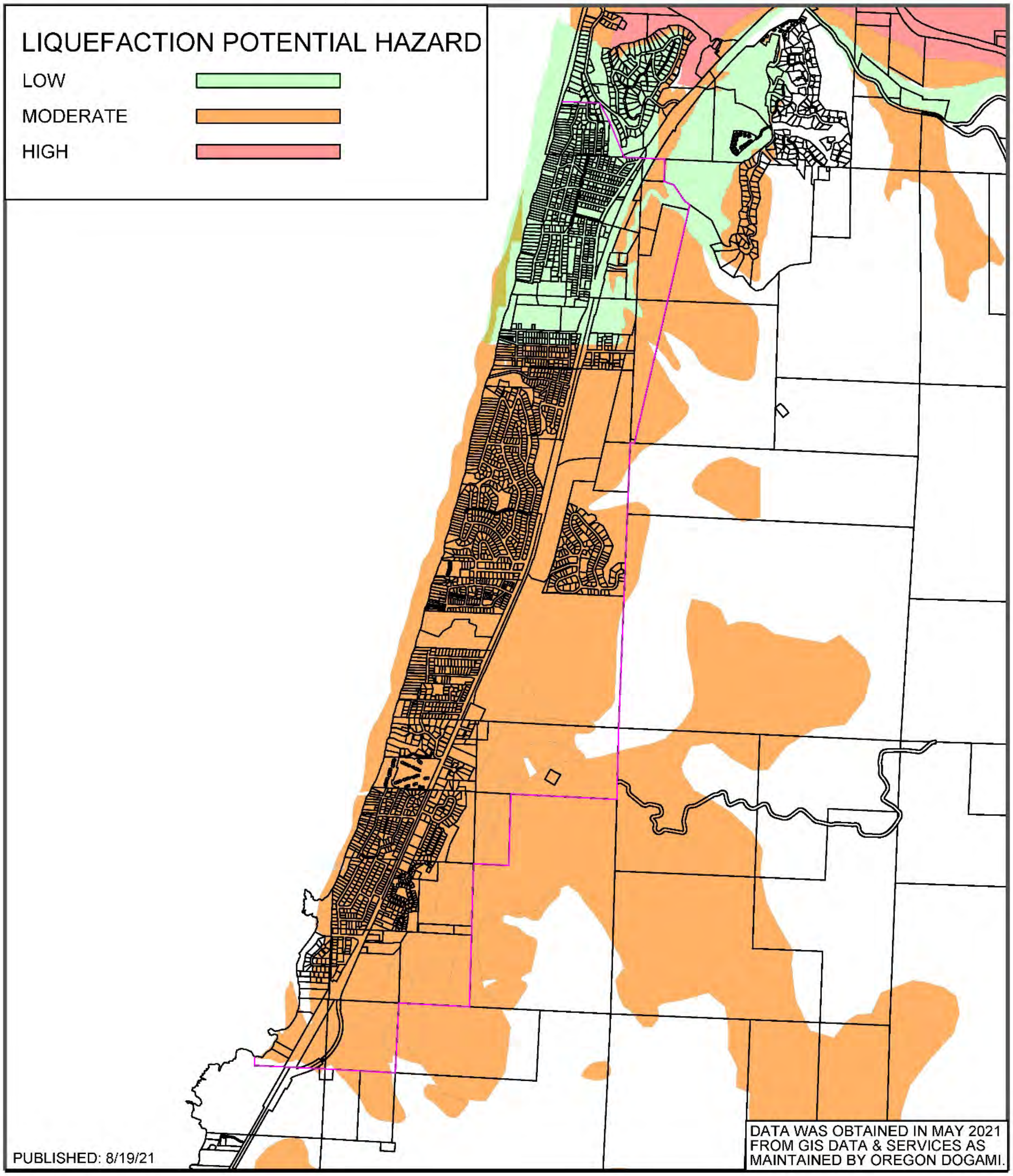

FIGURE 1.11: SOIL LIQUIFICATION POTENTIAL IN THE GLENEDEN SANITARY DISTRICT SERVICE AREA.

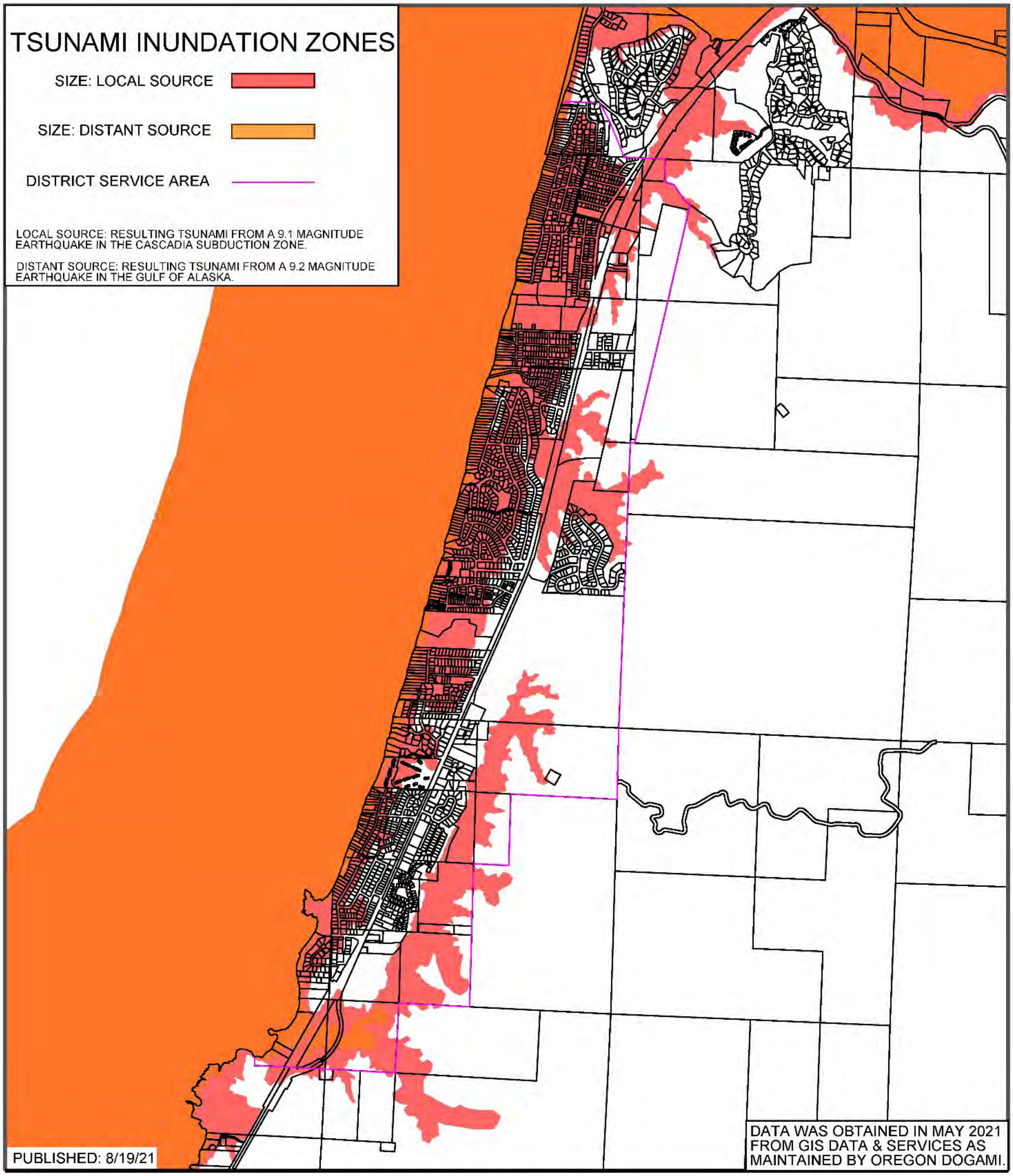

FIGURE 1.12: TSUNAMI INUNDATION ZONES IN THE GLENEDEN SANITARY DISTRICT SERVICE AREA.

1.3.8 Environmentally Sensitive Areas

Several environmentally sensitive areas are in or near the District and must be considered when evaluating potential project impacts. The District's location on the Pacific Ocean abuts the Oregon Coastal Refuge Complex. This complex includes several specific refuges including two which may directly impact work in the District: the Siletz Bay National Wildlife Refuge and the larger Oregon Islands National Wildlife Refuge.

Spanning nearly the entire length of the Oregon coast, the Oregon Islands National Wildlife Refuge consists of 1,853 rocks, reefs, and islands. This refuge is home to nesting seabirds, seals, and sea lions. Areas identified as part of the refuge within the District's boundary are located in the southern region near Fogarty Creek Beach and Fishing Rock State Recreation Site. Additionally, refuge areas are located north of the District on the eastern shore of Siletz Bay.

Encompassing Siletz Bay and adjacent land areas, the Siletz Bay National Wildlife Refuge is located approximately a half mile to the north of the northern boundary of the District. The refuge area includes the Siletz Bay and nearby marshes, sloughs, and mudflats. The Millport Slough extends from its discharge in Siletz Bay near Kernville more than a mile upstream along the Siletz River.

1.3.9 Flora and Fauna

TABLE 1-1: THREATENED AND ENDANGERED SPECIES POTENTIALLY PRESENT NEAR GLENEDEN SANITARY DISTRICT.

	Birds	
Common Name	**Scientific Name**	**Status**
Short-Tailed Albatross	*Phoebastria albatrus*	Endangered
Marbled Murrelet	*Brachyramphus marmoratus*	Threatened
Northern Spotted Owl	Strix occidentalis caurina	Threatened
Western Snowy Plover	*Charadrius nivosus*	Threatened
	Reptiles	
Common Name	**Scientific Name**	**Status**
Leatherback Sea Turtle	*Dermochelys coriacea*	Endangered
Loggerhead Sea Turtle	*Caretta caretta*	Endangered
Olive Ridley Sea Turtle	*Lepidochelys olivacea*	Threatened

Biological resources in the District include numerous fish, birds, plants, and mammals. The U.S. Fish and Wildlife Service's Information for Planning and Conservation (IPaC) tool was used to identify threatened and endangered species in the vicinity of the District (U.S. Fish & Wildlife Service, 2021). Seven threatened or endangered species were identified as potentially being present in the region and are shown in Table 1-1. It is important to note that the IPaC search indicated that no critical habitats were identified in the District.

TABLE 1-2 COHO HABITAT USE DESIGNATIONS FOR WATERBODIES PRESENT NEAR GLENEDEN SANITARY DISTRICT.

Waterbody	Coho Habitat Use[1]
Sijota Creek	Rearing
Schoolhouse Creek	Spawning
Fogarty Creek	Rearing and Spawning
Siletz River (near Siletz Bay)	Rearing

[1]Coho Habitat Use as defined in the Coho Distribution Map produced by the Oregon Department of Fish and Wildlife (06/25/2012).

TABLE 1-3 MIGRATORY BIRD SPECIES POTENTIALLY PRESENT NEAR GLENEDEN SANITARY DISTRICT.

Common Name	Scientific Name	Breeding Season
Bald Eagle	*Haliaeetus leucocephalus*	Jan 1 - Sep 30
Black Oystercatcher	*Haematopus bachmani*	Apr 15 - Oct 31
Black Turnstone	*Arenaria melanocephala*	Breeds elsewhere
Black-footed Albatross	*Phoebastria nigripes*	Breeds elsewhere
Black-vented Shearwater	*Puffinus opisthomelas*	Breeds elsewhere
California Thrasher	*Toxostoma redivivum*	Jan 1 - Jul 31
Clark's Grebe	*Aechmophorus clarkii*	Jan 1 - Dec 31
Great Blue Heron	*Ardea herodias fannini*	Mar 15 - Aug 15
Lesser Yellowlegs	*Tringa flavipes*	Breeds elsewhere
Long-billed Curlew	*Numenius americanus*	Breeds elsewhere
Marbled Godwit	*Limosa fedoa*	Breeds elsewhere
Olive-sided Flycatcher	*Contopus cooperi*	May 20 - Aug 31
Pink-footed Shearwater	*Puffinus creatopus*	Breeds elsewhere
Red-throated Loon	*Gavia stellata*	Breeds elsewhere
Rufous Hummingbird	*Selasphorus rufus*	Apr 15 - Jul 15
Short-billed Dowitcher	*Limnodromus griseus*	Breeds elsewhere
Whimbrel	*Numenius phaeopus*	Breeds elsewhere
Willet	*Tringa semipalmata*	Breeds elsewhere

In addition to the species listed in Table 1-1, Coho Salmon (Oregon Coast ESU) are a threatened species present in waterbodies in the District. Table 1-2 summarizes the habitat use designations of surface water bodies in or near the District.

The IPaC tool was also used to identify migratory birds which could potentially be impacted by activities within the District. The eighteen migratory bird species listed in Table 1-3 were identified as potentially present in the District.

1.3.10 Cultural Resources

A preliminary screening for culturally significant structures was performed using the National Register of Historic Places GIS map. No structures in the Gleneden Sanitary District were identified on the map.

1.4 Populations Trends

1.4.1 Historic Growth Rates

Per Oregon Administrative Rule 660-032-0020, communities outside the Metro boundary must apply the most recent final forecast issued by the Portland State University Population Research Center (PSU PRC) to develop population projections. As an unincorporated area of Lincoln County, population estimates within the District boundaries were not specifically defined during the decennial census process conducted by the U.S. Department of Commerce (U.S. Census Bureau, 2021) or in the annual population estimates calculated by the PSU PRC as reported in the *Proposed Coordinated Forecasts for Lincoln County, its Urban Growth Boundaries (UGBs), and the Area Outside UGBs* dated March 2021 (PSU, 2021).

It is necessary to use a combination of data developed in these studies with service connection information provided by the District to calculate the equivalent served population of the District. During the 2010 U.S. Census, the Lincoln Beach Census-Designated Place (which includes Lincoln Beach and Gleneden Beach) was estimated to have a population of 2,045 people (U.S. Census Bureau, 2021). This estimate likely underrepresents the total population served by the District, especially during warm weather months. The District is known to have a significant number of second homes used seasonally by their owners or as rental properties. The U.S. Census methodology only counts the permanent population of an area; therefore, individuals with second residences in the District would not be considered during the census population estimating process. However, these second residences would still discharge to the wastewater system when occupied. It is necessary to determine the peak population of the district when these second residences are occupied in order to calculate the peak wastewater capacity needs of the District.

To evaluate growth trends in the District, changes in equivalent dwelling unit (EDU) counts were used as a proxy for changes in population. An equivalent dwelling unit is a unit of measure for the sewage generated from particular buildings, structures or uses. One equivalent dwelling unit is equal to an approximation of the amount of sewage generated by an average single-family residence. The District determines its EDU count annually based on the type of use served by the connection or the associated water meter size. A summary of the EDU's allocated to each connection type and the total EDU count in the district as of 2020 is in Table 1-4.

The total EDU count for the District as of 2020 is 2,221. EDU counts for the last 10-years by user classification are shown in Figure 2.14. The data generally shows minimal growth during the previous decade. Between 2010 and 2019, the District has experienced a net increase of 40 EDUs. This increase represents an average annual growth rate (AAGR) of approximately 0.2%. This is slightly less than the AAGR estimates from the PSU PRC for unincorporated portions of Lincoln County of 0.32% per year (PSU, 2021). Notably, the data shows a decrease in the number of residential single family development EDUs and an increase in the number of EDUs for residential multi-unit facilities between 2019 and 2020. This change in EDUs is attributed to an administrative reclassification of units by the District, resulting in a small reduction in total EDUs. Using information provided by Lincoln County, the District reclassified registered vacation and short-term rentals from single-family to residential multi-unit facilities. Because it was unclear if the reclassification contributed to the reduction in EDUs the data for 2020 was not used in the average EDU growth rate percentage calculation.

TABLE 1-4: EDU METHODOLOGY FOR GLENEDEN SANITARY DISTRICT.

Development Type	EDU's per Unit
Single Family Dwelling	1
Multi-Family	1
Manufactured Home	1
Tourist Accommodations[1]	1
Tourist Accommodations[2]	0.5
RV Parks / Campgrounds	0.5
Industrial / Commercial / Other	By Meter Size

Meter Size	EDU's per Meter
5/8" - 3/4"	1
1"	2.5
1-1/2"	5
2"	8
3"	16
4"	25
6"	50
8"	80

[1]Hotel/motel units with kitchens or fixtures other than bathrooms.
[2]Hotel/motel units with bathroom only.

Description	EDU Count (Yr 2020)
Residential SFD	1,493
Residential - Multi-Unit	79
Residential - Multi-Unit Facilities	385
Motel / RV Park	210
Motel / RV Park Mgr Unit	1
Commercial- 3/4"	36
Public- 2"	17
Total EDUs	2,221

THIS TREND OF MINIMAL POPULATION GROWTH WITHIN THE DISTRICT IS CONSISTENT WITH POPULATION ESTIMATES MADE FOR OTHER AREAS IN LINCOLN COUNTY.

Figure 1.13 shows how the population of municipal UGBs, unincorporated areas, and the total population of Lincoln County changed between 1990 and 2020. Data points for 1990, 2000, and 2010 represent US Census population estimates, while data points from 2010 to 2020 are based on certified population estimates from the PSU PRC. Since 2010, Lincoln County has observed an average annual population increase (AAGR) of 0.5%. During that time, unincorporated portions of Lincoln County decreased in population at an annual average rate of -0.1% per year.

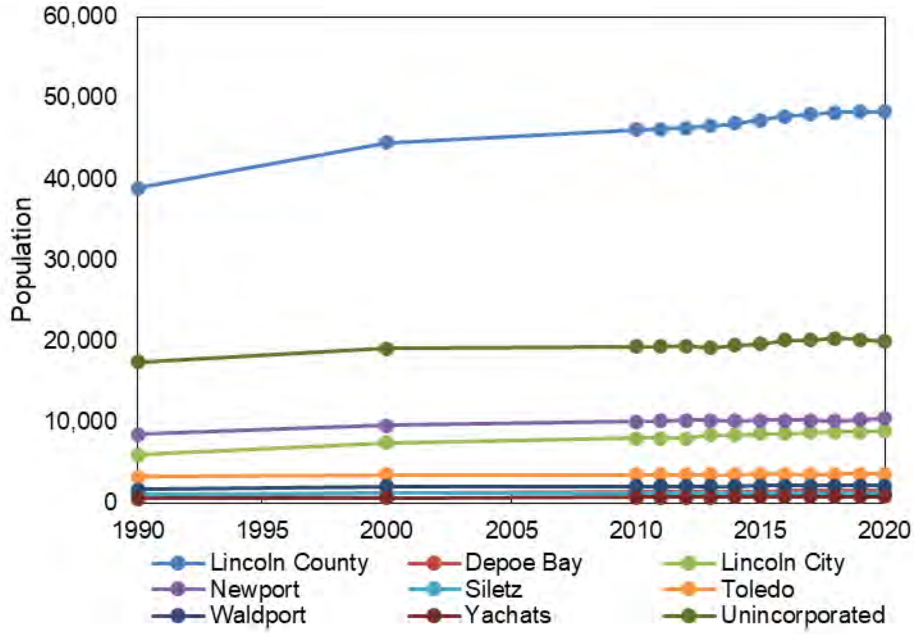

FIGURE 1.13: POPULATION ESTIMATES FOR LINCOLN COUNTY, UGB'S WITHIN LINCOLN COUNTY, AND UNINCORPORATED LINCOLN COUNTY BETWEEN 1990 AND 2020

(U.S. Census Bureau, 2021) (PSU, 2021)

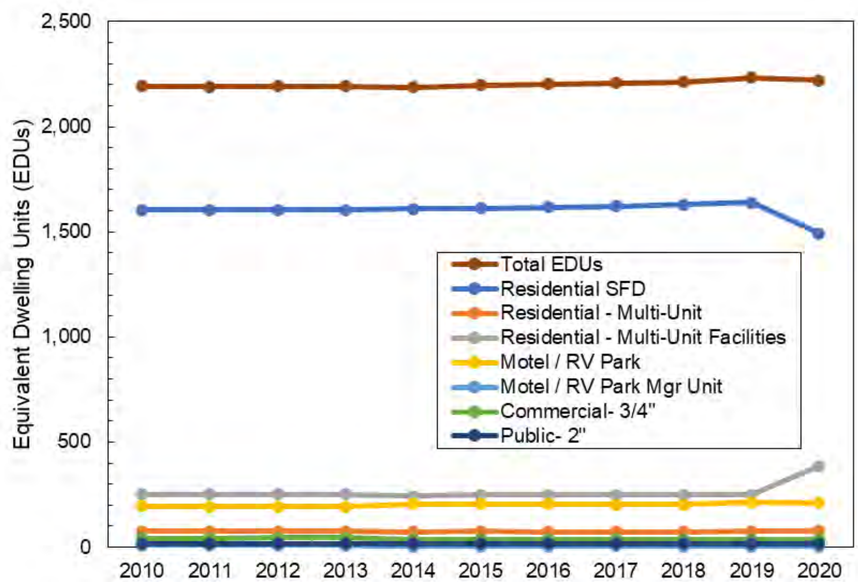

FIGURE 1.14: CHANGES IN DISTRICT EDU TOTALS FROM 2010 THROUGH 2020.

1.4.2 Projected Population Methodology

The 2021 calculated population of the District is 4,770 people considering residential EDUs only. The residential equivalent population served by the District is estimated to be 4,886 people including all EDU's. This population was determined by multiplying the total number of EDUs by the average number of persons per household in unincorporated areas of Lincoln County (2.2 Persons Per Household) as reported in 2010 U.S. Census and utilized by Portland State University (PSU) Population Research Center's Coordinated Population Forecast (U.S. Census Bureau, 2021; PSU, 2021). This population estimate is slightly higher than the population estimates presented in the District's *2018 Wastewater Collection System Facilities Plan Update* which estimated the 2022 population for the District at 4,428 persons (Harper Houf Peterson Righellis, Inc., 2018).

The HHPR report assumed that the growth rates and the average persons per household was a blend between the two neighboring communities of Depoe Bay and Lincoln City. Consequently, their projections used the District's 2017 EDU count, an average number of persons per household of 2.0 persons, and an AAGR of 0.9% to estimate the 2022 population.

Depoe Bay's average persons per household is the lowest in all of Lincoln County and likely underrepresents the District. Therefore, we have chosen to use the average Lincoln County persons per household of 2.2 people. Similarly, the AAGR of Depoe Bay was the highest in all of Lincoln County and does not correspond well with the observed growth rate of the District. However, all of the Lincoln County communities along the coast showed positive growth over the past decade, while the non-coastal areas of the County showed no-growth or negative growth. We have therefore chosen to use an AAGR that corresponds to the District observed growth of 0.2% which is higher than the Outside UGBs AAGR of -0.1% but lower than the Depoe Bay AAGR during the same period of 0.8%. Therefore, the projected residential equivalent population of the District at the end of the planning period in the year 2040 is 5,085 people, corresponding to 2,335 EDUs. The 2021 PSU PRC forecast for Lincoln County is shown in Table 1-5 and the District population and EDU forecast through the planning period is summarized in Table 1-6.

TABLE 1-5 LINCOLN COUNTY POPULATION ESTIMATES

	Historical			Estimates		Forecast			
Location	**2000**	**2010**	**AAGR (2000-2010)**	**2020**	**AAGR (2010-2020)**	**2045**	**2070**	**AAGR (2020-2045)**	**AAGR (2045-2070)**
Lincoln County (Overall)	44,479	46,034	0.3%	48,304	0.5%	53,500	53,858	0.4%	0.0%
Outside UGBs	17,036	17,216	0.1%	17,064	-0.1%	17,649	16,041	0.1%	-0.4%
Larger Sub-Areas									
Lincoln City	8,752	8,987	0.3%	9,671	0.7%	10,827	10,835	0.5%	0.0%
Newport	9,971	10,431	0.5%	11,882	1.3%	12,223	11,082	0.1%	-0.4%
Smaller Sub-Areas									
Depoe Bay	1,107	1,337	2.7%	1,450	0.8%	3,602	6,602	3.6%	2.4%
Siletz	1,150	1,322	1.4%	1,302	-0.1%	1,542	1,676	0.7%	0.3%
Toledo	3,698	3,783	0.2%	3,782	0.0%	3,827	3,422	0.0%	-0.4%
Waldport	2,229	2,258	0.1%	2,373	0.5%	2,810	3,014	0.7%	0.3%
Yachats	626	701	1.1%	780	1.1%	1,020	1,187	1.1%	0.6%

Sources: U.S. Census Bureau; PRC Estimates; Forecast by Population Research Center (PRC).

TABLE 1-6 DISTRICT POULATION AND EDU FORECAST THROUGH PLANNING PERIOD

Forecast for District EDUs and Average Population

Year	Total EDU's (1)	Residential Equivalent Estimated Population (2)	Residential EDUs	Estimated Population (3)
2020	2,221	4,886	2168	4,770
2025	2,243	4,935	2,190	4,817
2030	2,266	4,985	2,212	4,866
2035	2,289	5,035	2,234	4,915
2040	2,312	5,085	2,256	4,964
2045	2,335	5,136	2,279	5,014

(1) EDU and population projections based upon 0.2% AAGR and 2020 EDU count compiled by District

(2) Residential Equivalent Pop. Based on all EDUs in District with 2.2 PPH

(3) Residential EDUs only with 2.2 PPH

For the purposes of this study, the 2045 equivalent estimated population is 5,136 people. This is the population number that will be used for future flow projections.

1.4.3 Community Demographics and Socio-Economic Conditions

According to the 2015-2019 American Community Survey (ACS), there were approximately 21,300 households in Lincoln County. Those households have a median income of approximately $48,000 which is far less than the statewide median income of $62,800. Figure 1.15 shows the distribution of household incomes in the County and shows that most households have annual incomes less than $100,000. As shown in Figure 1.16, most households in the County have regular earned income while significant portions of households also receive income from social security or retirement accounts. This supports the characterization of Lincoln County as having a population distribution that tends to be older. The median age of a Lincoln County resident was 51.6 years while the statewide median age was only 39.3 years.

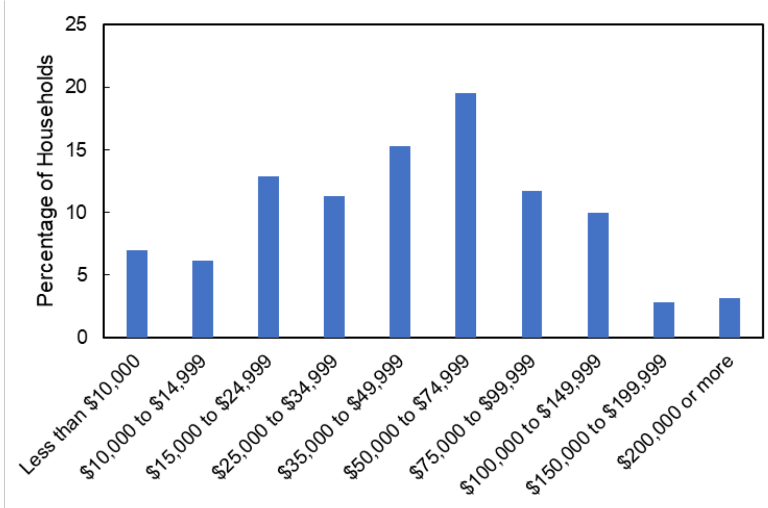

FIGURE 1.15 : INCOME DISTRIBUTION FOR HOUSEHOLDS IN LINCOLN COUNTY, 2015-2019 AMERICAN COMMUNITY SURVEY

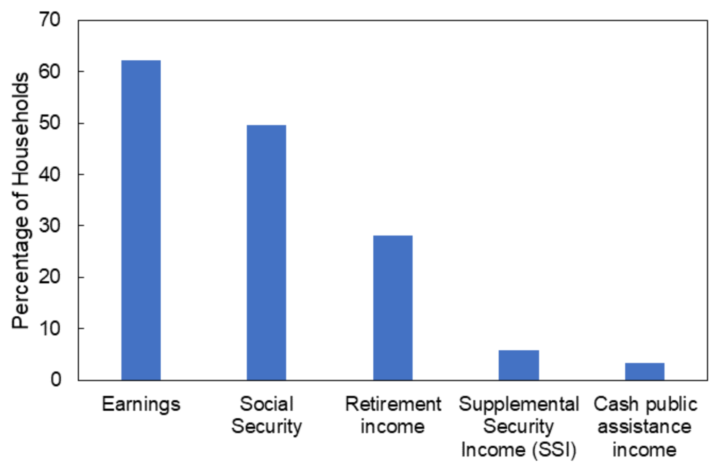

FIGURE 1.16: SOURCES OF INCOME FOR HOUSEHOLDS IN LINCOLN COUNTY, 2015-2019 AMERICAN COMMUNITY SURVEY.

Figure 1.17 shows the distribution of employment by industry in Lincoln County. The largest industry by employment appears to be the “art, entertainment, and recreation, and accommodation, and food services” sector. This is likely reflective of the importance of coastal tourism to the economy of Lincoln County.

The population of Lincoln County is relatively non-diverse. During the 2015-2019 ACS, approximately 95% of respondents self-reported a single race, and of those respondents, more than 88% indicated that they were white.

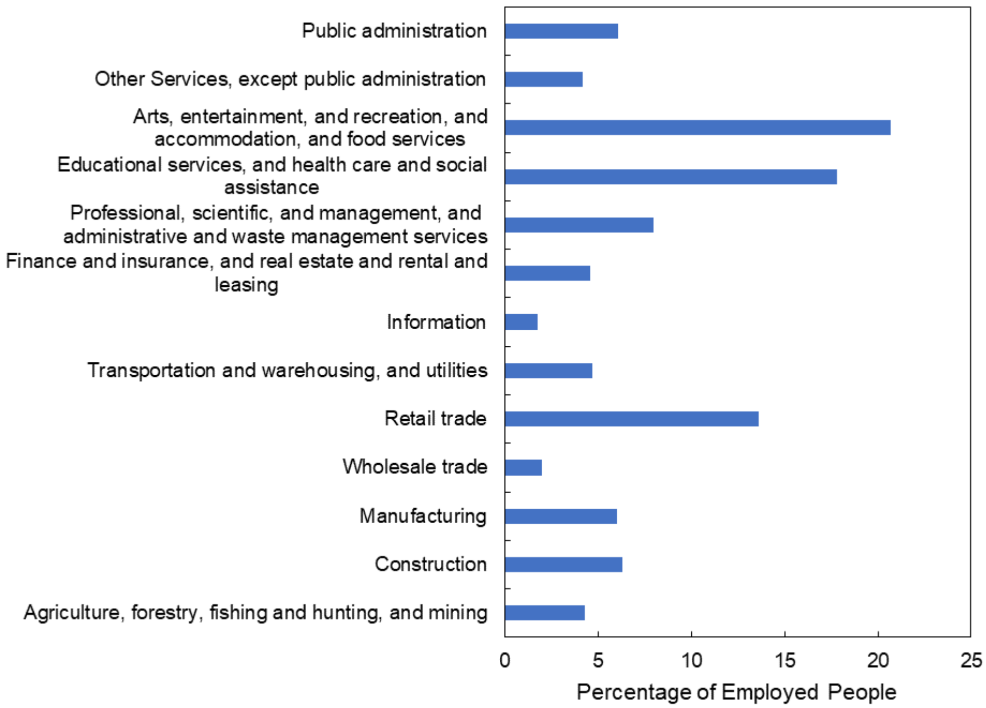

FIGURE 1.17: EMPLOYMENT DISTRIBUTION BY INDUSTRY FOR LINCOLN COUNTY, 2015-2019 AMERICAN COMMUNITY SURVEY.

1.5 Community Engagement

This process is relatively new for the District and to date Public Engagement has been limited to discussion during publicly advertised regular Board meetings of both Gleneden Sanitary District and the City of Depoe Bay. As the District advances the development of the new facility, it is recommended that the District conduct periodic open houses so that rate payers can be updated and have the opportunity to comment on the process, and that information be sent as part of the regular billing statements.

1.6 References

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2 EXISTING FACILITIES

2.1 Introduction and Location Map

The Gleneden Sanitary District provides wastewater collection and treatment services to the areas of Gleneden Beach, Coronado Shores, Lincoln Beach, and other nearby developments. See Figure 2-2. Wastewater collection is accomplished with a series of gravity collection systems that drain to local pump stations. In some cases, particularly in the northern portion of the collection system, wastewater may be pumped multiple times before it ultimately enters the Highway 101 interceptor. The interceptor conveys flow to the far southern boundary of the District where it enters the Fogarty Creek Pump Station located inside the Fogarty Creek State Recreation Area. The Fogarty Creek Pump Station pumps all wastewater from the District to the City of Depoe Bay collection system where it is treated at the Depoe Bay Wastewater Treatment Plant under an existing service agreement the District has with the City of Depoe Bay.

The wastewater assets belonging to the District generally consist of gravity system piping, pump stations, and their accompanying force mains. The District recently completed a Wastewater Collection System Facilities Plan Update which evaluated the condition of the collection system and provided recommendations for improvement (Harper Houf Peterson Righellis, Inc., 2018). Given the age of the report, many of the findings of that report likely remain valid and have been incorporated into this document for easy reference by reviewers. At the time of preparing this Facilities Plan, the District is completing extensive upgrades to several of its pump stations. When possible, the content in this Facilities Plan has been updated to reflect the expected conditions at the completion of that project (anticipated completion: summer 2022).

FIGURE 2-1: GSD SERVICE AREA MAP

2.2 History of Gleneden Sanitary District

The Gleneden Sanitary District was formed in the early 1970's and borne from the need to address sewage treatment and disposal concerns in the Gleneden Beach region. When the District formed, its service area consisted of properties with individual on-site disposal systems. When first developed, the District's collection system consisted of just seven pump stations, far fewer than the current 16 pump stations. Since its formation, the District has collected and conveyed wastewater to the Depoe Bay wastewater plant for treatment and disposal. An Environmental Impact Assessment prepared in 1974 indicates that conveyance of wastewater to the Depoe Bay wastewater plant for treatment and disposal was the selected approach instead of constructing lagoon or modified activated sludge treatment plants with an ocean outfall offshore from Fishing Rock State Recreation Site. Over time, additional pump stations and collection system gravity sewer and forcemain pipes were added to accommodate development growth.

2.3 Existing Facilities Inventories

2.3.1 Gravity Sewers and Force Mains

Table 2-1 summarizes the gravity sewer and force main lengths broken down by size, as well as the number of collection system manholes. These quantities have been updated since the 2018 masterplan with the completion of the recent collection system and pump station improvements completed in 2022.

TABLE 2-1: INVENTORY OF EXISTING COLLECTION SYSTEM PIPING

Gravity Sewers	
Pipe Size (in.)	**Length (ft.)**
6	1,405
8	72,925
10	3,185
12	320
15	13,755
Total Length	**91,590**
No. of Gravity Sewer MHs: 387	

Force Mains	
Pipe Size (in.)	**Length (ft.)**
4	4,340
6	4,430
8	7,015
10	1,795
Total Length:	**17,580**

Concrete was the material of choice for gravity sewer and pressure pipe in the 1970's when the system was originally installed. Over time, materials were gradually changed to PVC for gravity sewer pipe and PVC, Ductile Iron or HDPE for pressure pipe. Manholes are constructed of precast concrete.

2.3.2 Pump Stations and Appurtenances

Table 2-2 lists the District's pump stations and summarizes the upgrades and retrofits that have been completed since the 2004 Facilities Plan was prepared.

Table 2-3 summarizes the characteristics of all the pump stations.

TABLE 2-2: PUMP STATION UPGRADES AND RETROFITS

Recent Pump Station Upgrades and Retrofits (since 2007)							
Pump Station		Descriptions of Improvements	Date	Pump Station		Descriptions of Improvements	Date
PS #1 -	Fogarty Creek	1. Replaced w/ submersible PS 2. Added third pump 3. Installed cellular telemetry unit	2007 2016 2016	PS #9 -	Holiday Hills	1. Installed genset 2. Replaced impellers & motors (increased impeller diameter) 3. Retrofitted S&L priming system	2008-09
PS #2 -	Surfrider	None	---	PS #10 -	South Coronado	1. Added AC Apron 2 New UG power feed 3. Replaced impellers & motors 4. Retrofitted S&L priming system	2007 2010 2009 2008-09
PS #3 -	Pacific Palisades	1. Replaced impellers & motors (increased impeller diameter) 2. Retrofitted S&L priming system	2008-09	PS #11 -	Seagrove South	1. New Pump Station 2. Rebuilt existing wetwell	2022
PS #4 -	Willark Park West	None	--	PS #12 -	Seagrove North	1. New Pump Station 2. Rebuilt existing wetwell	2022
PS #5 -	Willark Park East	1. Replaced w/ package PS	2008	PS #13 -	North Coronado	New Pump Station and Forcemain	2022
PS #6 -	Searidge	1. Installed Multitrode	2008-09	PS #14 -	Wells Street	1. Installed genset from PS #1 (in garage) 2. Retrofitted S&L priming system	2007 2008-09
PS #7 -	Evergreen Ridge	Replaced Pumps (larger motor)	2009	PS #15 -	Trend West	1. Added AC access drive 2. New SS meter base & disconnect	2014 2016
PS #8 -	Rush Place	1. Installed genset 2. Replaced impellers & motors (increased impeller diameter) 3. Retrofitted S&L priming system	2008-09	PS #16 -	Laurel Street	1. New Pump Station	2022

TABLE 2-3: INVENTORY OF EXISTING PUMP STATIONS

Inventory of Existing Pump Stations													
							Rated Duty Point		Pump Motors			Force Main	
Pump Station ID	Location	PS Configuration	Pump Station Supplier	Wet Well Diameter (ft)	Pump Manufacturer	# of Pumps	Flow (gpm)	Head (ft)	Size (hp)	Speed (rpm)	Auxiliary Power	Size (in)	Length (ft)
PS #1 - Fogarty Creek	Fogarty Creek State Park - South Access	Submersible	Custom	8	Xylem Flygt	3	700	105	34	1,750	60 kW	10	1,976
PS #2 - Surfrider	Hwy 101 & Fogarty Ave.	Submerisble (in Septic Tank)	Custom	1,000 Gal.	Goulds Pumps	2	38	45	1	3,500	See Note	2	<100
PS #3 - Pacific Palisades	Lincoln Ave. & Seaview St.	Suction Lift Package PS	Smith & Loveless	5	Smith & Loveless	2	250	84	10	1,800	55 kW	4	910
PS #4 - Willark Park West	South End of Park	Submersible (in Manhole)	Custom	3	Hydromatic	1	50	17	1/2	---	See Note	2	250
PS #5 - Willark Park East	North End of Park	Submersible	Triangle Pump	3	Myers	2	60	18	1/2	1,750	See Note	2	300
PS #6 - Searidge	Searidge Drive	Suction Lift Package PS	Hydronix Model 111-T	5	Hydromatic	2	100	28	3	1,150	Portable	4	140
PS #7 - Evergreen Ridge	Wakash St.	Suction Lift Package PS	Hydronix	4 ft x 7 ft	Hydromatic	2	150	50	5	1,150	Portable	4	950
PS #8 - Rush Place	Rush Pl. - South End	Suction Lift Package PS	Smith & Loveless	5	Smith & Loveless	2	200	82	10	1,750	30 kW	4	600
PS #9 - Holiday Hills	J Way - West End	Suction Lift Package PS	Smith & Loveless	5	Smith & Loveless	2	200	81	10	1,750	30 kW	4	1,050
PS #10 - South Coronado	Monterey Ave.	Suction Lift Package PS	Smith & Loveless	5	Smith & Loveless	2	300	82	15	1,750	55kW	6	2,600
PS #11 - Seagrove South	Seagrove Drive	Suction Lift Package PS		5	Barnes	2	135	52	7.5	1,750	Portable	4	832
PS #12 - Seagrove North	Seagrove Loop	Suction Lift Package PS		5	Barnes	2	60	22	3	1,750	Portable	4	632
PS #13 - North Coronado	Hacienda Ave. & Palisades Dr.	Submersible		8	Barnes	2	680	106	50	1,750	150	8	3,910
PS #14 - Wells Street	Wells St.	Suction Lift Package PS	Smith & Loveless	5	Smith & Loveless	2	100	35	5	1,750	60kW	4	1,076
PS #15 - Trend West	Worldmark Dr.	Suction Lift Package PS	Hydronix Mondel 181	8	Aurora/ Hydromatic	2	140	45	7.5	1,750	Portable	4	~800
PS #16 - Laurel Street	Laurel Street & Neptune Ave.	Submersible		8	Barnes	2	500	128	40	1,750	125kW	6	2,350

2.3.3 Storage Garage and Portable Equipment

The District owns a three bay metal storage warehouse. The District uses the warehouse to store portable equipment, spare parts, and other miscellaneous items.

The District owns the following major portable equipment:

- Two portable generator sets, a 100-kW unit that was manufactured in approximately 2009 and a smaller 30 kW unit that was manufactured in approximately 1979.
- A trailer mounter sewer cleaner/jetter machine that was manufactured and purchased in approximately 1993. This equipment is primarily used for hydro-excavation, emergency repairs and blockage removal.
- An emergency pump assembly, including a trailer mounted hoist.
- A smoke testing manhole insert.
- Blowers for ventilating vaults and manholes prior to entry.

The District also owns portable bypass pumps for emergency use at the smaller pump stations and a trench shoring box. The District contracts for sewer cleaning, inspections and televising, and wet well cleaning. Cleaning of trouble spots in the sewer system and the wet wells is typically performed twice per year.

2.4 Existing Facilities Conditions

This Facility Plan has been prepared to assess alternatives and make recommendations for providing alternative wastewater treatment for the District. Collection system components have not been included in this analysis unless they directly affect the alternatives considered for treatment. A summary of collection system components is included below and is discussed in more detail in the 2004 and 2018 Wastewater Master Plans.

2.4.1 Conditions of Existing Gravity Sewers

Comparisons of wet weather/dry weather flow measurements at the Fogarty Creek Pump Station show that inflow and infiltration (I&I) from rainfall causes significant increases in flow rates during wet weather. However, no major deterioration of the sewer lines was detected during televising inspections of the system. The 40-year-old concrete pipe generally appears to be in fair condition and the pipe joints are mainly in fair to good condition. If hydraulic capacity is not an issue, then based upon the reasonable condition of the concrete pipe it will likely continue to perform adequately through duration of the 20-year planning period. It is likely that the pipe will be nearing the end of its useful life at that time and the District should consider an annual pipe rehabilitation/replacement program to spread life-cycle costs over time so the District is not forced to replace the bulk of the collection system all at once.

The leaks found during video inspections are most often caused by damaged service laterals or lateral connections to the main sewer pipe. Given that many laterals in the system are also approximately 40 years old, an ongoing program of lateral rehabilitation or replacement should be considered by the District to reduce I&I impacts.

The sewer manholes in the system have also generally been found to be in fair condition. Manholes receiving force main discharges show signs of accelerated corrosion associated with hydrogen sulfide off gassing. The manholes will be reaching the end of their service lives at the end of the 20-year planning period. The District should consider implementing a manhole rehabilitation/replacement program to address ongoing deterioration, beginning with the manholes that are receiving pump station effluent.

The 2004 planning effort included a simplified hydraulic analysis of the collection system that used a computer model to evaluate existing and projected capacity needs. The hydraulic analysis predicted that a deficiency would occur in the 15-inch, Highway 101 Interceptor from Pacific Street to Rock Drive and recommended the District install a 10-inch parallel sewer to eliminate the capacity deficit projected to occur at flows above 1.7 MGD. The 2018 planning effort did not include a new collection system model but did concur that the District will likely see system-wide peak design flows exceeding 1.7 MGD by the end of the 20-year planning period.

2.4.2 Conditions of Existing Pump Stations

Table 2-4 summarizes the overall conditions of the collection system pump stations. Additional detail on pump station condition is included in the 2004 and 2018 Master Plans. The 2004 plan identified capacity deficiencies at three pump stations including Fogarty Creek (PS #1), North Coronado (PS #13), and Laurel Street (PS #16). The 2018 plan also identified Seagrove South (PS #11) as potentially having inadequate firm pumping capacity. Since the publishing of those reports, all of these pump stations have been replaced. The Seagrove North (PS#12) has also been replaced.

TABLE 2-4: CONDITIONS OF COLLECTION SYSTEM PUMP STATIONS.

Summary of PS Conditions				
PS Name	**Structural Condition(1)**	**Equipment Condition**	**General Safety Rating**	**Overall Condition**
PS #1 - Fogarty Creek	Excellent	Excellent to Good	Excellent	Excellent
PS #2 - Surfrider	Good	Fair	Good	Fair
PS #3 - Pacific Palisades	Good to Fair	;ood to Fair to Goo	Fair to Poor	Fair
PS #4 - Willark Park West	Poor	Fair	Good	Fair
PS #5 - Willark Park East	Good	Good	Good	Good
PS #6 - Searidge	Fair	Poor	Poor	Poor
PS #7 - Evergreen Rdige	Good	Good to Fair	Fair to Poor	Fair
PS #8 - Rush Place	Good to Fair	Fari to Poor	Fair	Fair
PS #9 - Holiday Hills	Good to Fair?	Fair	Fair to Poor	Fair
PS #10 - South Coronado	Fair	Good to Fair	Fair to Poor	Fair(3)
PS #11 - Seagrove South	Excellent	Excellent	Excellent	Excellent
PS #12 - Seagrove North	Excellent	Excellent	Excellent	Excellent
PS #13 - North Coronado	Excellent	Excellent	Excellent	Excellent
PS #14 - Wells Street	Fair	Fair	Fair to Poor	Fair
PS #15 - Trend West	Fair	Fair	Fair	Fair
PS #16 - Laurel Street	Excellent	Excellent	Excellent	Excellent

(1)Based on observations by District staff. No leak tests were performed.

(2)Threat of ongoing erosion impacts reliability.

(3)Small wet well volume impacts reliability.

2.5 Facilities Mapping

Maps of the current wastewater collection system are provided in Table 2-1 through Figure 2-9. These maps are based on information provided by the District and reflect current conditions. These maps are excerpted directly from the 2018 Master Plan. (Harper Houf Peterson Righellis, Inc., 2018)

FIGURE 2-2: PUMP STATION SCHEMATIC

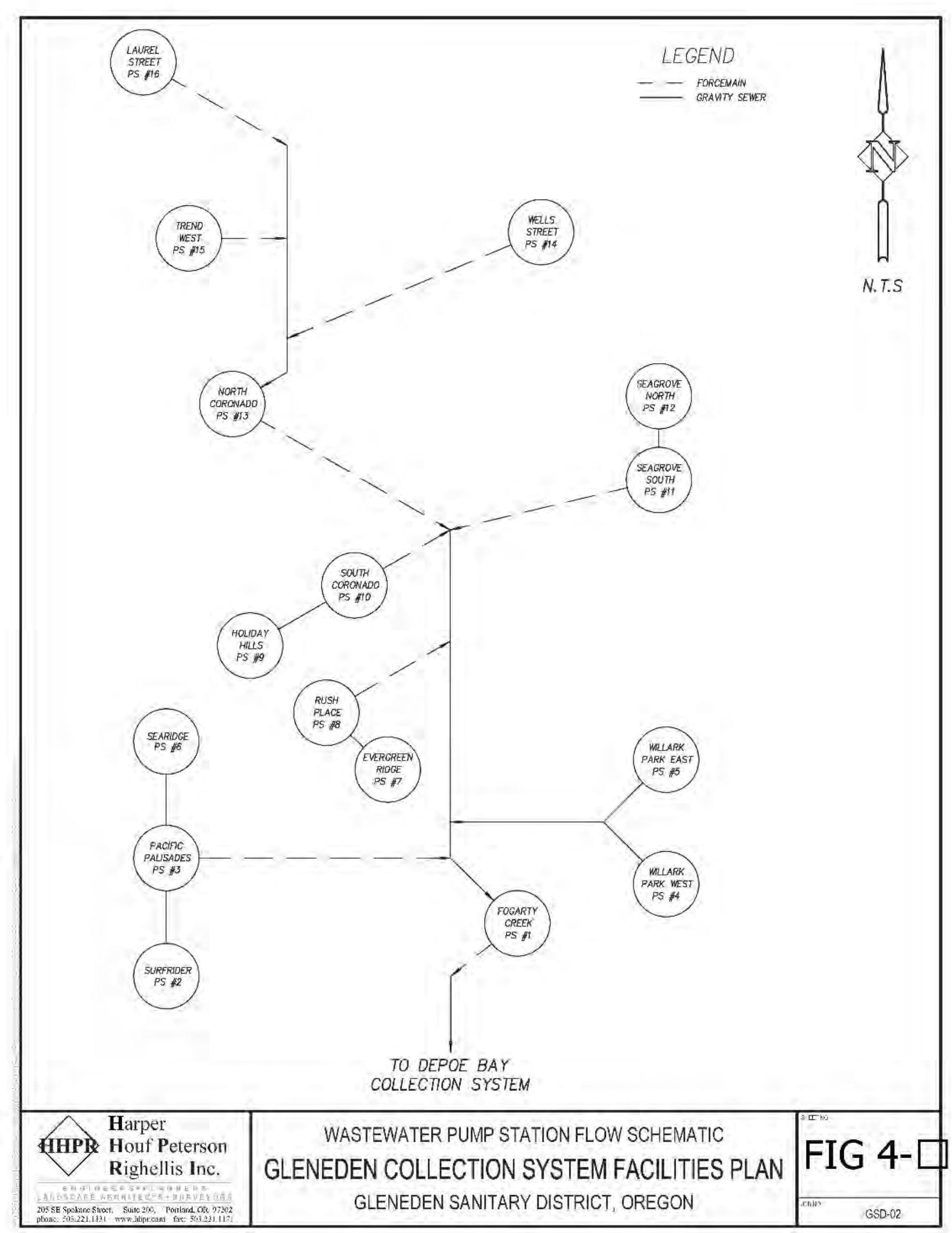


FIGURE 2-3: CURRENT OVERALL WASTEWATER COLLECTION SYSTEM

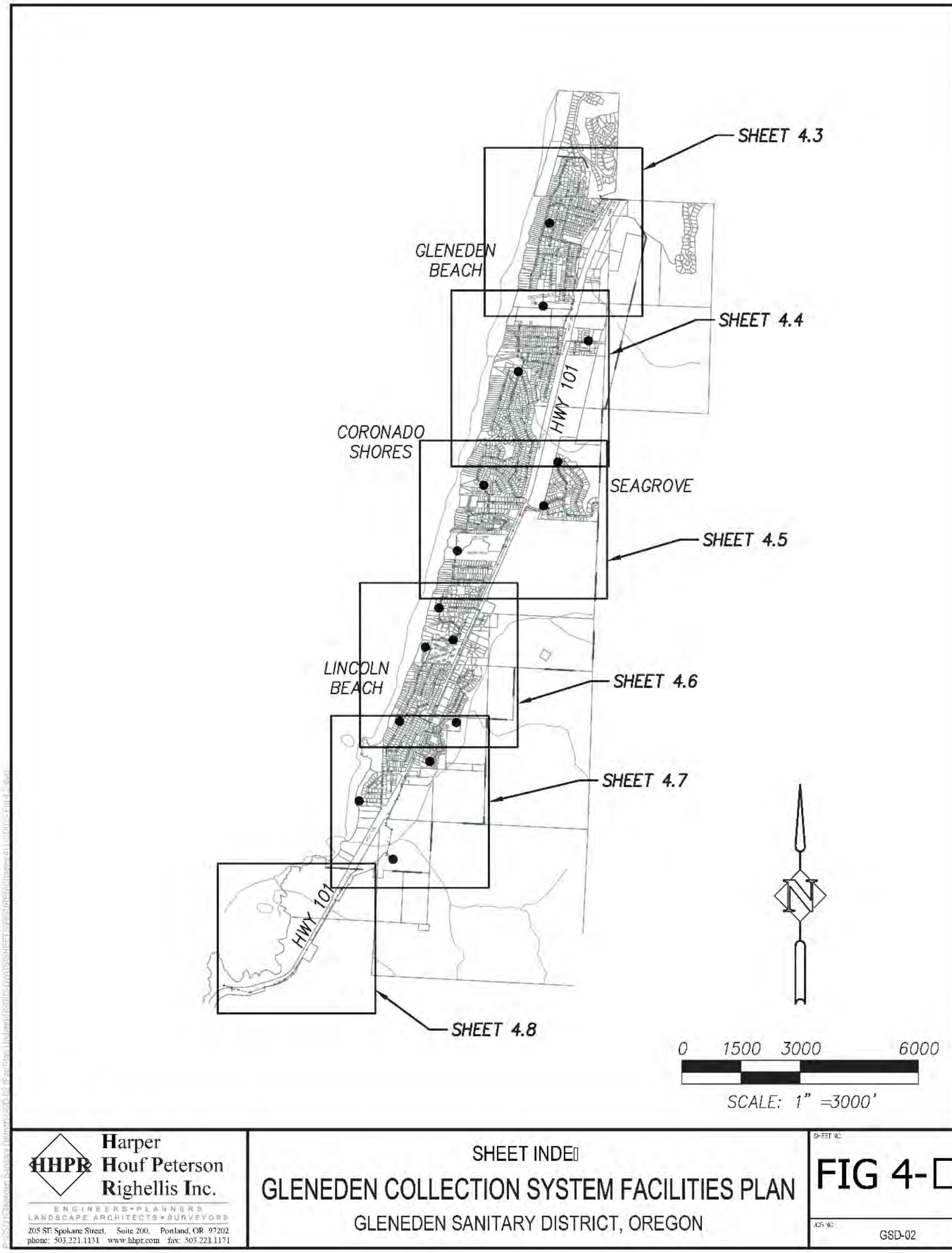


FIGURE 2-4: CURRENT WASTEWATER SUB-BASIN #1

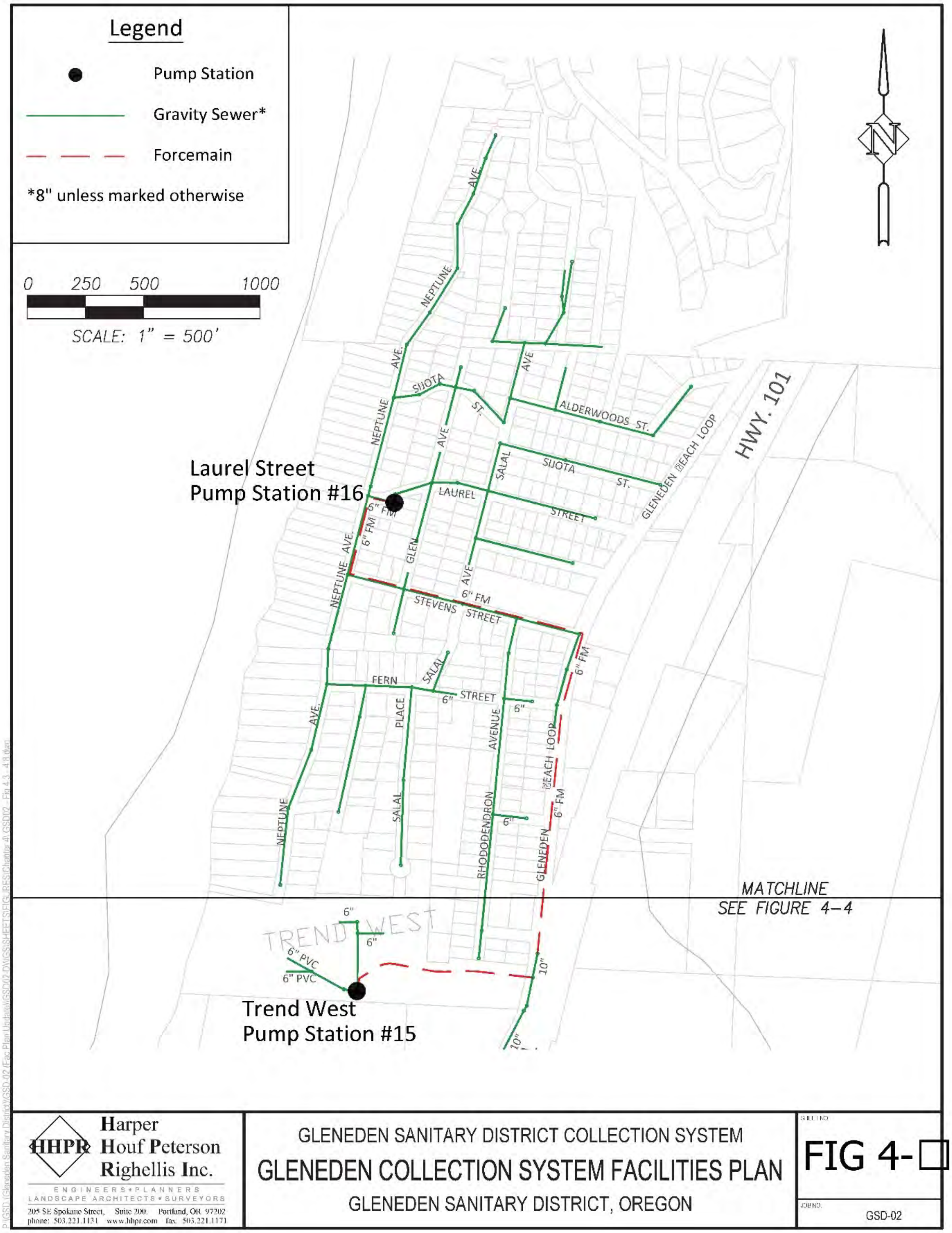


FIGURE 2-5: CURRENT WASTEWATER SUB-BASIN #2

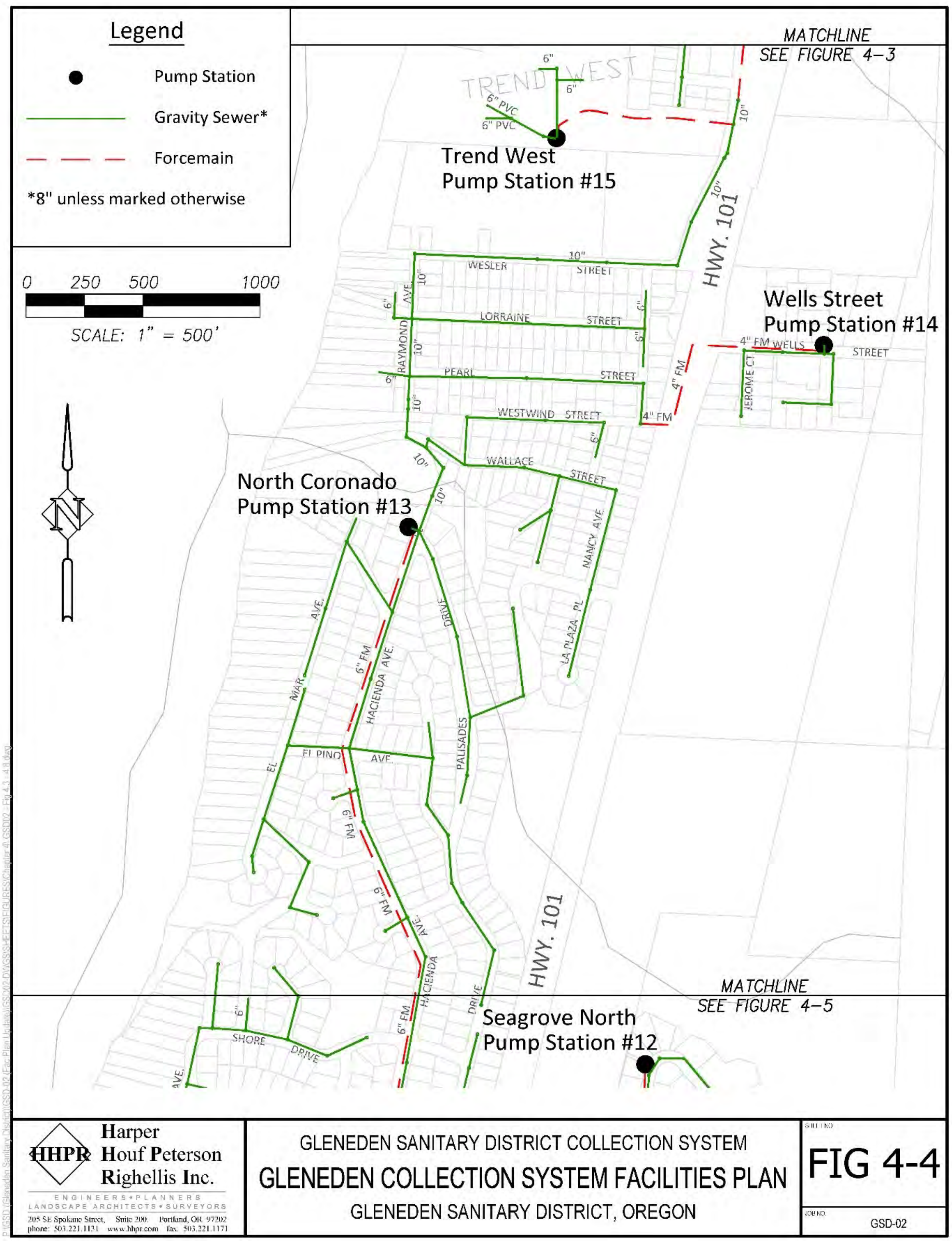


FIGURE 2-6: CURRENT WASTEWATER SUB-BASIN #3

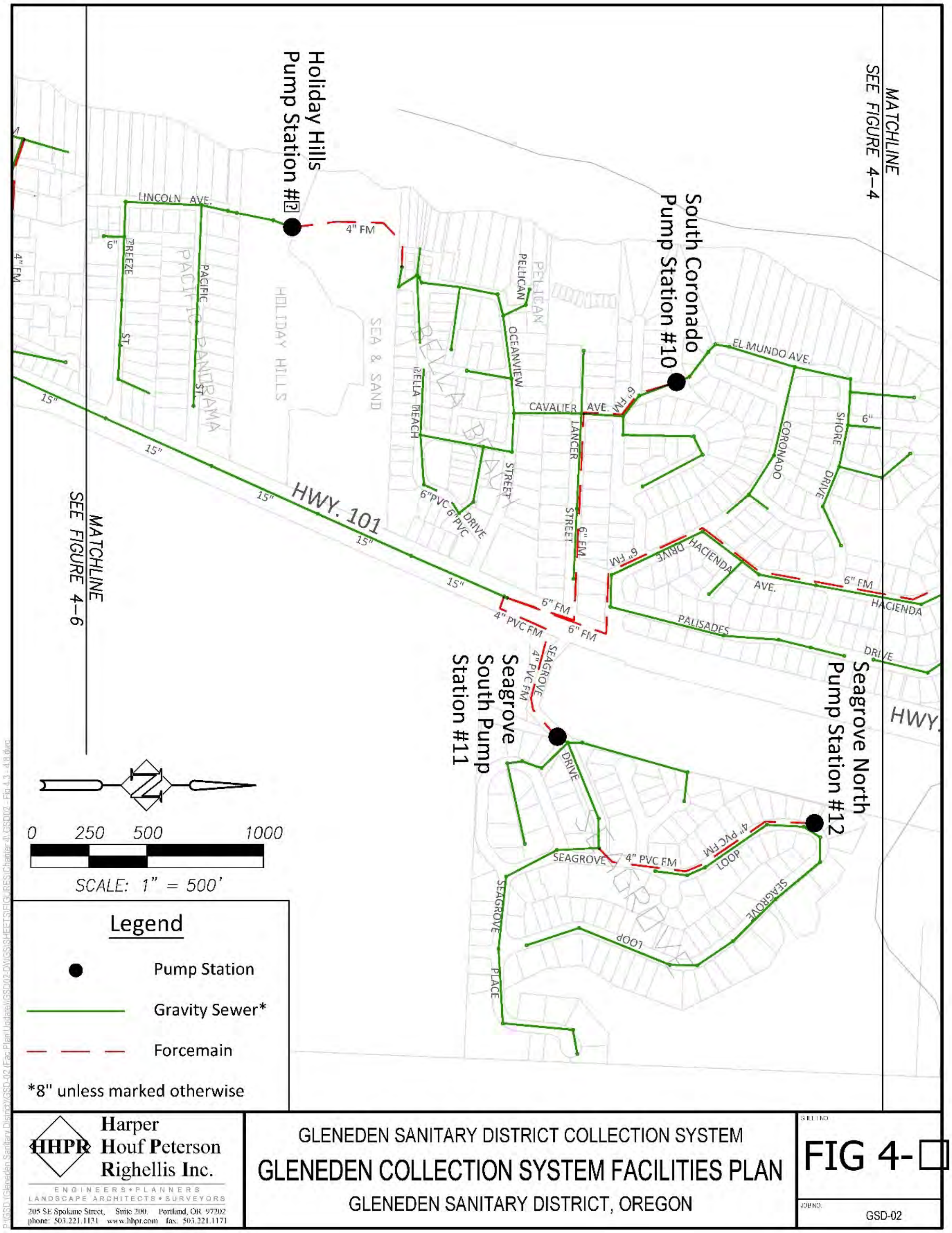


FIGURE 2-7: CURRENT WASTEWATER SUB-BASIN #4

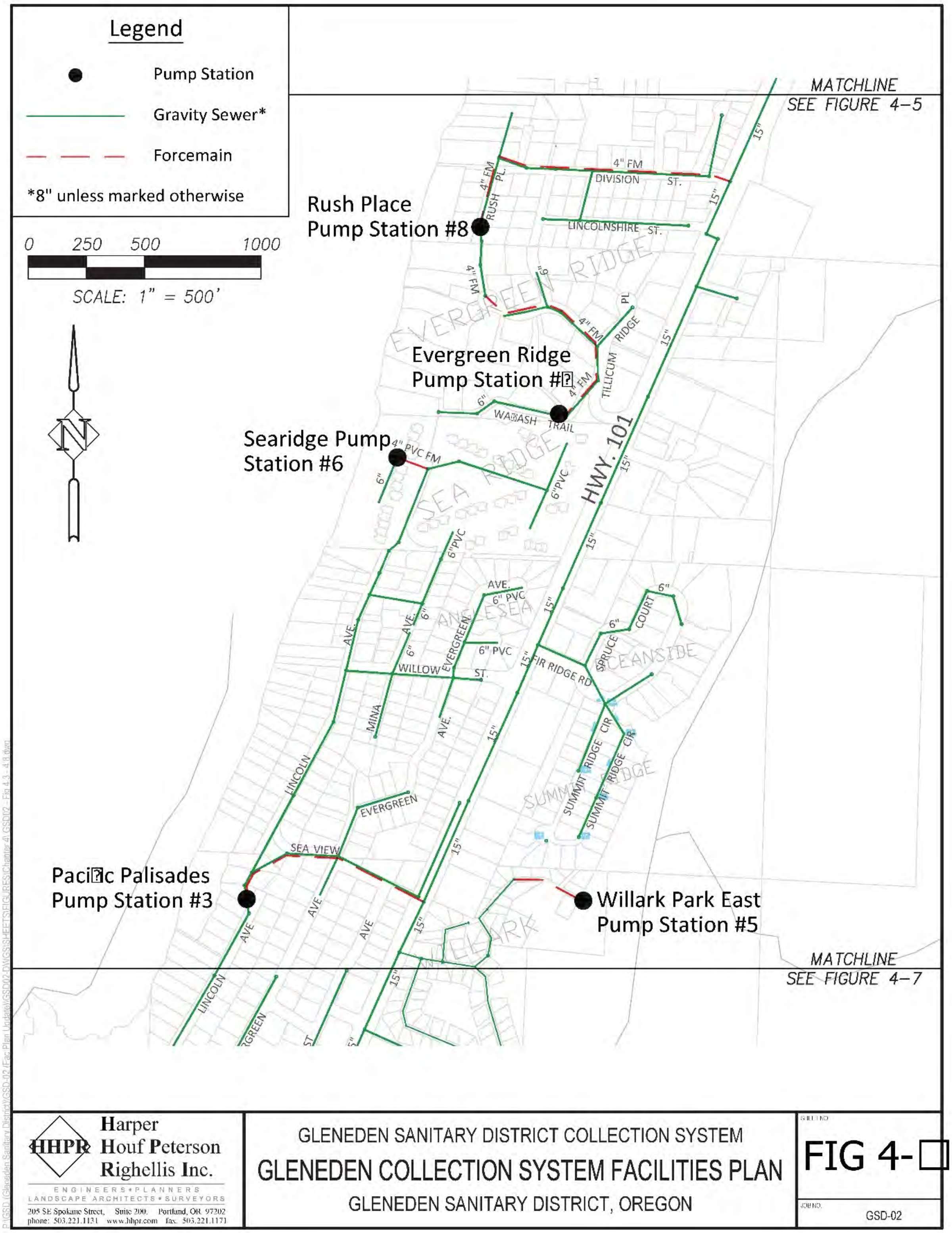


FIGURE 2-8: CURRENT WASTEWATER SUB-BASIN #5

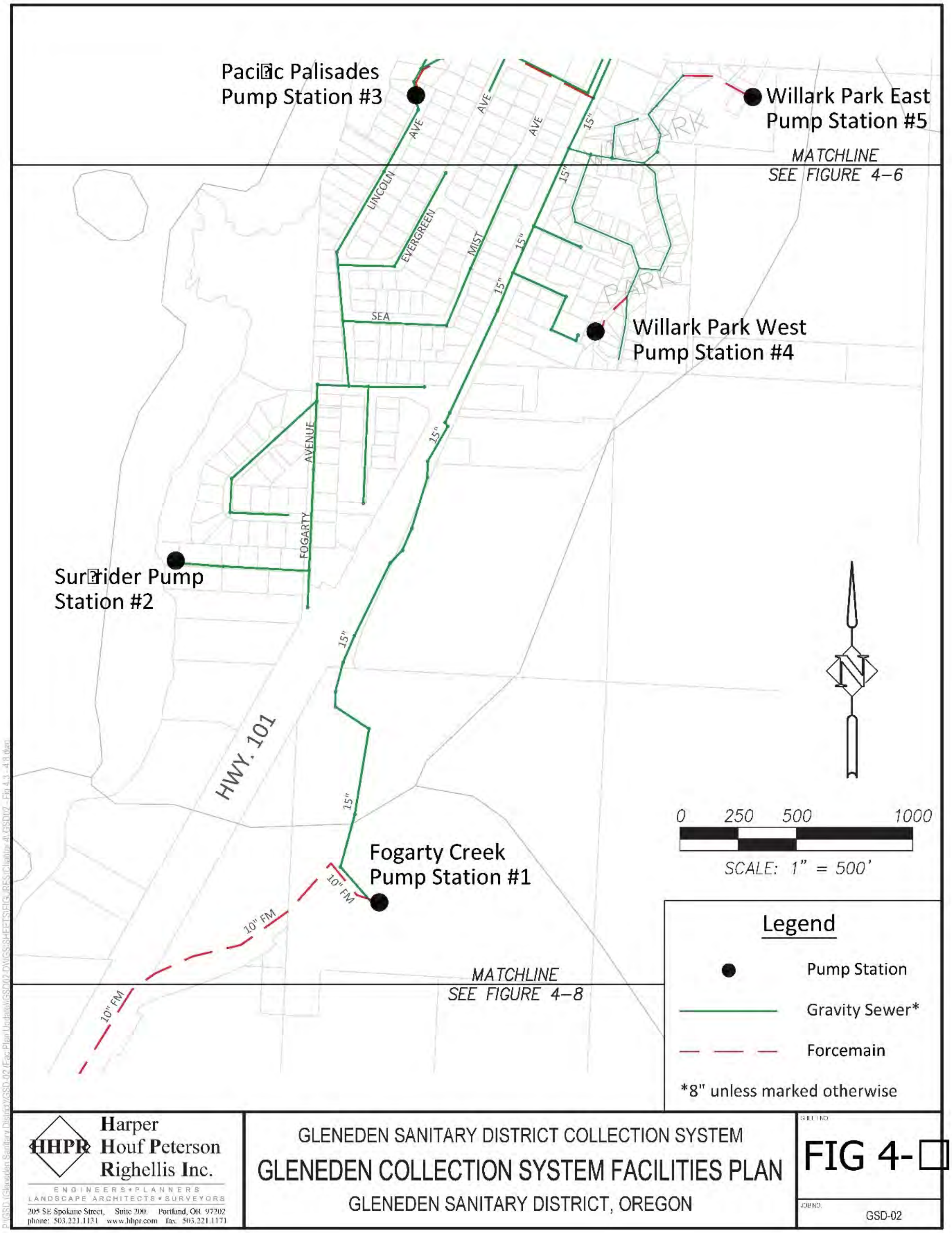
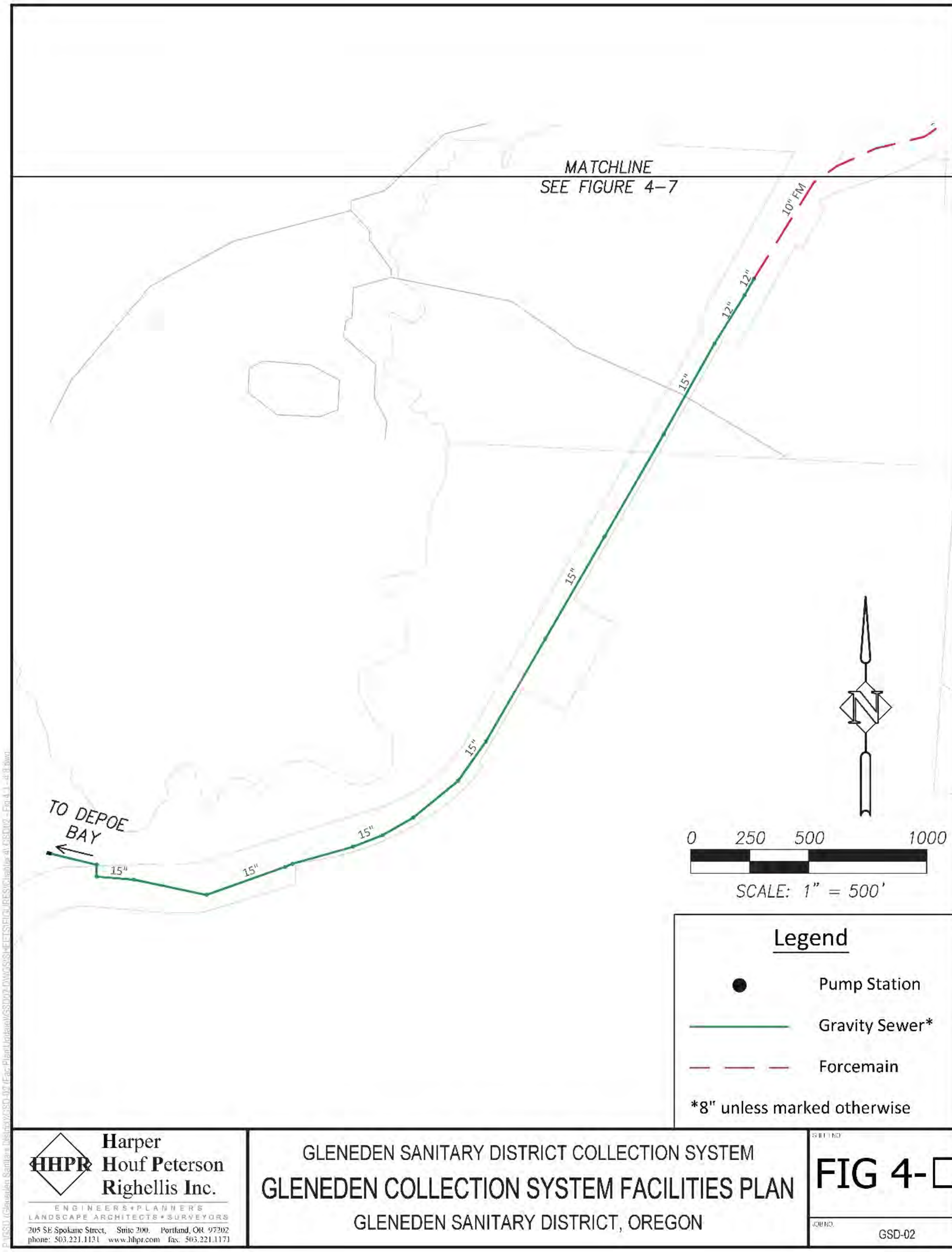


FIGURE 2-9: CURRENT WASTEWATER SUB-BASIN #6



2.6 Existing Flow Rate and Pollutant Loading

Gleneden Sanitary District currently conveys all wastewater to the City of Depoe Bay wastewater plant for treatment and discharge. All wastewater from the District flows to the Fogarty Creek Pump Station located on the southern boundary of the District where a pump station conveys flow to the City of Depoe Bay wastewater collection system. The following sections characterize the current flow rates and pollutant loading conditions for wastewater conveyed from the District to the City of Depoe Bay.

2.6.1 Existing Flow Rates

Existing flow rates from the District were determined according to the methodology established in the *Guidelines for Making Wet-Weather and Peak Flow Projections for Sewage Treatment in Western Oregon: MMDWF, MMWWF, PDAF, and PIF* (Oregon DEQ). Information used in this analysis was mainly obtained from historical pumping records from the Fogarty Creek Pump Station (PS#1). Flow rate data used for this analysis was collected between May 1, 2016, and April 30, 2021. Total daily flow rates and precipitation measurements as recorded at the City of Depoe Bay wastewater plant for this period are included in Figure 2-10.

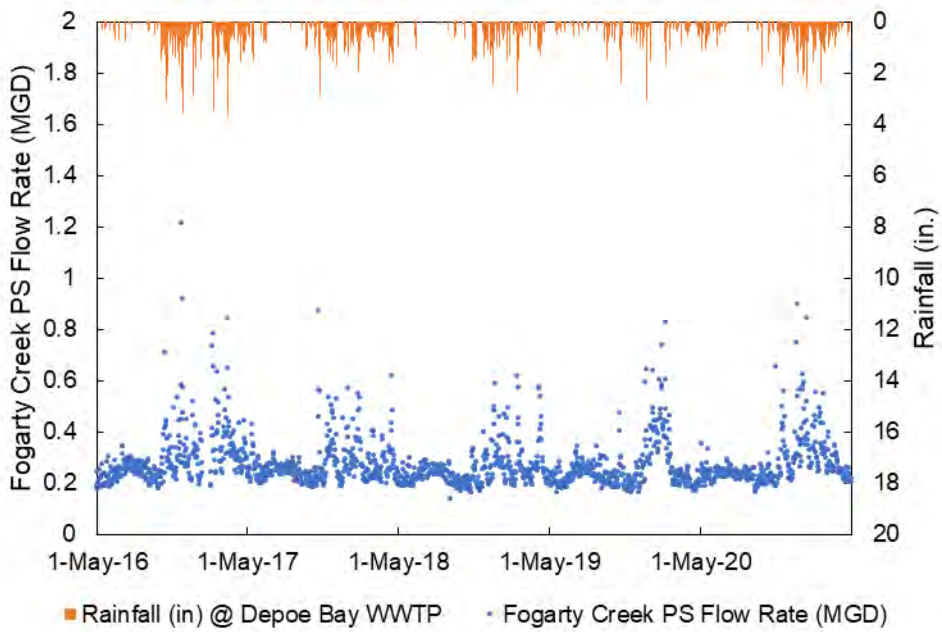


FIGURE 2-10: WASTEWATER FLOW RATES CONVEYED FROM GLENEDEN SANITARY DISTRICT TO THE CITY OF DEPOE BAY FROM MAY 2016 THROUGH APRIL 2021.

DEQ methodology requires the calculation of various characteristic flowrates which are defined as follows:

- **Average Annual Flow Rate (AAF)**: Total wastewater flow for a 12-month period divided by the number of days in the year.
- **Base Sewerage Flow Rate**: Average wastewater flow for the period between July 1 and September 30 when inflow and infiltration (I&I) is assumed to be minimal.

- **Average Dry Weather Flow Rate (ADWF)**: Total wastewater flow for the dry weather period divided by the number of days in the period. The dry weather period is the period when precipitation and stream flows are low (May 1 through October 31).
- **Average Wet Weather Flow Rate (AWWF)**: Total wastewater flow for the wet weather period divided by the number of days in the period. The wet weather period if the period when precipitation and stream flows are high (November 1 through April 30).
- **Maximum Month Dry Weather Flow Rate (MMDWF)**: Total wastewater flow for the month with the highest flow during the dry weather period divided by the number of days in the period.
- **Ten-Year Maximum Month Dry Weather Flow Rate ($MMDWF_{10}$)**: The monthly average dry weather period flow rate with a 10% probability of occurrence.
- **Maximum Month Wet Weather Flow Rate (MMWWF)**: Total wastewater flow for the month with the highest flow during the wet weather period divided by the number of days in the period.
- **Five-Year Maximum Month Wet Weather Flow Rate ($MMWWF_5$)**: The monthly average wet weather period flow rate with a 20% probability of occurrence.
- **Peak Day Average Flow Rate (PDAF)**: Total flow for the day with the highest wastewater flow during the year.
- **Five-Year Peak Day Average Flow Rate ($PDAF_5$)**: The peak day average flow rate associated with a five-year storm event.
- **Peak Instantaneous Flow Rate (PIF)**: Highest observed flow rate at any time.
- **Five-Year Peak Instantaneous Flow Rate (PIF_5)**: Highest observed flow rate occurring during the five-year peak day storm event. The PIF_5 is approximated using the statistical occurrence for probability for something happening once in 8,760 hours.

In addition to the characteristic flow rates described above, several additional characteristic flow rates were determined to evaluate the impact of I&I on the collection system. The following terms were developed specifically for the inflow and infiltration analysis:

- **Base Infiltration Flow Rate**: The daily average flow rate attributable to inflow and infiltration. This flow rate is the difference between the Base Sewerage Flow Rate and the Average Dry Weather Flow Rate.
- **Average Wet Weather Inflow and Infiltration Flow Rate (AWW I&I)**: The daily average flow rate attributable to inflow and infiltration during the wet weather period. This flow rate is the difference between the Base Sewerage Flow Rate and the Average Wet Weather Flow Rate.
- **Maximum Month Wet Weather Inflow and Infiltration Flow Rate (MMWW I&I)**: The daily average flow rate during the five-year maximum month wet weather conditions attributable to inflow and infiltration. This flow rate is the difference between the Base Sewerage Flow Rate and the Five-Year Maximum Month Wet Weather Flow Rate.
- **Peak Day Inflow and Infiltration Flow Rate (PD I&I)**: The daily average flow rate during the five-year peak day conditions attributable to inflow and infiltration. This flow rate is the difference between the Base Sewerage Flow Rate and the Five-Year Peak Day Average Flow Rate.

Peak Instantaneous Inflow and Infiltration Flow Rate (PIF I&I): The daily average flow rate during the five-year peak instantaneous conditions attributable to inflow and infiltration. This flow rate is the difference between the Base Sewerage Flow Rate and the Five-Year Peak Instantaneous Flow Rate.

Average annual, dry weather, and wet weather conditions were evaluated using calculated averages of flow rate measurement data provided by the District. Analytical years in this report begin in May and end in the following April. Using this approach, rather than a calendar year approach, ensures that contiguous data for wet weather months are analyzed as a cohesive set. For example, a calendar year approach would use data from January through April and combine it with data from the following November and December when the area could be subject to different climatic conditions. The approach used in this report analyzes data from November and December combined with data from the following January through April so that trends occurring in a specific season can be reflected in the analysis. Table 2-5 summarizes monthly and seasonal flow rate statistics for the period of analysis. Figure 2-11 compares each of the monthly average daily flow rates to the dry and wet weather seasonal averages.

TABLE 2-5: ANALYSIS OF MONTHLY AND SEASONAL FLOW RATE DATA FROM GLENEDEN SANITARY DISTRICT FOR MAY 2016 THROUGH APRIL 2021.

	Average Daily Flow Rate (MGD)					
	2016-2017	**2017-2018**	**2018-2019**	**2019-2020**	**2020-2021**	**5-Year Ave.**
May	0.212	0.264	0.214	0.209	0.235	0.227
June	0.229	0.236	0.224	0.214	0.235	0.228
July	0.274	0.261	0.252	0.261	0.240	0.258
August	0.250	0.245	0.238	0.248	0.230	0.242
September	0.219	0.221	0.203	0.222	0.214	0.216
October	0.318	0.271	0.210	0.234	0.232	0.253
Dry Weather	0.250	0.250	0.223	0.231	0.231	**0.237**
November	0.388	0.336	0.242	0.202	0.310	0.296
December	0.312	0.289	0.308	0.290	0.337	0.307
January	0.276	0.337	0.288	0.443	0.408	0.361
February	0.388	0.245	0.293	0.341	0.359	0.325
March	0.396	0.273	0.237	0.219	0.285	0.282
April	0.303	0.291	0.305	0.196	0.230	0.265
Wet Weather	0.351	0.296	0.278	0.282	0.322	**0.305**
Annual	0.298	0.273	0.251	0.257	0.276	**0.270**

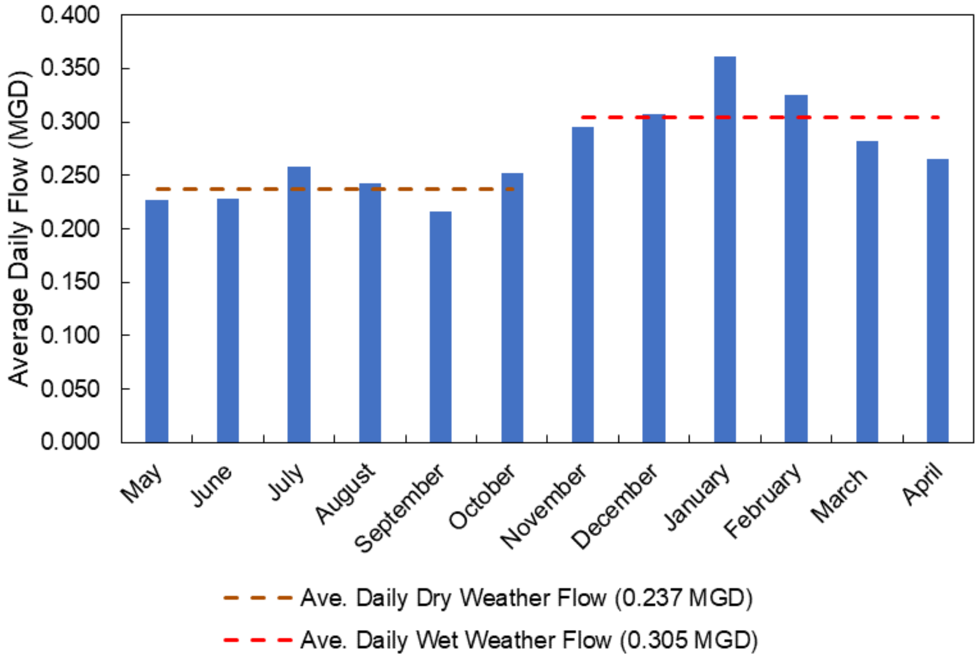


FIGURE 2-11: AVERAGE DAILY DRY AND WET WEATHER FLOW RATES COMPARED TO MONTHLY AVERAGE DAILY FLOW RATES FROM MAY 2016 THROUGH APRIL 2021.

2.6.1.1 Base Sewerage Estimate

The base sewerage for a wastewater system is the volume of wastewater that would be expected to occur if the system only received user inputs and was not subject to additional flow rate contributions from inflow and infiltration. To estimate the base sewerage flow rate for the District, flow rate data collected between July 1 and September 30 was analyzed. This period generally coincides with low groundwater levels and limited precipitation that would otherwise contribute to I&I. Annual and five-year average base sewerage flow rates are shown in Table 2-6. This method resulted in a base sewerage estimate of 0.239 MGD which is approximately equal to the calculated average dry weather flow rate.

TABLE 2-6: ESTIMATES OF BASE SEWERAGE FLOW RATES FOR GLENDEDEN SANITARY DISTRICT BETWEEN MAY 2016 AND APRIL 2021.

	Average Daily Flow Rate (MGD)					
	2016-2017	**2017-2018**	**2018-2019**	**2019-2020**	**2020-2021**	**5-Year Ave.**
Base Sewerage	0.248	0.243	0.231	0.244	0.228	**0.239**

It is expected that the average dry weather flow rate should be greater than the base sewerage flow rate because of the potential for rain events or elevated groundwater levels to occasionally occur during the shoulder months of the dry weather period (May and October). In this instance, the reason base sewerage and average dry weather flow rate estimates are equivalent is likely due to seasonal changes in population that characterize the District. Experience indicates that coastal Oregon experiences a tourism boom during the summer between the time that school ends in mid-June through Labor Day in early September. As a result, the period used to estimate the base sewerage flow rate likely coincides with the period of time when the District has the largest number of system contributors. As shown in Figure 2-11, monthly average flow rates in July and August can be two of the highest monthly rates for all dry weather period months. Because of this seasonal affect, the average daily flow rate for the month of September (0.216 MGD) was selected as the base sewerage flow rate, rather than the full three-month period.

2.6.1.2 Dry Weather Conditions

Coastal Oregon weather is characterized by rainy winter months and very dry summer months. Dry weather flows typically occur between May 1 and September 30 when precipitation is minimal and groundwater is lowest. Annual rainfall records for the Otis weather station (356366) between 1991 and 2020 show average annual rainfall as 96.39 inches with only 14.4% of that total occurring during the period between May and September (US Dept. of Commerce, NOAA, NESDIS, 2021). Dry weather typically correlates to the lowest average daily wastewater flows because I&I has a negligible affect due to low groundwater and decreased precipitation. Oregon DEQ requires the reporting of the maximum monthly average dry weather flow with a 10% probability of occurrence ($MMDWF_{10}$). DEQ's method of estimating the $MMDWF_{10}$ assumes that wastewater flow rates are heavily influenced by precipitation and that there is a linear relationship between the total rainfall occurring during a month and the average daily wastewater flow rate for a service area. Table 2-7 provides a comparison of the average daily flow rates recorded at the Fogarty Creek Pump Station for January through April 2021 compared to the cumulative monthly rainfall recorded at the Depoe Bay wastewater plant.

TABLE 2-7: MONTHLY RAINFALL ACCUMULATION AND AVERAGE DAILY WASTEWATER FLOW RATES.

Year	Month	Monthly Average Daily Flow (MGD)	Total Monthly Rainfall Accumulation (in.)
2021	April	0.230	2.1
2021	March	0.285	7.4
2021	February	0.359	15.3
2021	January	0.408	21.9
May (10% prob.)[1]		0.295	8.83
January (20% prob.)[1]		0.394	19.85

[1]Monthly precipitation for the specified probability level as reported in Climatography of the United States No. 20 1971-2000 for Otis, OR (COOP ID: 356366).

When the data from Table 2-7 is plotted as shown in Figure 2-12, a consistent linear correlation between monthly rainfall and monthly average daily wastewater flow rate is apparent.

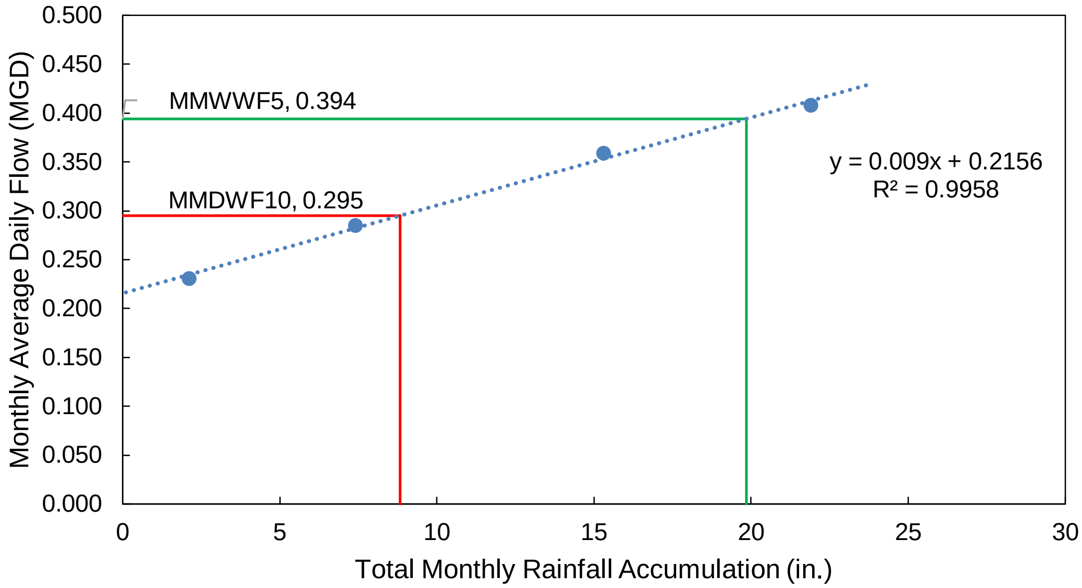


FIGURE 2-12: DEQ FLOW RATE ESTIMATION METHODOLOGY GRAPH #1- AVERAGE DAILY FLOW RATE AT FOGARTY CREEK PUMP STATION VERSUS MONTHLY RAINFALL ACCUMULATION.

To estimate the $MMDWF_{10}$, a linear regression analysis method was used to determine a best fit line for the data presented in Figure 2-12. Given regional weather patterns, it was assumed that May would likely be the month in the dry weather period when groundwater levels and rainfall would be highest. The total monthly rainfall accumulation value for the District was determined from precipitation data reported in *NOAA Climatological Data* for the Otis, OR weather station (no. 356366) (US Dept. of Commerce, NOAA, NESDIS, 2021). This weather station represents the closest location to the proposed project site with available historical climatological data.

The 10-year MMDWF is the wastewater flow corresponding to the 10% probability precipitation of 8.83 inches for the month of May as calculated for the Otis, Oregon weather station (356366). As shown in Figure 2-12, the $MMDWF_{10}$ was estimated as 0.295 MDG.

2.6.1.3 Wet Weather Conditions

Similar to dry weather flow, the DEQ guidelines outline a method to estimate wet weather flow rates in the wastewater collection system. The guidelines state that high groundwater in Western Oregon typically does not occur until January. Similar to the 10-Year Max Month Dry Weather Flow ($MMDWF_{10}$), the 5-Year Max Month Wet Weather Flow ($MMWWF_5$) is a flow rate corresponding to a statistical storm. The $MMWWF_5$ is calculated using the same best fit line use to determine the $MMDWF_{10}$ but uses January monthly rainfall accumulation with a 20% probability of occurrence (19.85 inches). As shown in Figure 2-12, the $MMWWF_5$ was estimated to be 0.394 MGD.

DEQ guidelines establish that the Peak Day Average Flow ($PDAF_5$) is the flow rate corresponding to the five-year, 24-hour storm event as defined by the NOAA Atlas 2, Volume X-Oregon isopluvial maps (US Dept. of Commerce, NOAA, NWS, 1973). To determine $PDAF_5$, actual rainfall events are plotted against the flow rate measured at the Depoe Bay wastewater plant on the same day. Plotted data was limited to measurements occurring in January through April when groundwater levels are high. Furthermore, a qualifying rain event needed to consist of at least 1-inch of rain following three days that had received a combined rainfall in excess of 0.5 inches. Qualifying rain events used to develop this plot and corresponding measured wastewater plant flow rates are shown in Table 2-8.

TABLE 2-8: STORM EVENTS USED TO DETERMINE THE $PDAF_5$

Qualifying Storm (Event > 1.0"; 3-Day > 0.5")		
Date	**Flow Rate (MGD)**	**Rainfall (in.)**
8-Jan-17	0.369	1.5
4-Feb-17	0.384	1.4
5-Feb-17	0.733	2.6
8-Feb-17	0.782	3.5
15-Feb-17	0.522	2.2
16-Feb-17	0.635	1.4
19-Feb-17	0.464	1.4
4-Mar-17	0.420	1.1
6-Mar-17	0.292	1.3
8-Mar-17	0.400	1.2
13-Mar-17	0.400	1.4
14-Mar-17	0.649	3.7
17-Mar-17	0.436	1.6
11-Apr-17	0.300	1.6
19-Apr-17	0.332	1.2
23-Apr-17	0.374	1.2
23-Jan-18	0.484	2.0
26-Jan-18	0.532	1.2
28-Feb-18	0.404	1.2
7-Apr-18	0.344	1.6
12-Apr-18	0.328	1.2
15-Apr-18	0.616	1.6
18-Jan-19	0.451	1.5
22-Jan-19	0.494	1.3
11-Feb-19	0.271	2.8
14-Feb-19	0.451	1.5
5-Apr-19	0.361	1.1
7-Apr-19	0.572	1.3
4-Feb-20	0.381	1.3
5-Feb-20	0.829	1.7
15-Feb-20	0.462	1.1
1-Jan-21	0.411	1.3
2-Jan-21	0.624	2.1
3-Jan-21	0.564	1.7
5-Jan-21	0.487	2.0
11-Jan-21	0.445	1.8
12-Jan-21	0.841	2.5
26-Jan-21	0.423	1.6
30-Jan-21	0.418	1.1
31-Jan-21	0.461	1.1
12-Feb-21	0.494	2.4
14-Feb-21	0.435	1.1
21-Feb-21	0.431	1.1
22-Feb-21	0.547	1.2

The qualifying storm events were plotted in Figure 2-13 and a regression analysis was performed to establish a best-fit line for the data. The data appears to show a moderate positive correlation between daily rainfall and wastewater plant flow rates.

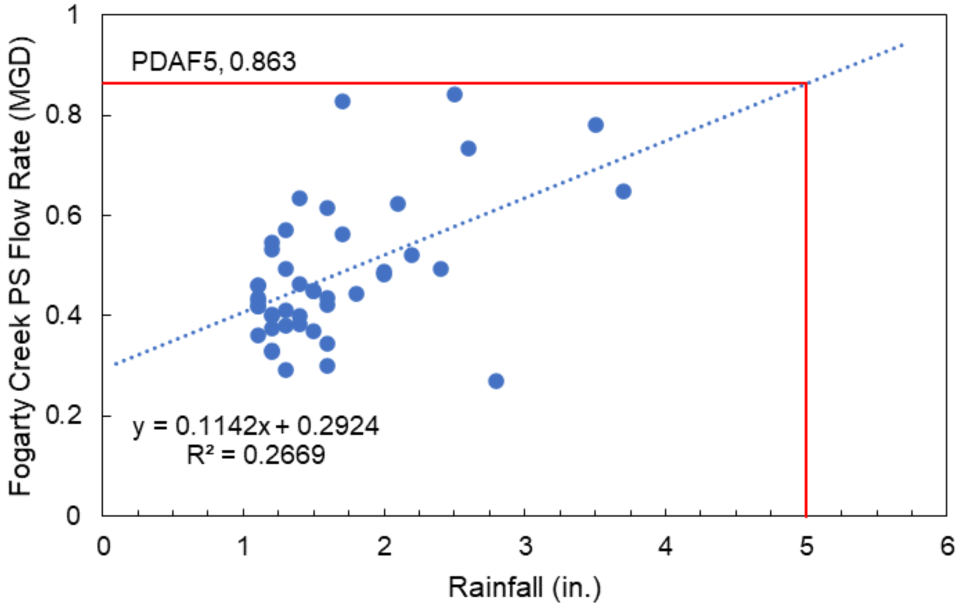


FIGURE 2-13: DEQ FLOW RATE METHODOLOGY GRAPH #2

The five-year, 24-hour rainfall for the Gleneden area based on the *NOAA Atlas 2, Vol. X-Oregon* isopluvial map is 5.0 inches (US Dept. of Commerce, NOAA, NWS, 1973). Using a best fit line, a $PDAF_5$ of 0.863 MGD is determined from this rainfall data.

DEQ guidelines for wastewater conveyance and treatment require critical system components to be designed to convey the Peak Instantaneous Flow (PIF). The 5-year PIF_5 and Peak Week Flow Rate (PWF_5) were calculated from a plot of flow rate versus recurrence probability. The data points included on the plot include the following:

- The Average Annual Flow (AAF) rate is the mean flow rate observed during a complete year. Because it is an average, the probability of exceeding the AAF is 50%.
    - AAF = 0.270 MGD
- The Max Month Wet Weather Flow ($MMWWF_{5)}$ has an exceedance probability of 1/12, or 8.33% in any particular month.
    - $MMWWF_5$ = 0.394 MGD
- The Peak Weekly Flow (PWF) occurs one week out of the year, for an exceedance probability of 1/52, or 1.92%.
    - PWF = 0.600 MGD
- The Peak Daily Average Flow ($PDAF_5$) is the daily flow associated with the 5-year/24-hr storm. The probability of exceeding the $PDAF_5$ is 1/365, or 0.27%.
    - $PDAF_5$ = 0.863 MGD.

- The Peak Hourly Flow (PHF) is the highest hourly flow rate that occurs once per year, with an exceedance probability of 1/8,760 or 0.01%.
  - o PHF = 1.178 MGD

Following DEQ guidelines, Figure 2-14 was created to identify the maximum PHF and maximum PWF.

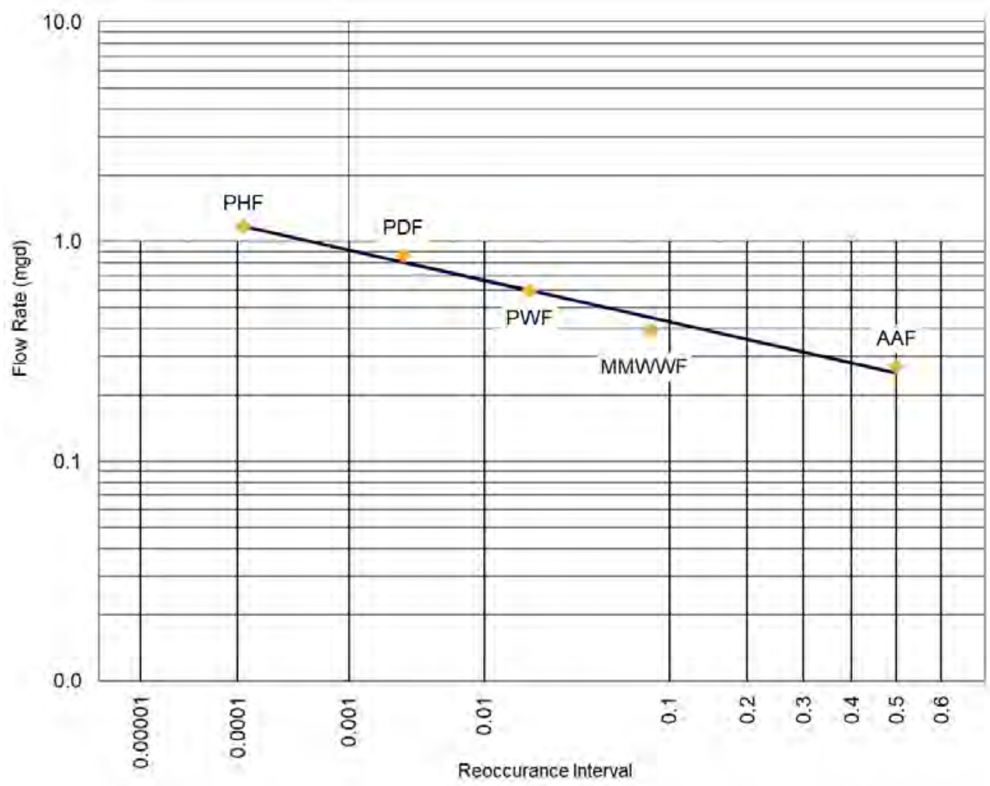


FIGURE 2-14: DEQ FLOW RATE METHODOLOGY GRAPH #3.

As shown in Figure 2-14 when the known flow rates and corresponding associated probabilities of occurrence are platted and a best-fit trend line is produced, unknown flow rates can be extrapolated based on occurrence probabilities. Applying this method to the data set for GSD yields an estimate for the Peak Hour Flow Rate of 1.178 MGD and an estimate of 0.600 MGD for the Peak Week Flow Rate.

The Fogarty Creek Pump Station has a maximum capacity of 700 GPM which equates to approximately 1.0 MGD. In the 5-years of historical records, only one datapoint exceeded 1.0 MGD on November 24, 2016 when the Depoe Bay WWTF flowmeter recorded 1.214 MGD from GSD. It is assumed that this datapoint is an error and it was not used. The Peak Daily Average Flow of 0.863 MGD, based on recorded data from this meter, is consistent with the maximum available capacity of the pump station.

Figure 2-15 shows the estimated characteristic flow rates plotted with the measured wastewater flow rates used in this analysis. Visual inspection suggests that the flow rates estimated using the DEQ guidelines fit the data reasonably well.

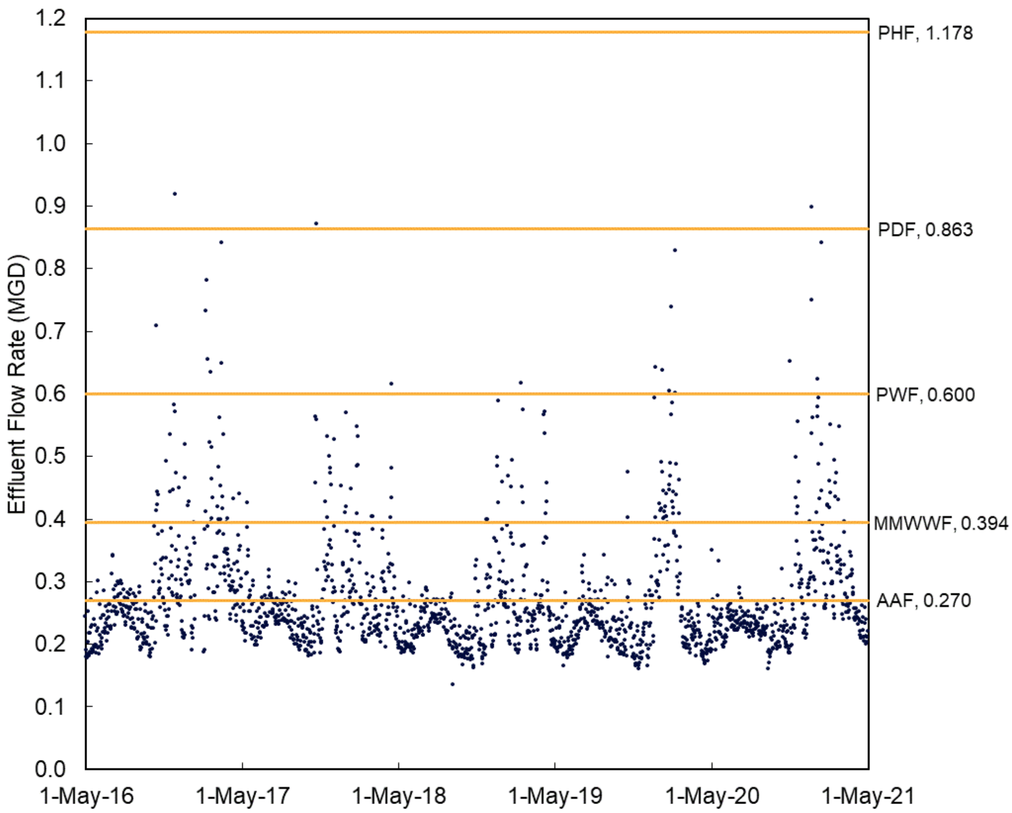


FIGURE 2-15: DMR FLOW RATE MEASUREMENTS COMPARED TO THE CHARACTERISTIC FLOW RATES DETERMINED BY THE DEQ FLOW RATE METHODOLOGY.

The current characteristic flow rates for the Fogarty Creek Pump Station are summarized in Table 2-9.

TABLE 2-9: SUMMARY OF THE CURRENT FLOW RATE CONDITIONS.

Parameter	Flow (gpd)	Basis of Determination	[1]Per Capita Flow Rate (gpcd)
Annual Flow Rates			
AAF	270,410	May 2016 - Apr. 2021 DMRs	56
Dry Weather Flow Rates			
ADWF	237,229	DMRs (May-Oct)	49
Base Sewerage	238,684	DMRs (July-Sept.)	50
Base Inflitration	0	ADWF - Base Sewerage	0
$MMDWF_{10}$	295,000	DEQ Graph #1	61
Wet Weather Flow Rates			
AWWF	304,790	DMRs (Nov. - April)	63
$MMWWF_5$	394,000	Graph #1	82
Peak Week (PWF)	600,000	Graph #2	125
Peak Day ($PDAF_5$)	863,000	Graph#3	180
Peak Hourly (PIF)	1,178,000	Graph #3	245

[1]gpcd calculated assuming a population of 4,800. (See Table 2-6)

2.6.1.4 Inflow and Infiltration (I&I) Assessment

Because of heavy seasonal rainfall and corresponding ground water, communities throughout western Oregon are often plagued by inflow and infiltration in wastewater collection systems. Inflow and infiltration are generally defined as follows:

- Inflow is water entering the collection system through illicit connections or above-ground paths, such as flooding over a manhole. Illicit connections may include the connection of building downspouts or storm drains to wastewater collection systems.
- Infiltration is water entering the collection system via unsealed components of the collection system including bad manhole joints, bad pipe joints, and breaks or cracks. Infiltration is often most prevalent during periods of high groundwater. Exfiltration can also occur through these same system defects when the collection system is surcharged.

I&I can significantly affect the capacity of wastewater collection and treatment facilities. Table 2-10 summarizes the estimated impact of I&I in the GSD wastewater collection system.

TABLE 2-10: INFLOW AND INFILTRATION FLOW RATE SUMMARY

Inflow & Infiltration Summary										
Flow Rate		**Calculation**							**I/I Flow (gpd)**	**[1]Per Capita (gpcd)**
Average Wet Weather I&I	=	AWWF	-	Base Sewerage	=	0.305	-	0.239 =	66,106	13.8
Max. Monthly Wet Weather I&I	=	MMWWF	-	Base Sewerage	=	0.394	-	0.239 =	155,316	32.4
Peak Day I&I	=	PDAF	-	Base Sewerage	=	0.863	-	0.239 =	624,316	130.1
Peak Instantaneous I&I	=	PIF	-	Base Sewerage	=	1.178	-	0.239 =	939,316	195.7

[1]gpcd calculated assuming a population of 4,800. (See Table 2-6)

2.6.1.4.1 Infiltration

Based on the *EPA I&I Analysis and Project Certification* guidance document, the determination of “excessive” infiltration is based on a comparison of the highest average daily flow rate recorded during a 1-2 week period during high groundwater conditions relative to the national average per capita dry weather flow rate of 120 gpcd (US Environmental Protection Agency, 1985). Due to western Oregon groundwater remaining low between June and December, the excessive infiltration analysis only considers the months of January through May. Both the 7-day and 14-day average per capita flow rates were calculated and are presented in Table 2-11. Based upon the 14-day (2-week) gpcd calculations, the collection system is experiencing excessive infiltration.

DEQ may require the District to address the infiltration issue during the permitting process.

TABLE 2-11: AVERAGE FLOW RATES USED FOR THE EVALUATION OF EXCESSIVE INFILTRATION

Excessive Infiltration Analysis Summary		
Parameter	**gpd**	**[1]gpcd**
Max 7-Day Average Flow Rate	650,857	135.6
Max 14-Day Average Flow Rate	515,929	107.5

[1]gpcd calculated assuming a population of 4,800. (See Table 2-6)

2.6.1.4.2 Inflow

Based on the *EPA I&I Analysis and Project Certification* guidance document, excessive inflow is determined by comparing a maximum inflow rate of 275 gpcd to the highest daily flow recorded wastewater flow during a storm event (US Environmental Protection Agency, 1985). By this definition, the comparison should be made to the Peak Day Average Flow Rate (PDAF) which is equal to 180 gpcd. The PDAF is below the 275 gpcd threshold therefore the GSD system is considered to have non-excessive inflow.

2.6.1.5 Summary of Existing Flow Rates

Table 2-12 summarizes the current dry weather flows for GSD. Definitions for the different flow criteria are provided in Section 2.6.1.

TABLE 2-12: EXISTING WASTEWATER SYSTEM FLOW RATE SUMMARY

Parameter	Flow (gpd)	Basis of Determination	[1]Per Capita Flow Rate (gpcd)
Annual Flow Rates			
AAF	270,410	May 2016 - Apr. 2021 DMRs	56
Dry Weather Flow Rates			
ADWF	237,229	DMRs (May-Oct)	49
Base Sewerage	238,684	DMRs (July-Sept.)	50
Base Inflitration	0	ADWF - Base Sewerage	0
$MMDWF_{10}$	295,000	DEQ Graph #1	61
Wet Weather Flow Rates			
AWWF	304,790	DMRs (Nov. - April)	63
$MMWWF_5$	394,000	Graph #1	82
Peak Week (PWF)	600,000	Graph #2	125
Peak Day ($PDAF_5$)	863,000	Graph#3	180
Peak Hourly (PIF)	1,178,000	Graph #3	245
Inflow and Infiltration Assessment			
AWW I/I	66,106	AWWF - Base Sewerage	14
MMWW I/I	155,316	MMWWF - Base Sewerage	32
Peak Day I/I	624,316	PDAF - Base Sewerage	130
Peak Instantaneous I/I	939,316	PIF - Base Sewerage	196

[1]gpcd calculated assuming a population of 4,800. (See Table 2-6)

2.6.2 Existing Pollutant Loading Rates

Wastewater composition refers to the solids, chemicals, organics, and other materials that make up municipal wastewater. Because wastewater can be generated by residential, commercial, and industrial sources, wastewater composition can vary significantly from community to community. The treatment process employed must be capable of handling the variability of influent composition and flowrates, while producing consistent effluent quality meeting specified standards.

Pollutant loading rates are tracked by wastewater treatment plants using Discharge Monitoring Reports (DMRs). Since the wastewater from GSD is mixed with wastewater from, and treated in Depoe Bay, the available DMRs reflect a mixed wastewater and do not accurately predict the waste load associated with the discharge from GSD only. In order to establish a basis for determining loading rates, five wastewater samples were drawn in the wet season between 4/5/2021 and 4/21/21 and six were drawn in the dry season between 8/2/21 and 8/13/21. The corresponding average flow rate over that time along with the current population of 4,800 was used to determine the per capita loading rate of each constituent as shown in Table 2-13. A review of the literature showed that many of the District's per capita loading rates were lower than rates typically seen which are provided in Table 2-13. The higher rate between the measured and literature rates is used for loading analyses to ensure the wastewater plant will be capable of treating a minimum of typical loading rates. Design loading and process sizing will be refined during preliminary design.

The information resulting from the loading rate analysis has been used to develop treatment process and operation alternatives to meet NPDES permit requirements.

TABLE 2-13: PER CAPITA LOADING RATES FOR ANALYSIS

Constituent	Loading Rate (ppcd) Measured	Literature[1]	Loading Rate for Analysis (ppcd)
BOD5	0.09	0.20	0.20
COD	0.30	0.50	0.50
TSS	0.067	0.19	0.19
TKN	0.026	0.31	0.31
Ammonia-N	0.016	0.017	0.017
Total Phosphorous	0.0034	0.0048	0.0048

[1]Typical per capita loading rate with ground up kitchen waste from Table 3-13 (Metcalf & Eddy, 2014).

2.6.2.1 Five-Day Biochemical Oxygen Demand

Five-day Biochemical Oxygen Demand (BOD_5) is a measure of the dissolved oxygen used in the biochemical oxidation of organic matter. BOD_5 total mass loading rates in pounds per day (ppd), and the corresponding per capita mass loading rates (assuming a population of 4,800 persons) were evaluated using a typical per capita loading rate (ppcd) from literature of 0.20 lb./capita/day (Metcalf & Eddy, 2014). Table 2-14 below shows the resulting average annual and peak BOD_5 loading rates. Peaking factors to determine the maximum month loading rate and peak day loading rate were obtained from Figure 3-13 in Metcalf & Eddy (Metcalf & Eddy, 2014).

TABLE 2-14: CURRENT EXPECTED BOD5 LOADING RATES FROM LITERATURE

Parameter	BOD_5 ppd	Loading ppcd	Peaking Factor[1]
Average Annual	960	0.200	1.00
Max Month	1248	0.260	1.30
Peak Day	2400	0.500	2.50

[1]Peak factor selected from Figure 3-13 in Metcalf & Eddy, 2014.

2.6.2.2 Chemical Oxygen Demand

Chemical oxygen demand (COD) is the amount of dissolved oxygen that must be present in water to oxidize chemical organic materials, like petroleum. COD describes the amount of oxygen required to chemically break down pollutants, while BOD indicates the amount of oxygen required to breakdown organic pollutants biologically with microorganisms. COD total mass loading rates (in ppd) and per capita mass loading rates (assuming a population of 4,800 persons) were evaluated using typical per capita loading rate from literature of 0.5 lb./capita/day (Metcalf & Eddy, 2014). Table 2-15 below shows the resulting average annual and peak COD loading rates. Peaking factors to determine the maximum month loading rate and peak day loading rate were obtained from Figure 3-13 in Metcalf & Eddy.

TABLE 2-15: CURRENT EXPECTED COD LOADING RATES FROM LITERATURE

Parameter	COD ppd	Loading ppcd	Peaking Factor[1,2]
Average Annual	2400	0.500	1.00
Max Month	3120	0.650	1.30
Peak Day	6000	1.250	2.50

[1]Peak factor selected from Figure 3-13 in Metcalf & Eddy, 2014.

[2]Peaking Factor relationship is assumed linear between BOD_5 and COD.

2.6.2.3 Total Suspended Solids

Total Suspended Solids (TSS) are the solids retained when a liquid sample is filtered through ha filter of known pore size and subsequently dried to remove moisture. TSS total mass loading rates (in ppd) and per capita mass loading rates (assuming a population of 4,800 persons) were evaluated using typical per capita loading rate from literature of 0.19 lb./capita/day (Metcalf & Eddy, 2014). Table 2-16 below shows the resulting average annual and peak TSS loading rates. Peaking factors to determine the maximum month loading rate and peak day loading rate were obtained from Figure 3-13 in Metcalf & Eddy.

TABLE 2-16: CURRENT EXPECTED TSS LOADING RATES FROM LITERATURE

Parameter	TSS ppd	Loading ppcd	Peaking Factor[1]
Average Annual	912	0.190	1.00
Max Month	1213	0.253	1.33
Peak Day	2645	0.551	2.90

[1]Peak factor selected from Figure 3-13 in Metcalf & Eddy, 2014.

2.6.2.4 Total Kjeldahl Nitrogen

Total Kjeldahl Nitrogen (TKN) is the total concentration of organic nitrogen and ammonia. TKN total mass loading rates (in ppd) and per capita mass loading rates (assuming a population of 4,800 persons) were evaluated using typical per capita loading rate from literature of 0.31 lb./capita/day (Metcalf & Eddy, 2014). Table 2-17 below shows the resulting average annual and peak TKN loading rates. Peaking factors to determine the maximum month loading rate and peak day loading rate were obtained from Figure 3-13 in Metcalf & Eddy.

TABLE 2-17: CURRENT EXPECTED TKN LOADING RATES FROM LITERATURE

Parameter	TKN ppd	Loading ppcd	Peaking Factor[1]
Average Annual	1488	0.31	1.00
Max Month	2083	0.43	1.40
Peak Day	3125	0.65	2.10

[1]Peak factor selected from Figure 3-13 in Metcalf & Eddy, 2014.

2.6.2.5 Ammonia

Based upon other coastal NPDES permits with ocean discharges, it is unlikely that GSD will have an ammonia limit. However, it is prudent to calculate what treatment requirements may be necessary if an ammonia limit is prescribed in the permit. Nitrification is a biological process that converts ammonia to nitrite and nitrite to nitrate. Ammonia total mass loading rates (in ppd) and per capita mass loading rates (assuming a population of 4,800 persons) were evaluated using typical per capita loading rate from literature of 0.18 lb/capita/day (Metcalf & Eddy, 2014). Table 2-18 below shows the resulting average annual and peak ammonia loading rates. Peaking factors to determine the maximum month loading rate and peak day loading rate were obtained from Figure 3-13 in Metcalf & Eddy.

TABLE 2-18: CURRENT EXPECTED AMMONIA LOADING RATES FROM LITERATURE

Parameter	NH_3-N ppd	Loading ppcd	Peaking Factor[1]
Average Annual	82	0.017	1.00
Max Month	106	0.022	1.30
Peak Day	122	0.026	1.50

[1]Peak factor selected from Figure 3-13 in Metcalf & Eddy, 2014.

2.6.2.6 Total Phosphorous

Phosphorus is a nutrient that is essential for plant growth, but in excessive amounts can lead to eutrophication, or the advanced growth of certain types of plants over others, including many types of algae. One of the most significant consequences of eutrophication is the growth of algal blooms (cyanobacteria), some of which produce toxins that are harmful to humans and animals. Total phosphorous mass loading rates (in ppd) and per capita mass loading rates (assuming a population of 4,800 persons) were evaluated using typical per capita loading rate from literature of 0.0048 lb/capita/day (Metcalf & Eddy, 2014). Table 2-19 below shows the resulting average annual and peak total phosphorous loading rates. Peaking factors to determine the maximum month loading rate and peak day loading rate were obtained from Figure 3-13 in Metcalf & Eddy.

TABLE 2-19: CURRENT EXPECTED TOTAL PHOSPHOROUS LOADING RATES FROM LITERATURE

Parameter	Total P ppd	Loading ppcd	Peaking Factor[1]
Average Annual	23	0.0048	1.00
Max Month	30	0.0062	1.30
Peak Day	37	0.0077	1.60

[1]Peak factor selected from Figure 3-13 in Metcalf & Eddy, 2014.

2.6.2.7 Wastewater Composition Summary

Figure 2-16 summarizes the pollutant loading conditions used as a basis of analysis for this planning document.

FIGURE 2-16: SUMMARY OF ESTIMATED CURRENT INFLUENT WASTEWATER COMPOSITION.

Existing Loading Rates (Estimated)

Parameter	ppd	ppcd
Five-Day Biochemical Oxygen Demand (BOD_5)		
Annual Average	960	0.20
Max Month	1248	0.26
Peak Day	2400	0.50
Chemical Oxygen Demand (COD)		
Annual Average	2400	0.50
Max Month	3120	0.65
Peak Day	6000	1.25
Total Suspended Solids (TSS)		
Annual Average	912	0.190
Max Month	1213	0.253
Peak Day	2645	0.551
Total Kjedhal Nitrogen (TKN)		
Annual Average	1488	0.310
Max Month	2083	0.434
Peak Day	3125	0.651
Ammonia		
Annual Average	82	0.017
Max Month	106	0.022
Peak Day	122	0.026
Total Phosphorous		
Annual Average	23	0.0048
Max Month	30	0.0062
Peak Day	37	0.0077

2.7 Financial Status of Existing Facilities

Information on the financial status of existing facilities is included in Chapter 10.

2.8 Water/Energy/Waste Audits

Currently GSD is a collections system only and has not completed any audits.

2.9 References

Harper Houf Peterson Righellis, Inc. (2018). *Gleneden Sanitary District Wastewater Collection System Facilities Plan Update.*

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US Dept. of Commerce, NOAA, NWS. (1973). *Precipitation Frequency Atlas of the Western United States, Volume X- Oregon.*

US Environmental Protection Agency. (1985). *I&I Analysis and Project Certification.*

3 NEED FOR PROJECT

3.1 Purpose

The Gleneden Sanitary District (GSD) owns, operates, and maintains a wastewater collection system that serves unincorporated communities within Lincoln County along the central Oregon coast. The system was first placed into service in 1976 and covers the area between Salishan and Fogarty Creek (See Figure 3-1).

FIGURE 3-1: GLENEDEN SANITARY DISTRICT SERVICE AREA

The wastewater from the collection system is conveyed south to the Fogarty Creek State Recreational Area. A pump station within the state park parking lot pump wastewater to the City of Depoe Bay collection system for treatment at the Depoe Bay Wastewater Treatment Plant. The District and City use these shared facilities according to an intergovernmental agreement (IGA) last updated in 1998 (Appendix A). The IGA requires GSD and the City to share financial responsibility for the joint facilities in proportion to the equivalent dwelling units served by each party. On March 1, 2022 the City of Depoe Bay issued a letter to the GSD enacting the termination clause in the IGA (Appendix B). Consequently, GSD must find an alternative means to treat wastewater beginning 5-years from the date of the IGA notice of termination, March 1, 2027.

GSD contracts with the Kernville-Gleneden Beach-Lincoln Beach (KGBLB) Water District to operate and maintain the wastewater collection system. This arrangement allows the two

Districts to share staff, offices, vehicles and some materials, thereby controlling costs by avoiding unnecessary duplications. The Water District covers the area served by GSD, plus the Salishan Resort and private community, the Siletz Keys neighborhood, and the Kernville neighborhood areas.

Previous GSD Studies. GSD has previously had the following three planning reports prepared since the collection system was initially constructed:

- Sewerage Facilities, Final Study Report (HGE Inc., 1990)
- Collection System Facilities Plan (ACE Consultants Inc., 2004)
- Collection System Facilities Plan Update (HHPR Inc., 2018)
- Analysis of WW Treatment Plant Options, Phase 1 (HHPR Inc., 2020)

At the time of the 1990 study, the collection system was less than 15 years old and no system deficiencies were identified. Instead that study focused on wastewater treatment alternatives and recommended the District continue the practice of discharging to the Depoe Bay system.

Neither the 2004 report nor the 2018 report evaluated treatment alternatives. The 2004 planning effort included a hydraulic analysis of the sewer system, a comprehensive evaluation of the pump stations, and a study of projected 20-year service needs. Brief supplements to the 2004 report were issued in 2009 and 2016 to update estimates of probable costs for recommended pump station upgrades.

The 2018 Plan Update provided updated population projections, a collection system inventory, condition assessments of system components, a current wastewater flow analysis, and a current capital improvements plan.

The 2020 Phase 1 analysis of wastewater treatment options is a high-level planning effort that is intended to be a first stage in comparing the relative cost-effectiveness of wastewater treatment options. This report was intended as a supplement to the 2018 Plan Update. The Phase 1 report has completed much of the research needed for this Facility Plan and has been referenced extensively in this report. Much of Chapter 1 has been derived and updated from Phase 1 report.

The City of Depoe Bay had separate engineering reports on their wastewater facilities prepared (in 1995, 1999 and 2009. The 2009 Wastewater Master Plan Update (Appendix C), prepared by HBH Consulting Engineers, provided a review of the existing wastewater facilities and identified projected needs through 2028.

3.2 Need for Planning Effort

Depoe Bay has made it clear that they are not interested in continuing to treat wastewater from GSD in the future. Several attempts have been made at negotiating with Depoe Bay to continue treating GSD wastewater without success. Although it is the desire of the District that the IGA with Depoe Bay can be renewed, they have acknowledged the need to prepare for developing an alternative means of wastewater treatment. This facility plan for wastewater treatment is intended to identify options for the District to develop alternative treatment means, support long-term planning for the District's wastewater treatment and collection systems, and provide guidance to the District by identifying the steps necessary for developing alternative treatment options.

The District will require funding support to design and construct any new treatment alternatives identified in this report. In order to meet the criteria of several of the most common funding agencies, including DEQ, Business Oregon, US Department of Agriculture (USDA) and the Rural Community Assistance Corporation (RCAC), it is necessary to develop a wastewater facility planning document to confirm that the proposed project protects public health and maintains a high quality of life, is environmentally sound, and is an efficient use of public funds. This document is being prepared to satisfy those requirements and has been developed to conform with *Preparing Wastewater Planning Documents and Environmental Reports for Public Utilities* (Business Oregon, USDA, RCAC, DEQ, 2019).

3.2.1 Purpose and Scope of Study

The purpose of this study is to identify and evaluate feasible wastewater treatment options to meet the District's projected service needs. This report builds upon the A*nalysis of Wastewater Options, Phase 1* (Harper Houf Peterson Righellis, Inc., 2020)(Attachment E), and, to avoid duplication of effort, draws upon information in that previous report.

The scope of this wastewater treatment analysis generally consists of the following main elements:

1) Planning Area Description
    a. Address existing conditions, natural resources, and cultural resources
    b. Describe potential receiving streams for treated effluent from wastewater facilities
2) Basis of Planning
    a. Update 20-year population, EDU, and flow projections
    b. Address potential impacts of developments beyond the 20 years on wastewater treatment needs
3) Existing Facilities. Provide summary descriptions of existing local wastewater facilities and refer to planning reports that provide more detailed information
4) Development of Wastewater Treatment Alternatives
    a. Identify and present alternatives treatment options.
    b. Describe key considerations for selecting a new wastewater treatment plant site
    c. Identify and describe siting options for a new wastewater treatment plant
    d. Describe options for joint wastewater treatment facilities with nearby jurisdictions
    e. Describe potential wastewater treatment plant discharge options
    f. Provide background on required treatment levels and potential treatment processes
5) Alternatives Analysis
    a. Describe the basis for alternatives analysis/comparison
    b. Summarize treatment and outfall options
    c. Present estimates of probable life-cycle costs
    d. Present analysis of nonmonetary factors and summary of scoring and ranking
6) Recommended Alternative and Implementation Plan

a. Present an overview of the analysis results

b. Identify the recommended combination of Alternatives and the basis for the recommendation

c. Identify the main steps the District would need to take to continue planning for wastewater treatment needs and the implementation of selected plan

3.2.2 Health, Sanitation, Environmental Regulations and Security

The project will be designed to comply with health, sanitation, and environmental regulations and to comply with necessary security requirements. Since this is a new project, there is no correspondence with regulatory agencies to date. The specific health, sanitation and environmental permits and regulations are described in detail below in Section 3.3.

3.2.3 Aging Infrastructure

The proposed project is to construct a new wastewater treatment facility, therefore aging infrastructure associated with a treatment process is not applicable. A detailed description of the existing collection system is included in Chapter 2, Existing Facilities. Capacities of the new treatment works may be affected by collection system aging and infiltration.

3.2.4 Reasonable Growth

The new treatment facility will be sized to accommodate existing demand and reasonable projected growth of the District through year 2045. A detailed population projection and methodology is included in Chapter 2, Section 1.4, Population Trends.

3.3 Permits and Regulatory Framework

3.3.1 Discharge Permits for Wastewater Treatment Facilities

A permit must be obtained from the Oregon Department of Environmental Quality (DEQ) to construct and operate a wastewater treatment plant in Oregon and to discharge treated effluent from the facility. DEQ issues two types of permits. An NPDES permit is required for wastewater treatment plants that discharge into surface waters and a WPCF permit is required for facilities that recycle effluent according to DEQ regulations.

DEQ's authority to issue these permits is established in OAR 340-045. The permits are required to keep wastewater facilities in compliance with the Federal Water Pollution Control (Clean Water) Act and related State statutes. The conditions of operation described in the permits generally fall into the following categories:

- discharge flow rate limits
- pollutant concentration and total load limits
- biosolids pollutant concentrations and load limits for land application
- effluent monitoring and reporting
- biosolids monitoring and reporting
- minimum required training level for operators

- other general conditions of operation

GSD does not have its own NPDES permit but rather operates under the authority of the Depoe Bay permit. The IGA between the District and Depoe Bay obligates the District to construct and operate the District's collection system in accordance with DEQ rules and regulations. The Depoe Bay wastewater treatment plant has been issued National Pollutant Discharge Elimination System (NPDES) Permit No. 101383 (Appendix D).

3.3.2 Treatment Requirements

NPDES permits for a surface-water discharge contain effluent quality limitations that are either based on the receiving water body water quality standards or a minimum required treatment level. The effluent limits in the permit determine required wastewater treatment plant design criteria.

3.3.2.1 Effluent Water Quality Criteria

Current water quality standards for Oregon waters are published in OAR 340-041 and include both state-wide and basin-specific water quality criteria. GSD and the surrounding vicinity are located in the Mid-Coast Basin. This basin encompasses watersheds and near-shore ocean waters from the Salmon River north of Lincoln City, to streams in the Oregon Dunes National Recreation Area south of Florence.

Wastewater effluent quality criteria for each specific water body are impacted by the designated beneficial uses identified in the water quality standards for the respective water body. The beneficial uses DEQ has designated for water bodies in the Mid Coast Basin are summarized in Chapter 5.

Wastewater effluent quality criteria discharged to a water body are also impacted by impairments in the water body. When the biological, chemical, and/or physical conditions in a water body do not meet published numerical standards, then the water body is categorized as water quality impaired. When water bodies are determined to be water quality impaired, DEQ is required to develop a Total Maximum Daily Loads (TMDL) which limits the amount if pollutants that may be discharged to a waterbody by all sources. The issuance of a TMDL can result in more strict treatment requirements for a wastewater treatment plant discharging to that waterbody.

Wastewater effluent water quality criteria are also influenced by narrative standards that apply to all Waters of the State and are an important consideration when a wastewater treatment plant discharges to small receiving streams. One standard establishes an antidegradation policy (OAR 240-041-0004) intended to prevent the further degradation of water quality from new or increased pollution sources. This policy requires the District to provide an analysis showing that the proposed wastewater plant discharge will not degrade water quality during the permitting period. Another standard requires adequate dilution of organic material and may result in the limitation of organic material discharges to streams with low seasonal flows. The antidegradation policy is reviewed in depth in Chapter 5.

The District currently conveys untreated wastewater to the City of Depoe Bay for treatment and final disposal. The Depoe Bay WWTP uses an activated sludge treatment process to treat wastewater prior to discharging treated effluent into the Pacific Ocean. Treatment at the Depoe Bay WWTP must be completed in accordance with the facility's NPDES permit (Permit No. 101383). The requirements for effluent water quality are listed in Table 3-2. Additional requirements for groundwater protection, monitoring, and biosolids management are included in the permit. Based upon discussions with DEQ's Permitting Team, it is reasonable to expect that effluent standards as part of a future permit for GSD will look similar. A full copy of the Depoe Bay permit is included in Appendix D.

Parameter	Units	Average Monthly	Average Weekly	Daily Maximum
BOD_5 (May 1 - Oct. 31)	mg/L	20	30	-
	lb/day*	114	170	230
	% Removal	85		
BOD_5 (Nov 1 - April 30)	mg/L	30	45	-
	lb/day*	200	300	400
	% Removal	85		
TSS (May 1 - Oct. 31)	mg/L	20	30	
	lb/day*	114	170	230
	% Removal	85		
TSS (Nov 1 - April 30)	mg/L	30	45	
	lb/day*	200	300	400
	% Removal	85		
Enterrococci Bacteria	#/100 mL	A monthly geometric mean of 35 organisms per 100 mL. No more than 10% of the samples may exceed 130 organisms per 100 mL.		
Fecal Coliform Bacteria	#/100 mL	A monthly median concentration of 14 organisms per 100 mL. No more than 10% of the samples may exceed 43 organisms per 100 mL.		
pH	S.U.	Shall be within the range of 6.0 - 9.0.		

*Average dry weather design flow to the facility equals 0.85 MGD. Mass loads have been individually assigned based on what the plant can reasonably achieve and the highest monthly average discharge flow with a two year recurrence at the 20 year design of the facility.

TABLE 3-1 EFFLUENT WATER QUALITY REQUIREMENTS IN THE DEPOE BAY WWTP NPDES PERMIT.

3.3.2.2 Treated Effluent Water Recycling.

The use of treated effluent from wastewater treatment plants as recycled water is regulated in Oregon by DEQ according to OAR 340-055. These rules define recycled-water classes, identify minimum treatment and monitoring requirements for each class, and list the allowable beneficial uses for each class. NPDES permits contain required treatment levels based on recycled water uses proposed by the permittee and potential levels of public exposure.

Recycled water is most-commonly used for irrigation of agricultural land, horticultural land, or landscaping. Various industrial, commercial, and construction applications and groundwater recharge are also allowed as beneficial uses. Regardless of use, recycled water is not allowed to negatively impact groundwater quality.

Agencies with permits that only allow recycling cannot discharge to surface waters and often need storage ponds to hold treated effluent during winter or wet weather when recycling is not feasible. To avoid the need for seasonal storage capacity, an agency may obtain a permit to discharge to a receiving waterbody for part of the year when flows are high enough to provide adequate dilution and mixing, then recycle for the rest of the year.

3.3.3 Additional Regulatory Factors

3.3.3.1 Collection System Requirements

GSD operates the collection system according to rules it has adopted by a sewer use ordinance. The agreement between the District and the City of Depoe Bay requires these rules to be consistent with rules adopted by the City and the State. The agreement also requires GSD to measure and record the daily and peak wastewater flows pumped from Fogarty Creek Pump Station into the Depoe Bay collection system.

GSD does not have its own NPDES permit but rather operates under the authority of the Depoe Bay permit. The IGA between the District and Depoe Bay obligates the District to construct and operate the District's collection system in accordance with DEQ rules and regulations. The Depoe Bay NPDES permit contains the following requirements relating to operation of the GSD collection system:

- The permittee must control all wastes it allows to be discharged into the system.
- The system must be operated under the supervision of a wastewater collections operator with Oregon Class II certification.

Consistent with these requirements, GSD enforces the sewer use ordinance to regulate waste discharges and employs operators with Class II certification for collections system operations.

3.3.3.2 Applicable State and Federal Rules, Codes and Standards

The following paragraphs summarize the key rules, codes and standards that impact the design, operation, maintenance, and management of wastewater facilities, including a wastewater treatment plant. These rules and guidelines would apply to all treatment options evaluated in this study. Although not comprehensive, this list generally identifies the standards and permits that will apply to a new wastewater facility.

3.3.3.2.1 Occupational Safety and Health.

Operations and maintenance (O&M) activities and constructed system improvements must conform to applicable rules published and administered by the Oregon Occupational Safety and Health Administration (OSHA). These State rules are based on, and mostly coincide with, Federal OSHA rules. Many of the general occupational safety and health regulations issued by the State under OAR 437-002 apply to operation and maintenance tasks that staff must perform, but also affect the design of system improvements.

A few key examples of OSHA rules that impact the District include those that relate to the following:

- stairs, ladders, and fall protection systems
- ventilation and noise exposure
- personal protective equipment
- lockout/tag-out procedures
- confined spaces
- fire protection

3.3.3.2.2 Design Criteria.

The United States Environmental Protection Agency (USEPA) publishes guidelines for the design of wastewater treatment facilities titled, *Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability* (US Environmental Protection Agency, 1973). This technical bulletin presents general standards for the design of wastewater treatment plants to maintain a minimum level of reliability for the facilities.

Due to the variability in flow between the dry and wet season in western Oregon, DEQ has developed additional guidelines to estimate current or projected sewage flow as not to oversize a wastewater treatment facility based upon the EPA reliability requirements (Infrastructure Finance Authority, 2013).

3.3.3.2.3 Pump Station Standards

Oregon Standards for Design and Construction of Wastewater Pump Stations (Oregon Department of Environmental Quality, 2021) guidelines regulate pump station design. These standards will apply to a wastewater treatment plant influent pump station and any collection system pump station that may need to be constructed or modified to pump flows to a wastewater treatment plant.

3.3.3.2.4 Codes

The State of Oregon adopts amended versions of national building codes to establish requirements for new construction. The Lincoln County Building Division in turn has adopted the Oregon building codes and requires conformance with those codes as a condition of issuing construction permits.

The design of any new building or major building renovation must comply with applicable requirements of the following Oregon codes:

- Oregon Fire Code
- Uniform Building Code (UBC)
- Structural Specialty Code (OSSC)
- Electrical Specialty Code
- Energy Efficiency Specialty Code
- Mechanical Specialty Code
- Plumbing Specialty Code

The Oregon specialty codes are typically updated and readopted every 4 or 5 years following the reissuance of the respective national code. Of special note is that Gleneden is in a special seismic and wind zone which will require conformance with applicable code provisions.

3.3.3.2.5 Fire Protection Standards

The NFPA has developed a specific *Standard for Fire Protection In Wastewater Treatment and Collection Facilities* (National Fire Prevention Association, 2020). This document, *NFPA 820*, identifies design requirements intended to prevent fires and explosions from potential hazards at wastewater facilities.

3.3.3.2.6 Regulations of Public Funding Agencies

If the District obtains a loan from a Federal or State agency, the GSD will be required to meet certain planning, administrative, and financial conditions established by the funding agency. One of those requirements is the development of this Facility Plan in accordance with the criteria as defined in *Preparing Wastewater Planning Documents and Environmental Reports for Public Utilities* (Business Oregon, USDA, RCAC, DEQ, 2019) published jointly by DEQ, Business Oregon, US Department of Agriculture (USDA) and the Rural Community Assistance Corporation (RCAC).

3.3.3.2.7 Federal Aviation Administration Standards for Airports

Federal Aviation Administration (FAA) guidelines place constraints on potential wastewater treatment plant sites in close proximity to the airport. The FAA has published guidance identifying wastewater treatment plants as potential wildlife attractants that should not be located near airports. As a result, a mitigation plan for deterring wildlife attraction would need to be developed by the District and accepted by the FAA for any wastewater treatment plant planned near the Siletz Bay State Airport. The FAA relies on the United States Department of Agriculture – Wildlife Services to review and approve mitigation plans.

3.3.3.2.8 Environmental, Historical and Cultural

Depending upon the location of the treatment facility, outfall location and alignment, and any associated pipelines and pump stations, a joint permit through the Army Corp of Engineers, Oregon Department of State Lands, Oregon Department of Fish and Wildlife, and NOAA Marine Fisheries may be required. Furthermore, review will be necessary to ensure no site of historical or cultural significance will be impacted by the construction or operation of the new infrastructure. It will be necessary to consult with the State Historic Preservation Office and the Confederated Tribe of the Siletz Indians. It is likely, based upon the scale of the project, that it will be necessary to develop and Inadvertent Discovery Plan that will identify how to process of items of historical or cultural significance are discovered during construction.

3.3.3.3 Potential for Regulatory Changes

In general, it can be costly and time consuming to obtain an NPDES permit for a new surface-water discharge. The regulatory climate generally favors regional wastewater treatment facilities over smaller, local facilities with separate discharges. However, based upon discussions with DEQ, since the volume and loading from GSD is currently encompassed within the Depoe Bay permit, and that facility has an ocean outfall, the permitting process will likely be straightforward since the District will be discharging the same volume and loading to the same waterbody, making the justification of receiving water non-degradation simple. It will likely at approximately 18-months from the first application submittal for the District to receive a final discharge permit. This timeframe should be considered as a potential critical path in project planning.

The regulatory climate is also generally more favorable toward water recycling practices as a beneficial use rather than a surface water discharge. Water quality standards for inland waters are more prone to revisions than the regulations for water recycling. However, the treatment requirements for a direct marine discharge would be less likely to undergo revisions than the requirements for a discharge to a river, creek, or bay.

The Oregon specialty codes are typically updated and readopted every 4 or 5 years following the reissuance of the respective national code. NFPA 820 is also periodically updated and reissued. One code that historically has been subject to significant revisions is the OSSC as it pertains to seismic design (earthquake resilience).

The DEQ standards and USEPA guidelines are still current to typical industry practices. Therefore, major changes to the document do not appear likely within the next 5 years.

3.4 References

Business Oregon, USDA, RCAC, DEQ. (2019). *Preparing Wastewater Planning Documents and Environmental Reports for Public Utilities.*

Harper Houf Peterson Righellis, Inc. (2020). *Analysis of Wastewater Options, Phase 1.*

Infrastructure Finance Authority, O. D. (2013). *Preparing Wastewater Planning Documents and Environmental Reports for Public Utilties Financed by Infrastructure Finance Authority, Oregon DEQ, Rural Community Assistance Coporation, USDA.*

National Fire Prevention Association. (2020). *820: Standard for Fire Protection in Wastewater Treatment and Collection Facilities.*

Oregon Department of Environmental Quality. (2021). *Oregon Standards for Design and Construction of Wastewater Pump Stations.*

US Environmental Protection Agency. (1973). *Design Criteria for Mechanical, Electric, and Fluid Systems and Component Reliability (EPA-430-99-74-001).*

Water Environment Federation. (2018). Design of Water Resource Recovery Facilities, Sixth Edition. New York: McGraw-Hill Education.

4 ALTERNATIVES CONSIDERED

4.1 Introduction

The Gleneden Sanitary District (GSD) currently does not have a wastewater treatment facility. Rather, the District has an intergovernmental agreement (IGA) with the City of Depoe Bay to send the District's wastewater to the Depoe Bay WWTF. On March 1, 2022, the City of Depoe Bay issued a termination letter to the GSD notifying the District of Depoe Bay's intent to terminate the contract and providing the 5-year notification of contract termination required per the IGA. This means that as of March 1, 2027 the GSD will need to find an alternative means to treat their wastewater. The intent of this facility plan is to identify alternatives to achieve that need.

4.2 Alternatives Description

Several alternatives have been considered to provide wastewater treatment for the District including:

1. Do nothing: this alternative implies that the District will make no changes and maintain the status quo by sending their wastewater to Depoe Bay.
2. Contract with an alternative wastewater district or municipality to treat the District's wastewater.
3. Develop a Centrally Managed/Decentralized System: this alternative means to convert the District customers to on-site treatment facilities (septic systems) or develop several smaller wastewater treatment systems throughout the District all managed by the District.
4. Develop an optimum combination of Centralized and Decentralized Systems: this alternative means to combine partially on-site treatment (usually solids settling or septic tanks) with a centralized treatment plant managed by the District.
5. Optimize the current facilities. This option is unfeasible because the District does not currently have wastewater treatment facilities.
6. Construct a new wastewater treatment facility.

4.2.1 Do Nothing/Maintain Status Quo

For several years the District has attempted to negotiate with Depoe Bay to restructure the existing IGA to improve the terms for the District. Since receiving the notice of termination from Depoe Bay the District has made several more attempts to re-open negotiations with Depoe Bay to restore the relationship and continue sending wastewater to the Depoe Bay treatment plant. The District has reached out directly to the Depoe Bay City Council, has coordinated through the District's and City's attorneys, has attempted to negotiate with the City through DEQ, and has attempted to coordinate through Kaety Jacobsen, Lincoln County Commissioner. Depoe Bay has repeatedly made it clear that they no longer will accept wastewater from GSD after March 1, 2027. The District has made every reasonable attempt to restore the status quo relationship with no success. Therefore, this alternative must now be considered unfeasible.

4.2.2 Contract with an Alternative Wastewater District or Municipality to Treat the District's Wastewater

The District is bounded by the City of Depoe Bay wastewater system to the south, and the Salishan Wastewater District and the City of Lincoln City wastewater system to the north. These are the only reasonably close facilities that may be able to accept wastewater from GSD. Depoe Bay is unwilling to accept wastewater from GSD as discussed in the section above.

The Salishan Wastewater District was asked if they would be willing to partner with GSD on a combined facility or would be willing to enlarge their facility to accept waste from the District. Salishan is currently undergoing a wastewater treatment plant upgrade from an existing sequencing batch reactor treatment process to a membrane filter treatment process. Both the current and planned Salishan treatment facilities are not sufficiently sized to accept wastewater from GSD. Salishan has indicated that they have already invested too much in the redevelopment of their facility and are not interested in developing a joint system, nor attempting to expand the new facility to accept waste from GSD. Salishan does not have an optimal outfall location and adding capacity to the system would likely result in permitting difficulty.

The City of Lincoln City was also asked if they would be willing to accept waste from GSD. Lincoln City has indicated that they do not have sufficient capacity at peak flow to accept waste from GSD. Furthermore, the revised NPDES permit for Lincoln City requires them to meet improved effluent limits for their current outfall on Schooner Creek. As an alternative to modifying the existing wastewater plant to meet the new effluent limits, Lincoln City is considering constructing a new ocean outfall instead, which would result in less onerous effluent requirements. Therefore, Lincoln City has indicated that they would not be willing to accept waste from GSD, but they would be interested in a joint ocean outfall if it proves feasible. The concept of a joint outfall is discussed in more detail in Chapter 6.

Because none of the reasonably close facilities have the willingness nor capacity to accept wastewater from GSD this option is considered unfeasible.

4.2.3 Develop Centrally Managed Decentralized Systems

This alternative means to convert the District customers to on-site treatment facilities (septic systems) or develop several smaller wastewater treatment systems throughout the District all managed by the District.

The GSD is comprised of primarily residential lots bounded by Hwy 101 on the east and the Pacific Ocean on the west. Lots are typical single family residential lots of between 5,000 and 10,000 square feet and between 2 to 3 bedrooms requiring a drain field size of between 800-1000 square feet. OAR 340-071-0285 requires sufficient space to install a redundant drain field if the original should fail requiring an additional 800-1000 SF of space. With 10' offset requirements from all lot lines, building faces, and waterlines, sufficient space is not available on most lots to construct a septic system. The relatively high-density of these neighborhoods precluded septic systems from the start, which is why there is a centralized sewer collection system.

The District could consider other decentralized treatment, or pretreatment options, such as small neighborhood level treatment systems. However unless the District discharged to the Siletz River Nature Reserve, the treated effluent outfall options for the District are limited to low-volume fish bearing streams or an ocean outfall. Furthermore, the proposed wastewater facilities will be required to comply with a Class I or II resiliency/redundancy requirement which will necessitate duplication in equipment and processes that will force the facility size to be several acres. In addition to the cost of constructing and operating multiple treatment facilities and the challenges in meeting outfall requirements, sufficiently sized land parcels are not available within the district to facilitate decentralized treatment facilities. Details on facility siting and outfall alternatives are discussed in Chapters 5 and 6 respectively. Implementing decentralized facilities is not considered a feasible option.

4.2.4 Develop an Optimum Combination of Centralized and Decentralized Systems

An additional alternative that the District can consider is the combination of centralized and decentralized systems such as on-site septic/solids tanks, or modification of existing pump stations to add solids removal.

This would in effect disperse solids removal and handling from a central location to multiple locations in the District. It will also necessitate either constructing solids settling tanks on private property, or constructing neighborhood scale solids removal in new locations or at existing pump stations. Since it will be necessary to construct solids and grit separation at the treatment facility anyway, there is no real value nor logic in creating multiple solids handling locations since it would increase cost of construction and operation and make the solids management program more complex. There is no operation value to removing solids early, therefore this option is not considered a viable alternative.

4.2.5 Optimizing the Current Facilities (No Construction)

This alternative, although required to be included in the report, is not currently feasible because the District does not have its own WWTF and the City of Depoe Bay has presented the District with a termination notice. Even if the notice is rescinded or suspended, no current planning information is available regarding what is needed to maintain the Depoe Bay WWTF in service over the planning period.

4.2.6 Construct a New Wastewater Treatment Facility

Based on the lack of other viable alternatives, the District is forced into the position of constructing a new wastewater treatment facility. The alternatives analysis for this facility are broken into three sections:

1. Site Alternatives Evaluation. This analysis is completed in Chapter 6.
2. Outfall Alternatives Evaluation. This analysis is completed in Chapter 5.
3. Wastewater Treatment Process Alternatives Analysis. This analysis is completed in Chapter 7.

4.3 Design Criteria

4.3.1 Introduction

This section summarizes the wastewater treatment system design criteria used when evaluating alternative facility locations, treatment system alternatives, and alternative treated effluent discharge locations. The development of these design criteria is discussed in previous sections.

4.3.2 Hydraulic Design Criteria

Hydraulic design criteria have been determined by analyzing historical flow rates from the District as measured by the flow meter at the Depoe Bay Wastewater Treatment Facility (WWTF), year 2021 and 2045 projected populations, and corresponding equivalent dwelling units (EDU's). Population and EDU analysis and projections are discussed in detail in Chapter 2, Section 4, *Population Trends*.

Wastewater from Gleneden Sanitary District (GSD) is pumped to the Depoe Bay WWTF via the Fogarty Creek Pump Station. Incoming flows are tracked at the at the Depoe Bay WWTF by a flow meter and documented as part of Depoe Bay's Daily Monitoring Report (DMR). Flow data from GSD was compiled from 2016 through 2021 to develop a 5 year dry weather, wet weather, and composite flow average, then the existing condition flow rates were determined according to the methodology established in the *Guidelines for Making Wet-Weather and Peak Flow Projections for Sewage Treatment in Western Oregon: MMDWF, MMWWF, PDAF, and PHF* (Oregon DEQ) including:

- Average Annual Flow Rate (AAF),
- Base Sewerage Flow Rate
- Average Dry Weather Flow Rate (ADWF)
- Average Wet Weather Flow Rate (AWWF)
- Maximum Month Dry Weather Flow Rate (MMDWF)
- Ten-Year Maximum Month Dry Weather Flow Rate ($MMDWF_{10}$)
- Maximum Month Wet Weather Flow Rate (MMWWF)
- Five-Year Maximum Month Wet Weather Flow Rate ($MMWWF_5$)
- Peak Day Average Flow Rate (PDAF)
- Five-Year Peak Day Average Flow Rate ($PDAF_5$)
- Peak Instantaneous (Hourly) Flow Rate (PHF)
- Five-Year Peak Instantaneous (hourly) Flow Rate (PIF5)

The existing existing-condition flow rate analysis is discussed in detail in Section 3.6.1

Using EDU projections for the end of the year 2045 planning period developed in Chapter 2, and existing flow rates per EDU developed in Chapter 3, projected flow rates at the end of the planning period were determined and are shown in Table 4-1 below.

TABLE 4-1 GSD EDU FLOWRATE PROJECTIONS

Parameter	Current Flow Rates (MGD)	Flow per EDU (gal/EDU)	Estimated 2045 Flow Rates (MGD)
Annual Flow Rates			
AAF	0.270	121	0.283
Dry Weather Flow Rates			
ADWF	0.239	107	0.251
Base Sewerage	0.239	107	0.251
$MMDWF_{10}$	0.318	143	0.334
Wet Weather Flow Rates			
AWWF	0.305	137	0.320
$MMWWF_5$	0.443	199	0.465
Peak Week (PWF)	0.558	251	0.585
Peak Day ($PDAF_5$)	0.919	413	0.964
Peak Instantaneous Flow $(PIF)_5$	1.178	529	1.235

The 2018 Wastewater Collection System Facilities Plan Update (Harper Houf Peterson Righellis, Inc., 2018) projected flows of 0.25 MGD for ADWF and 0.29 MGD for MMDWF. This is a difference from the actually recorded 2022 flows of -4.5% and 9.21% respectively.

An alternative methodology to calculate end of planning period flow rates was conducted using existing 2021 per-capita flow rate data as determined in Chapter 3 and calculating end of planning period flow rates using projected equivalent populations as determined in Chapter 2. Those flow rate projections are included below in Table 4-2.

TABLE 4-2 GSD PER-CAPITA FLOW RATE PROJECTIONS

2045 Projected Wastewater Flow Rates (Population: 5,136)			
Parameter	**Total Flow (mgd)**	**[1]Per Capita Flow (gpcd)**	**Sewerage Peaking Factor**
Annual Flow Rates			
AAF	0.283	55	1.14
Dry Weather Flow Rates			
ADWF	0.249	48	1.00
Base Sewerage	0.250	49	1.01
$MMDWF_{10}$	0.309	60	1.24
Wet Weather Flow Rates			
AWWF	0.318	62	1.28
$MMWWF_5$	0.413	80	1.66
Peak Week (PWF)	0.629	122	2.53
Peak Day ($PDAF_5$)	0.905	176	3.64
Peak Instantaneous Flow $(PIF)_5$	1.235	240	4.97

[1]Per capita flow rate calculations were completed using the 2045 population estimate as reported by PSU PRC.

Although these methodologies yield slightly different results, the intent is to predict expected flows in the future, based upon past population and development changes within the District. Census data is not specific for the District boundaries; therefore, some assumptions were necessary in predicting growth to ensure that proposed improvements can adequately handle flows within the planning period without being conservatively oversized. Results from both methodologies are very close, therefore the EDU Flow Projections, being the more conservative of the two, were chosen as design criteria. The treatment facility is required by DEQ to be able to treat the Ten-Year Maximum Month Dry Weather Flow Rate ($MMDWF_{10}$) of 0.318 MGD and the Five-Year Maximum Month Wet Weather Flow Rate ($MMWWF_5$) of 0.443 MGD.

DEQ guidelines for wastewater conveyance and treatment require critical system components to be designed to convey the Peak Instantaneous Flow (PIF) which represents the highest flowrate over the course of an hour that the plant may experience in a 5-year period. The PIF corresponding to the 5-year, 24-hr storm was calculated from a plot of flow rate versus recurrence probability. The determination of the present day PIF and PFW are detailed in Chapter 3, Section 6.1.3. The peak instantaneous flow for the end of the planning period was calculated to be 1.235 MGD.

4.3.3 Loading Design Criteria

Projected total pollutant loads at the end of the planning period were determined by comparing sampling data collected from the Fogarty Creek Pump Station with standard loading data from Metcalf & Eddy (Metcalf & Eddy, 2014). Existing loading data is analyzed and discussed in detail in Section 3.6.2, *Existing Pollutant Loading Rates.* Assuming that pollutant loads measured in pounds per capita day (ppcd) will remain the same, future loading can be predicted by multiplying this loading by the projected future equivalent population of the district at the end of the planning period. The maximum monthly dry weather flow is typically the controlling flow rate in establishing design loading for secondary treatment. Although flow rates may increase during winter months as a result of inflow and infiltration, loading for the District is highest in the summer during peak occupancy.

The sampling time frame was relatively short and produced a correspondingly small data set. The sampling information was compared to typical per capita loading rates from literature. In all instances, sampling loading rates were less than typical loading rates from literature. Therefore, the literature loading rates were selected as the design criteria because they are more conservative. Design loading and process sizing will be refined during preliminary design. A comparison of the sampled loading rates with typical loading rates is shown in Table 4-3 below.

TABLE 4-3 LOADING RATE COMPARISON

	Loading Rate (ppcd)		Loading Rate for Analysis
Constituent	Measured	Literature[1]	(ppcd)
BOD5	0.08	0.20	0.20
COD	0.29	0.50	0.50
TSS	0.066	0.19	0.19
TKN	0.025	0.31	0.31
Ammonia-N	0.016	0.017	0.017
Total Phosphorous	0.0033	0.0048	0.0048

[1]Typical per capita loading rate with ground up kitchen waste from Table 3-13 (Metcalf & Eddy, 2014).

Total projected daily loading at the end of the planning period is shown in Table 4-4 below.

TABLE 4-4 ESTIMATED DAILY LOADING RATE

Parameter	Per Capita Loading Rate (ppcd)	Estimated Peaking Factor	Estimated Loading Rates (ppd)	
			2021	2045
Five-day Biochemical Oxygen Demand				
Annual Average	0.20	1.00	980	1,027
Max Month	0.26	1.30	1,274	1,335
Total Suspended Solids				
Annual Average	0.19	1.00	931	976
Max Month	0.25	1.33	1,238	1,298
Ammonia				
Annual Average	0.017	1.00	83	87
Max Month	0.022	1.30	108	114

Notes:
1. Annual Average per capita loading rates are taken from Metcalf & Eddy, Table 3-13 (column 4) due to lack of long term analytical data specifically for the District.
2. Max Month per capita loading rates were estimated by multiplying the annual average per capita loading rate by the typical 30-day sustained peak peaking factor shown in Metcalf & Eddy,
3. Given the limited number of non-residential EDUs in the District, those EDUs were assumed to have wastewater constituent compositions similar to residential EDUs.

4.3.4 Redundancy and Reliability Design Criteria

4.3.4.1 Equipment Redundancy and Reliability

The EPA classifies wastewater facilities into one of three classes depending upon the level of redundancy and reliability that are needed to protect the receiving waters. Those classifications are defined in the EPA Technical Bulletin, *Design Criteria for Electrical, Mechanical, and Fluid Systems and Component Reliability* (EPA, 1974) as:

- Class I: Works which discharge into navigable waters that could be permanently or unacceptably damaged by effluent which was degraded in quality for only a few hours. Examples of Reliability Class I works might be those discharging near drinking water reservoirs, into shellfish waters, or in close proximity to areas used for water contact sports.
- Class II: Works which discharge into navigable waters that would not be permanently or unacceptably damaged by short-term effluent quality degradations but could be damaged by continued (on the order of several days) effluent quality degradation. An example of a Reliability Class II works might be one which discharges into recreational waters.
- Class III: Works not otherwise classified as Reliability Class I or Class II.

Note: Pumping stations associated with, but physically removed from, the actual treatment works could have a different classification from the works itself.

The Gleneden Wastewater Treatment Plant will likely be classified as a Class II facility since the proposed outfall is in the Pacific Ocean. The facility will have to comply with the requirement of this technical bulletin which dictates what the facility must contain and be able to do to prevent failures. This document requires a Class II treatment facility to include:

- Trash removal or a grinder (comminutor)
- Grit removal
- Provisions for removal of settled solids
- Diversions around treatment works for peak flows
- Bypassing of treatment unit components

The Technical Bulletin also require the following redundant systems:

- Backup bar screen/trash removal
- Comminutor bypass (if applicable) with bar screen
- Backup pumps for each set of pumps that perform the same function
- At least two (2) aeration vessels
- Backup blowers/mechanical aerators
- Redundant air diffusers (if applicable)
- Secondary chemical mixing tank
- At least two (2) flocculation basins
- Chlorination basin: sufficient units so that if the primary is out of service the design flow can be disinfected
- Primary and Final Sedimentation Basins and Trickling Filters: this means that the primary treatment process shall be sized in such a way that with the largest unit bypassed, sufficient capacity remains in secondary unit(s) to treat at least 50% of the design flow.

Solids handling is similar in that critical components must include backups or redundancy to ensure continued operation without environmental harm if part of the system fails. The Technical Bulletin does allow identification of alternative methods of solids removal and disposal if backup systems are not provided.

4.3.4.2 Required Design Flow Compliance Probability

The treatment facility is required by DEQ to be able to treat the Ten-Year Maximum Month Dry Weather Flow Rate (MMDWF10) of 0.318 MGD and the Five-Year Maximum Month Wet Weather Flow Rate (MMWWF5) of 0.443 MGD. DEQ also requires critical system components to be designed to convey the Peak Instantaneous Flow (PIF) of 1.235 MGD. The reason DEQ has chosen those design thresholds is described in the DEQ Guidelines for Making Wet-Weather and Peak Flow Projections for Sewage Treatment in Western Oregon: MMDWF, MMWWF, PDAF, and PIF. (DEQ, 1996)

> *At one time, annual average flow was the main parameter used for sizing sewage treatment plants. Plants were designed and rated according to their annual average capacity. This convention still continues in regions where effluent limits remain constant year-round, regardless of the season. In Western Oregon, however, an annual-average design basis had little applicability because of wide flow variations and seasonal effluent limits. Average summer flowrate replaced annual average flowrate as the basis for design, and average dry-weather flow became established as the basis for issuing NPDES permits. Oregon NPDES permits still designate an "Average Dry-Weather Flow" (ADWF) for each treatment plant. The ADWF is the average of daily flows over the 6-month dry-weather period, roughly May through October. This is the flowrate on which dry-weather mass loads are based. However, from the standpoint of reliability, it is implicit in the concept of a seasonal or annual average that there is a 50% chance every year for possible overload and failure of the process. To base design on average capacity implied*

a potential failure or sewage overflow every other year, which presented an excessive risk to the environment. In 1991, DEQ stopped using average flows as a design basis for sewage treatment in favor of the 5-year flow, which presents only 20% probability of a failure in any given year. In 1996, DEQ concluded that even a 20% probability of failure presented an excessive risk in the summer. The probability of a summertime failure or sewage overflow has now been reduced to 10%, which amounts to one failure every 10 years on average. This has the effect of further reducing the potential for poor treatment or raw sewage overflows during the period of May through October. An immediate consequence is to require somewhat larger and more reliable treatment facilities than previously. The regulations adopted in 1996, which require design capacities of MMWWF5 and MMDWF10, were published in OAR 34-41-120 (13) and (14). The anticipated compliance in the winter months with capacity at the MMWWF5 would be 98% (59/60 = 0.983). Compliance in the summer months with capacity at the MMDWF10 would be 99% (119/120 = 0.991). The use of these design flow rates assures compliance with the goals of EPA's water-quality regulations, which are designed to protect the environment if the regulations are met 95% of the time.

4.4 References

DEQ, O. (1996). *Guidelines for Making Wet-Weather and Peak Flow Projections for Sewage Treatment in Western Oregon.*

EPA, U. (1974). *Design Criteria for Electrical, Mechanical, and Fluid Sysytems and Component Reliability (EPA-430-99-74-001).*

Harper Houf Peterson Righellis, Inc. (2018). *Gleneden Sanitary District Wastewater Collection System Facilities Plan Update.*

Metcalf & Eddy, A. (2014). *Wastewater Engineering; Treatment and Resource Recovery, 5th Edition.* McGraw-Hill, Inc.

Oregon DEQ. (n.d.). *Guidelines for Making Wet-Weather and Peak Flow Projections for Sewage Treatment in Western oregon: MMDWF, MMWWF, PDAF, and PIF.*

Water Environment Federation. (2018). Design of Water Resource Recovery Facilities, Sixth Edition. New York: McGraw-Hill Education.

5 ALTERNATIVES ANALYSIS: TREATMENT PLANT OUTFALL

5.1 Introduction

This chapter discusses the various options for discharging treated wastewater effluent. There are several discharge options that can be considered and are discussed below including:

1. Underground Injection
2. Water Reuse
3. Inland surface water outfall to a river or creek
4. Ocean outfall

The type and level of treatment that the District will need is highly dependent upon where the treated effluent is discharged. Discharges to waterbodies will require a regulatory mixing zone within which the effluent must meet water quality standards to protect beneficial uses and to prevent impairing the water quality of the receiving water.

5.1.1 Types of Permit Limits

Effluent limitations serve as the primary mechanism in NPDES permits for controlling discharges of pollutants to receiving waters. Effluent limitations can be based on either the best technology available to control the pollutants or limits that are protective of the water quality standards for the receiving water including beneficial uses and compliance with anti-degradation policy. These two types of permit limits are referred to as technology-based effluent limitations (TBELs) and water quality-based effluent limits (WQBELs) respectively. When a TBEL is not restrictive enough to protect the receiving stream, a WQBEL must be placed in the permit. More explanation of each is provided below.

- *TBELs:*
    - *The intent of TBELs is to require a minimum level of treatment of pollutants ased on available treatment technologies, while allowing the discharger to use any available control technique to meet the limits*
    - *TBELs for municipal treatment plants, also known as federal secondary treatment standards, have been developed for the following parameters: biochemical oxygen demand measured over 5 days (BODs), total suspended solids (TSS) and pH. These are found in the Code of Federal Regulations (CFR) and are known as secondary treatment standards. The CFR also allows special considerations and exceptions to these standards for certain circumstances and types of treatment facilities such as lagoons.*
- *WQBELs:*
    - *The intent of WQBELs is to ensure the water quality standards of a receiving stream are met. The water quality standards are developed to protect the beneficial uses of the receiving stream such as swimming and fishing. In many cases TBELs are not restrictive enough to ensure the receiving stream meets water quality standards. In these cases, WQBELs need to be established to protect the receiving stream.*

- o *Oregon has minimum design criteria for BOD and TSS that are only applicable to sewage treatment plants. These design criteria vary by watershed basin and were developed to protect water quality in their respective basins. These are often times more stringent than the federal secondary treatment standards. When this is the case, the basin standards supersede the federal standards.*

TBELs are likely to be the most stringent if the receiving stream is large relative to the discharge, and WQBELs are likely to be the most stringent when the receiving stream is small or does not meet water quality standards. In some cases, both a TBEL and a WQBEL will be developed for a particular parameter. Permit writers must include the more stringent of the two in the permit.

Permit limits for bacteria are WQBELs when they are derived from the water quality standards found in OAR 340-041-0009 for freshwater, marine, and estuarine waters or 40 CFR § 131.41 for coastal recreation waters. Bacteria limits are designed to protect human health when swimming or eating shellfish. Each time a permit is renewed, the permit writer evaluates the existing limits to see if they need to be modified as a result of changes to technology based standards or water quality standards that may have occurred during the permit term. Anti-backsliding provisions (described in 40 CFR § 122.44(1)) generally do not allow relaxation of effluent limits in renewed/reissued permits. The more stringent of the existing or new limits must be included in the renewal permit. (OR DEQ, 2018)

5.1.2 Water Quality Requirements of Discharges – Regulatory Mixing Zones

Wastewater effluent must be treated to a sufficient water quality standard so that residual pollutants will not have a detrimental effect on beneficial uses of the receiving water body and will not further degrade already impaired waters. Discharges are allocated a regulatory mixing zone (RMZ) by permit, and applicable water quality standards must be met at the edge of this zone before entering the receiving body. The mixing zone is the area within which the effluent is diluted with water from the receiving water body to reduce concentration levels of pollutants to an acceptable level. Consequently, the ability of a mixing zone to effectively dilute wastewater effluent is a function of the amount of water within the receiving water, the size of the mixing zone, and the initial concentration of the effluent.

As opposed to concentration of pollutants, which is the amount of pollutant within a given volume of water, usually measured in milligrams per liter (mg/l) or parts per million (ppm), loading is the total mass of pollutants discharged, usually measured in pounds (lbs.). The permit for an outfall will dictate maximum concentrations as well as total loading over a period of time. The mixing zone does not affect loading, and so regardless of how effective the mixing zone may be, the effluent is always required to meet a certain water quality to comply with loading requirements.

5.1.3 Beneficial Uses

Wastewater effluent water quality standards are established to protect beneficial uses of the state's waters. Beneficial uses are designated for all waters of the state in the Oregon Administrative Rules for water quality standards (Chapter 340, Division 41). In some cases, beneficial uses vary by waterbody or reach. In other cases, uses are designated for all waters in a basin or sub-basin.

Beneficial uses include:

- Fish and aquatic life
- Water contact recreation
- Fishing
- Domestic water supply
- Industrial water supply
- Boating
- Irrigation
- Livestock watering
- Aesthetic quality
- Wildlife and hunting
- Hydropower
- Commercial navigation and transportation

The Mid-Coast Basin, of which the District is a part, has designated beneficial uses for all streams, estuaries and adjacent coastal waters per the Table 5-1 below. More specific beneficial uses for fish, salmon and steelhead, shellfish, and recreational uses within the District are more specifically shown in Figure 5-1 through Figure 5-3 below.

TABLE 5-1: MID-COAST BENEFICIAL USES

OAR 340-041-0220
Table 220A
Designated Beneficial Uses - Mid Coast Basin

Beneficial Uses	Estuaries & Adjacent Marine Waters	All Steams & Tributaries Thereto
Public Domestic Water Supply[1]		X
Private Domestic Water Supply[1]		X
Industrial Water Supply	X	X
Irrigation		X
Livestock Watering		X
Fish & Aquatic Life[2]	X	X
Wildlife & Hunting	X	X
Fishing[3]	X	X
Boating	X	X
Water Contact Recreation[3]	X	X
Aesthetic Quality	X	X
Hydro Power		X
Commercial Navigation & Transportation	X	

[1] With adequate pretreatment (filtration & disinfection) and natural quality to meet drinking water standards.
[2] See also Figures 230A and 230B for fish use designations for this basin.
[3] For coastal water contact recreation and shellfish harvesting uses, see also Figures 220C (Salmon River Estuary), 220D (Siletz Bay), 220E (Yaquina Bay), 220F (Alsea River Estuary), 220G (Yachats River Estuary), and 220H (Siuslaw River Estuary)

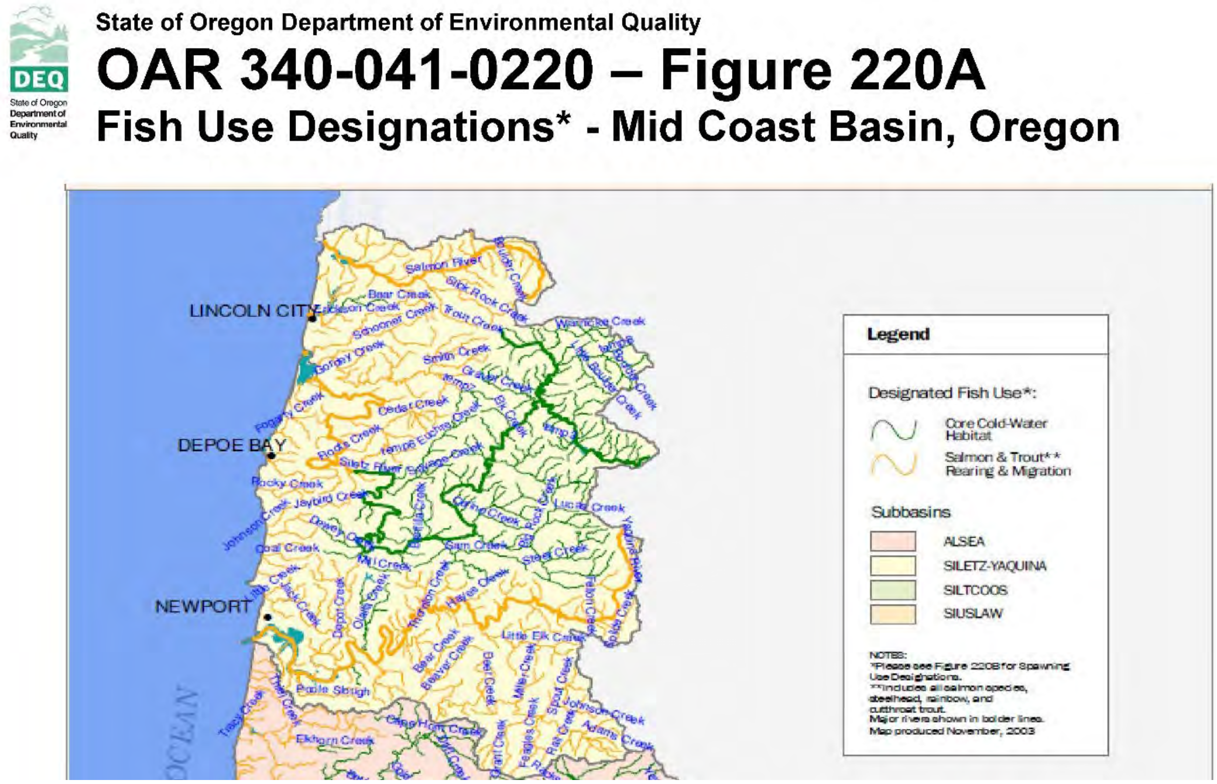

FIGURE 5-1: MID-COAST BASIN FISH BENEFICIAL USES

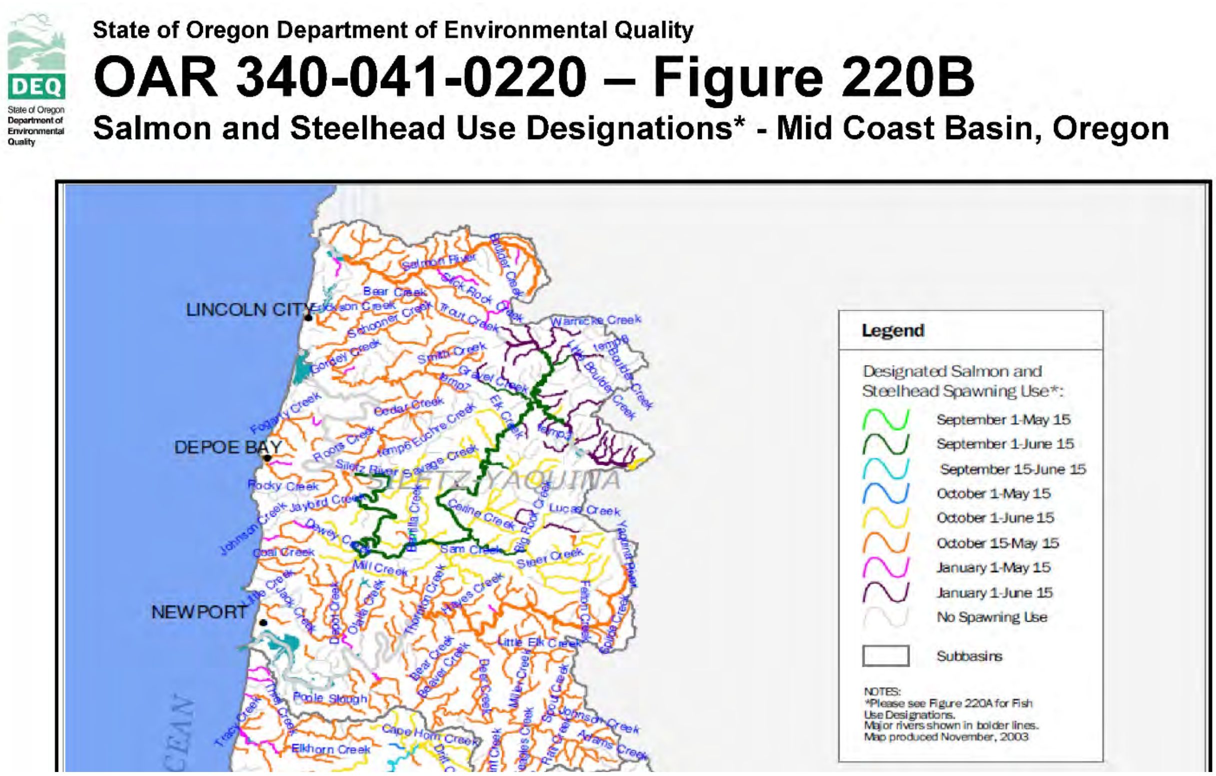

FIGURE 5-2: MID-COAST BASIN SALMON AND STEELHEAD BENEFICIAL USES

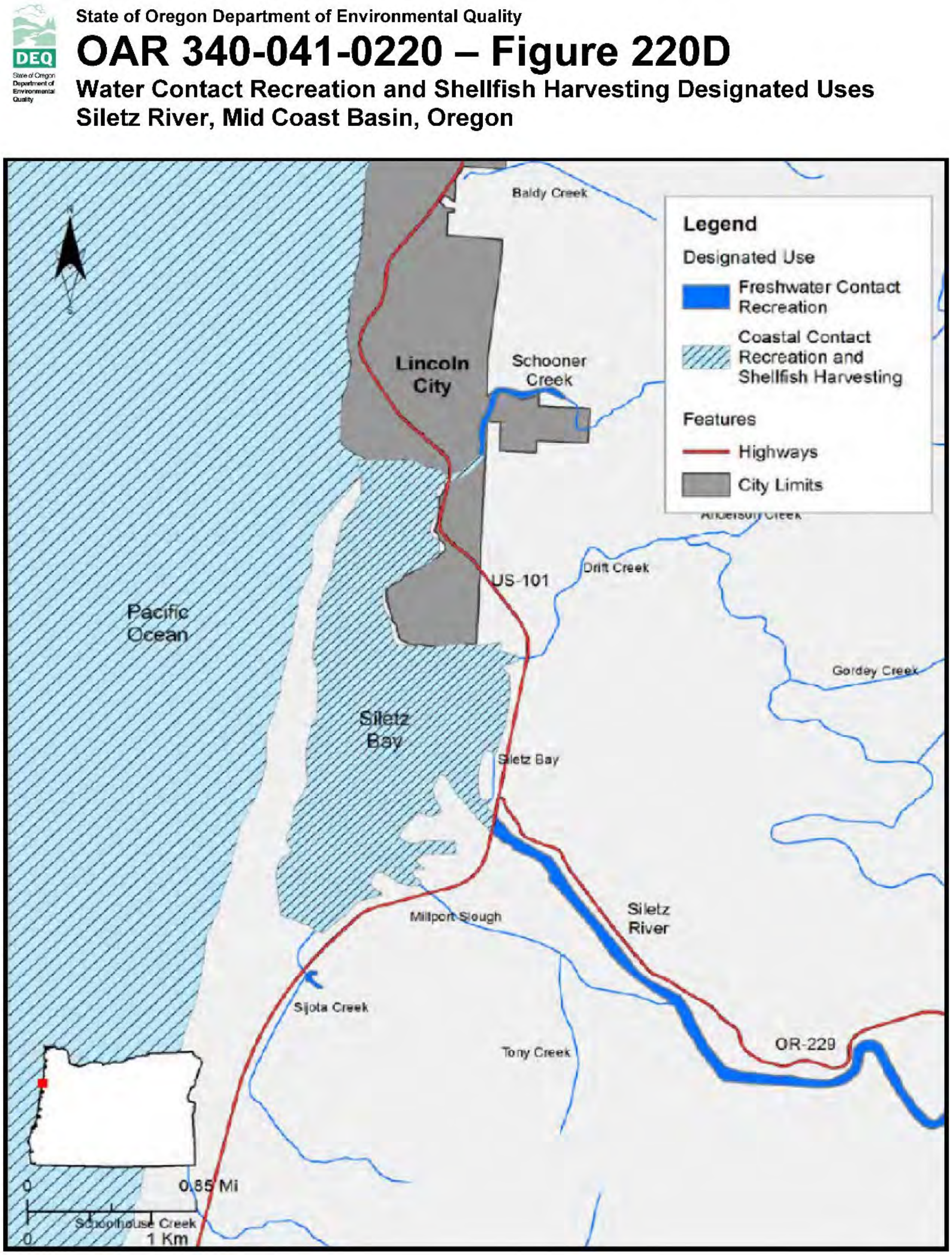

FIGURE 5-3: SILETZ RIVER AND ESTUARY SHELLFISH AND RECREATIONAL BENEFICIAL USES

5.1.4 Anti-Degradation

Wastewater effluent must also comply with the State's anti-degradation policy. *A fundamental premise of the Clean Water Act is the maintenance and restoration of the chemical, physical, and biological integrity of the Nation's waters. This concept forms the basis for what is referred to as antidegradation. Antidegradation policy is an integral component of DEQ's water quality standards. By definition, a water quality standard is composed of:*

1. *Designated uses of a waterbody which set the water quality goals of a waterbody (e.g. resident fish and aquatic life, water contact recreation),*
2. *Water quality criteria that define the minimum conditions necessary to achieve the designated beneficial uses* (see section 5.1.3 above)*, and;*
3. *Antidegradation policy that prevents existing water quality from degrading unless specific circumstances apply.*

The State's antidegradation policy provides a means for maintaining and protecting water quality of surface waters by requiring that all activities with the potential to affect existing water quality undergo review and comment prior to any decision to approve or deny a permit or certificate for the activity.

The antidegradation policy complements the use of water quality criteria. While criteria provide the absolute minimum values or conditions that must be met in order to protect designated uses, the antidegradation policy offers protection to existing water quality, including instances where that water quality equals or is better than the criteria. Antidegradation policy prohibits degradation of water quality in some circumstances and provides for exceptions to this prohibition in others; however, degradation of water quality is allowed only after a systematic decision-making process considering many factors. These factors include the classification of the waterbody, consideration of alternative treatments to the proposed activity, and comparison of economic and social benefits with environmental costs. In addition, the antidegradation policy requires the involvement of the public through direct notice and through coordination with other government agencies. In this way, decisions to maintain or to change current water quality are made only after a deliberate and inclusive process. (OR DEQ, 2001)

Within the District, only three waterbodies are currently listed per the DEQ's 2022 approved Integrated Report (OR DEQ, 2022):

1. Gleneden Beach: The beach and waters immediately adjacent to the beach from Fogarty Creek to Siletz Bay is listed as impaired for shellfish toxins.
2. Siletz Bay and Estuary: The bay and estuary are listed as impaired for temperature- (year round), and toxic substances for both aquatic life and human contact.
3. Siletz River: The river is listed as impaired for temperature (year round).

5.2 Underground Injection

Treated effluent can be injected into the ground to supplement groundwater. Underground injection is regulated by DEQ within the Underground Injection Control (UIC) Program. *The federal UIC program was enacted in 1974, under the Safe Drinking Water Act, and is administered under 40 Code of Federal Regulations part 144-146. The UIC program's goal is to protect freshwater aquifers from contamination due to underground injection systems. In 1984, EPA gave DEQ authority to regulate UIC systems on EPA's behalf and re-authorized the* *program in 1991. DEQ regulates the UIC Program under Oregon Administrative Rules Chapter 340, Division 44.*

DEQ operates Oregon's UIC Program through authorization from the Environmental Protection Agency. Under this program, DEQ issues permits to UIC system operators, handles enforcement of systems to make sure they are working properly, and conducts rule revisions when program changes are necessary. The program is administered under the Code of Federal Regulations title 40, parts 144 to 146.

Typical residential septic systems are considered underground injection systems but are exempt from regulation under the UIC Program. *In general, runoff from residential areas are the least likely to pollute groundwater as compared to runoff from industrial, commercial or transportation activities. The risk of pollution depends upon the quality and volume of the injected fluid, pretreatment prior to discharge, depth of injection, depth to seasonal high water table, nature and thickness of the unsaturated zone, soil profile and surficial geology. For example, fractured rock and coarse-grained sediments allow the contaminants to travel greater distances more rapidly, while clay minerals and organic matter the most restrictive to movement of contaminants. Cumulative impacts to water quality must also be considered along with the risks to human health. Contaminants of concern include heavy metals, toxic organics and other toxic chemicals, nutrients, pesticides, salts and microorganisms (e.g. cryptosporidium, E. Coli)*. (OR DEQ, 2022)

Geology in the Mid-Coast limits available groundwater resources. Mid-Coast geology is generally characterized by low-permeability and low-storage capacity bedrock aquifers. According to a USGS report on the water resources of Lincoln County conducted in 1976 (Frank & Laenen, 1976): *The Lincoln County coastal area is underlain by Tertiary volcanic and sedimentary rocks of low permeability that store only a small volume of the annual precipitation Consequently, the Tertiary units yield small quantities of water to wells and furnish little ground-water discharge to maintain the base flow of streams. Although streamflow is normally abundant during the wet season, flow decreases greatly during summer when needed most*. (GSI, Inc., 2018)

Aquifers in the area are recharged by precipitation with the majority of recharge occurring during late autumn and winter, when precipitation is highest. Groundwater is discharged (leaves the aquifer) through seeps, springs, and diffusion through the riverbed which provides water to rivers, streams, estuaries, and wetlands. In general, fractured-rock aquifers in the Mid-Coast have such low storage capacity that groundwater flow paths are short and a large proportion of aquifer recharge (filling) and discharge (draining) occurs seasonally, without providing significant, long-term water to streams (GSI, Inc., 2018).

Soils at Site Options 1,2 and 3 are classified as Gleneden silty clay-loam with a hydrologic group classification of D. *"Hydrologic group" is a group of soils having similar runoff potential under similar storm and cover conditions. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission rate. The soils in the United States are placed into four groups, A, B, C, and D, and three dual classes, A/D, B/D, and C/D.* (USDA-NRCS, 2022)

Soils in group D have high runoff potential when thoroughly wet. Water movement through the soil is restricted or very restricted. Group D soils typically have greater than 40 percent clay, less than 50 percent sand, and have clayey textures. In some areas, they also have high shrink-swell potential. (USDA/NRCS, 2009)

Because of the very restricted infiltration capacity of the soils, underground injection is not a viable alternative for the District.

5.3 Water Reuse

Treated effluent can be reused as irrigation water or repurposed in another fashion including cooling water or process water in manufacturing. It is common for treatment plants in agricultural areas to use treated wastewater effluent for irrigating crops or grassy fields. GSD has no industrial uses for reclaimed water and there is no agriculture within the District. Therefore, the District would be limited to irrigating grassy fields or forest land.

Application of treated wastewater as irrigation water is restricted by the agronomic loading rate (nutrient uptake) that the irrigated crop can support, as well as the infiltration potential and/or vegetative uptake/evaporation of the water. As discussed in 5.2 above, the soil has very low infiltration potential. Furthermore, the District is subject to approximately 95 inches or precipitation per year, 76% of which takes place between October to March. Since the majority of rainfall takes place in the season when vegetation is dormant, the District would not be able to irrigate during this period, which requires the District to have an alternative discharge location.

5.4 Inland Surface Water Outfall to a River or Creek

Within reasonable distance to the Gleneden Sanitary District are several inland creeks and rivers that may be viable outfall locations including, from south to north:

1. Fogarty Creek
2. Schoohouse Creek
3. Sijota Creek
4. George Creek
5. Siltez River

Because of limited water quantity for mixing, water quality standards for surface water discharges will most likely be based on water quality-based effluent limits (WQBELs) to protect beneficial uses and to comply with anti-degradation. See Section 5.1.1.

OAR 340-041-0053(2)(c)(A-D) defines location and size requirements for mixing zones to protect instream water quality, public health, and other beneficial uses. DEQ uses EPA's Mixing Zone Handbook for guidance in administering regulatory mixing zones. This guidance recommends that to prevent impairment of critical resource area (e.g., recreational areas, breeding grounds, areas with sensitive biota) the mixing zone should:

1. Avoid impingement on cold water refugia, critical structural habitat, and areas with poor mixing or specialized habitat.
    a. Prevent shore and bottom hugging plumes to protect salmonoid spawning areas, littoral (shore) zones, and shellfish growing and benthic habitat.
    b. Avoid encroaching on drinking water intakes
    c. Avoid known areas that are frequently used for fish harvesting
    d. Avoid known public swimming areas that are frequently used

   e. Prevent adverse effects to salmonoids due to thermal plumes

2. Provide a continuous zone of passage that meets water quality criteria for free swimming and drifting organisms
   a. Avoid overlap with other RMZ's
   b. Follow requirements for thermal plumes to prevent blocking migrating fish
   c. Provide for an EPA recommended zone of passage of 75% of the cross-sectional area or volume of flow of a stream or estuary.
3. Be limited to an area or volume as small as practicable so it will not interfere with existing and designated uses or cause lethality to passing organisms.
   a. Keep the total area affected by RMZ's small when compared with the total area of the water body
   b. Prevent toxic lethality to passing organisms (OR DEQ, 2012)

The width of the Siletz at the proposed outfall location is approximately 270 feet, which limits the mixing zone to approximately 67 feet wide by 200 feet long. It is necessary to meet water quality standards at the edge of the mixing zone. More stringent water quality-based effluent limits (WQBELs) make it more difficult to meet this standard, likely requiring more sophisticated and larger wastewater treatment equipment than would be necessary for an ocean outfall.

Permitting an outfall to a river or creek will have more immediate and long term risk than permitting for an ocean outfall because of seasonal fluctuations in flow, changes in receiving water quality (impairments) over time, and the close proximity to beneficial uses. For example, the City of Lincoln City Wastewater Treatment Facility recently renewed their NPDES permit in 2020 and additional waste discharge limits were added to their permit for ammonia, thermal load, copper and zinc. As a result, Lincoln City is now considering changing their current outfall from Schooner Creek, a tributary to the Siletz River, to an ocean outfall.

5.4.1 Fogarty Creek

Fogarty Creek is located at the south end of the District and discharges to the Pacific Ocean within the Fogarty Creek State Park. See Figure 5-4. The Fogarty Creek Pump Station is located within the Park. Fogarty Creek has fish and aquatic life, and recreational contact beneficial uses, and the creek outfall at the ocean is a public beach with recreation contact beneficial use. Fogarty Creek is considered essential salmonoid habitat. As discussed in Section 5.1.4 above, all of the beach areas in Gleneden are impaired for shellfish toxins.

FIGURE 5-4: FOGARTY CREEK

Limited flow data is available for Fogarty Creek. Data from the USGS National Water Information System includes only two flow measurements for Fogarty Creek: from August 1977 of 0.90 cfs and from August 1987 of 1.10 cfs. (USGS, 2022) Although flow measurement data is limited, these two flow measurements represent point in time measurement of dry weather flow at Fogarty Creek.

The predicted average annual flow (AAF) from the proposed wastewater facility in 2045 is 0.44 cfs and the average dry weather flow (ADWF) rate us 0.39 cfs. This AAF represents approximately 49% of the Fogarty Creek dry weather flow and the ADWF represents 43% of the Creek's dry weather flow. This implies that the mixing zone that would result would be very large in comparison to the total area of the receiving body and the mixing zone plume will likely encompass the whole stream from bank to bank including bottom attachment since the effluent flow constitutes almost 50% of the base stream flow.

A treated effluent outfall in Fogarty Creek would not be able to comply with many of the criteria listed in OAR 340-041-0053(2)(c)(A-D). Although the District could try to pursue an outfall in this location, due to the permitting difficulties it would entail this option has not been further considered.

5.4.2 Schoolhouse Creek

Schoolhouse Creek is located between the Seagrove neighborhood and the Siltz Bay State Airport. The creek discharges to the ocean just south of the Gleneden Beach State Recreation Site at the west end of Wallace Street. See Figure 5-5. Schoolhouse Creek has fish and aquatic life, and recreational contact beneficial uses, and the creek outfall at the ocean is a public beach with recreation contact beneficial use. As discussed in Section 5.1.4 above, all of the beach areas in Gleneden are impaired for shellfish toxins.

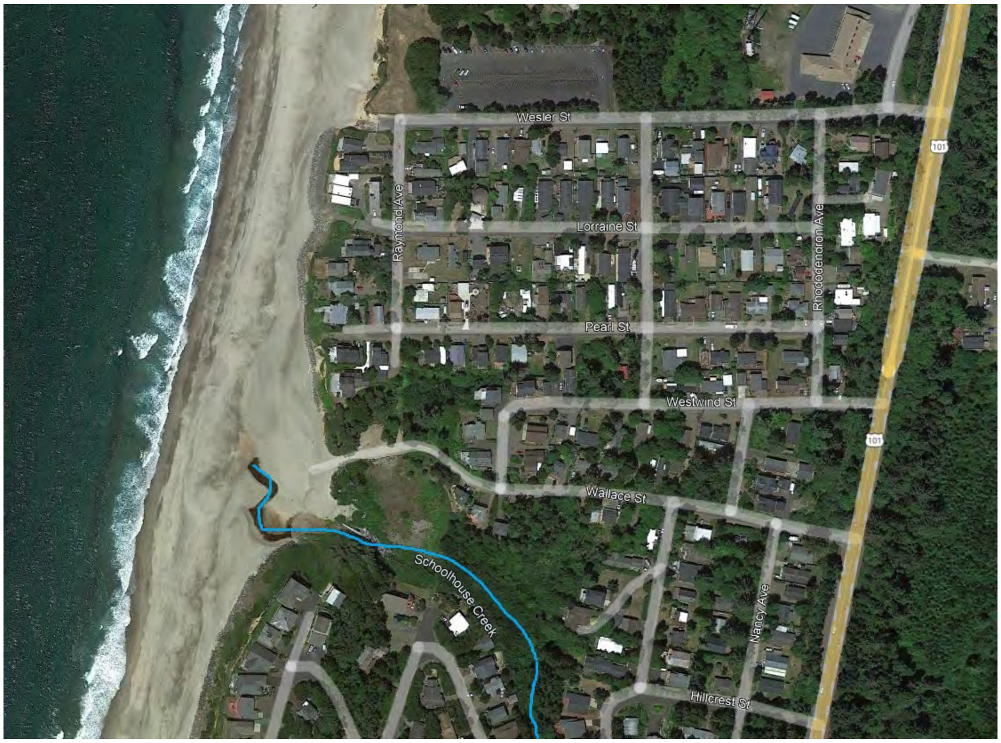

FIGURE 5-5: SCHOOLHOUSE CREEK

Schoolhouse Creek is a very small seasonal creek and no flow data is available, however its flowrate is visible smaller than Fogarty Creek and the water does not make it across the beach to the surf before infiltrating. A treated effluent outfall in Schoolhouse Creek would not be able to comply with many of the criteria listed in OAR 340-041-0053(2)(c)(A-D) therefore this option has not been further considered.

5.4.3 Sijota Creek

Sijota Creek is located just west of the Salishan Golf Course and flows northward, discharging into the Siletz Estuary. The Salishan Sewer District operates a wastewater treatment facility on the west side of Hwy 101 at Salishan Resort and private community. The effluent from the Salishan treatment facility discharges to Sijota Creek. See Figure 5-6. Sijota Creek has fish and aquatic life, and recreational contact beneficial uses. As discussed in Section 5.1.4 above, the Siletz Bay and estuary are listed as impaired for temperature year round, and toxic substances for both aquatic life and human contact.

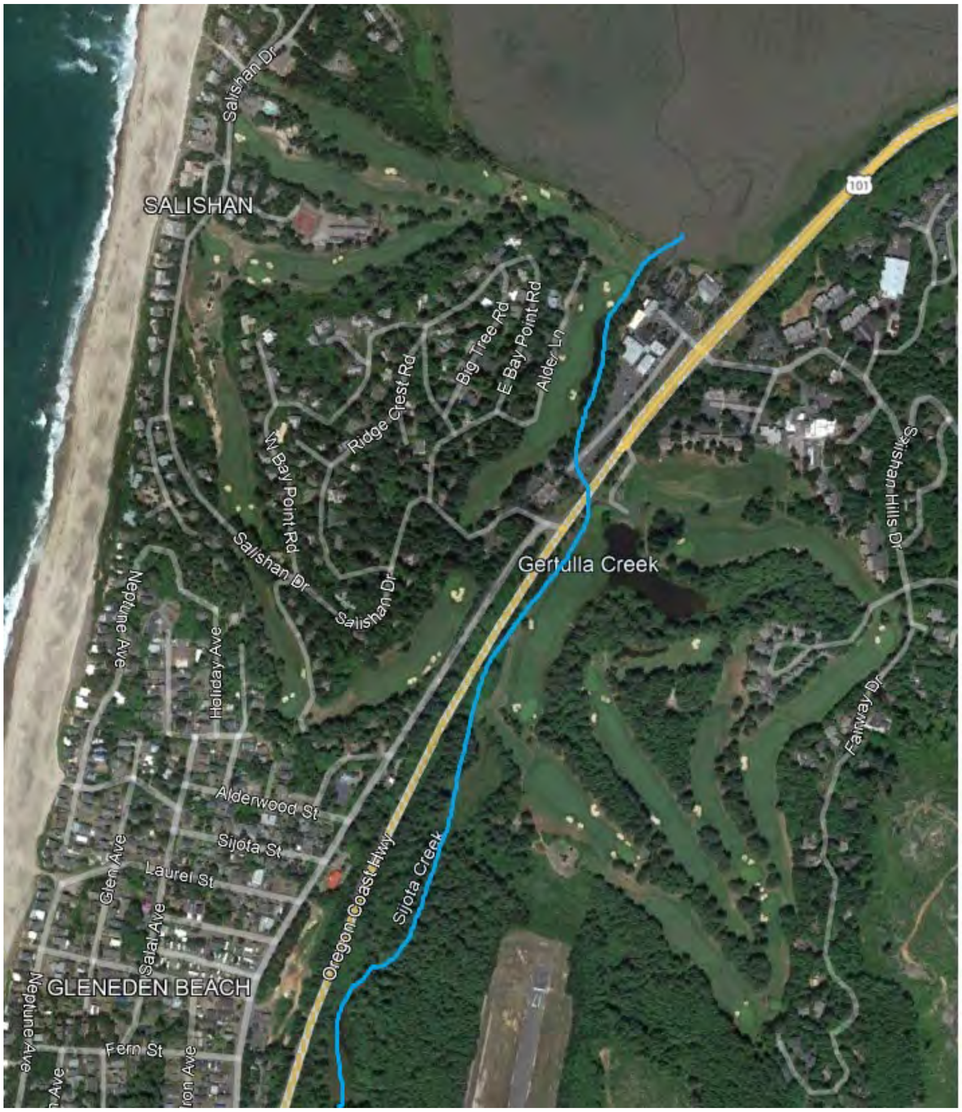

FIGURE 5-6: SIJOTA CREEK

Sijota Creek is a very small seasonal creek and no flow data is available, however its flowrate is visible smaller than Fogarty Creek. The Siletz Estuary is impaired for temperature and shellfish toxins therefore the District would have additional water quality standards included as part of the new facilities NPDES permit to prevent additional impairment to the estuary. A treated effluent outfall in Sijota Creek would not be able to comply with many of the criteria listed in OAR 340-041-0053(2)(c)(A-D) therefore this option has not been further considered.

5.4.4 George Creek

George Creek is located east of the Salishan Resort and discharges north to Millport Slough, which is part of the Siletz Estuary. See Figure 5-7. George Creek has fish and aquatic life, and recreational contact beneficial uses. As discussed in Section 5.1.4 above, the Siletz Bay and estuary are listed as impaired for temperature year round, and toxic substances for both aquatic life and human contact.

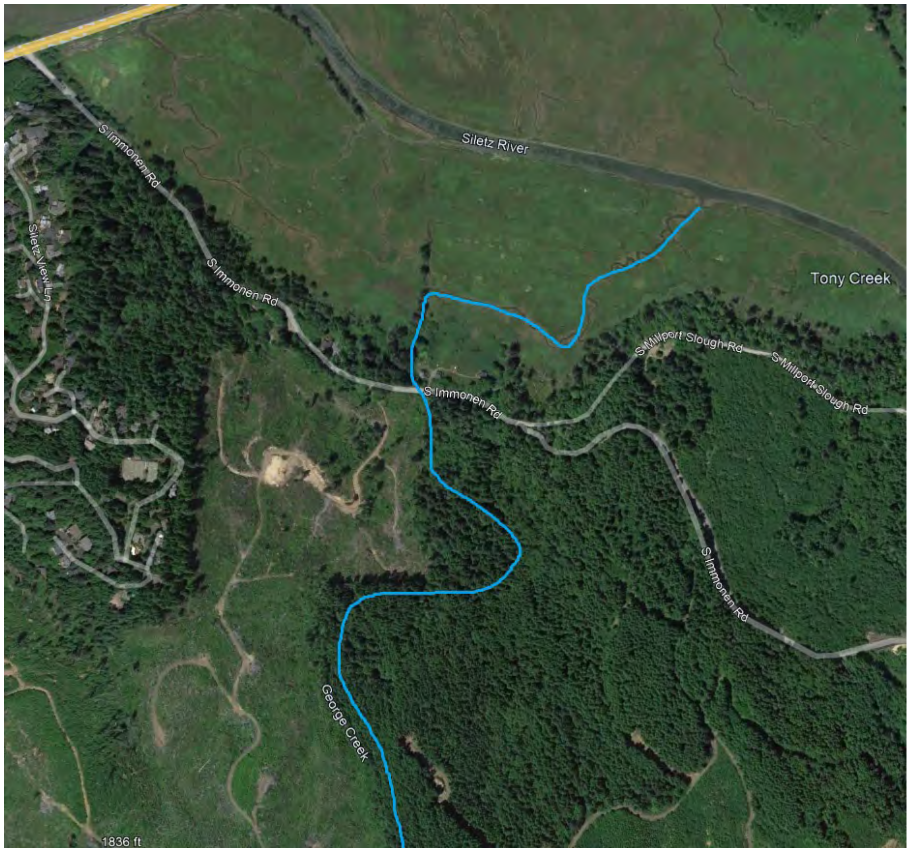

FIGURE 5-7: GEORGE CREEK

George Creek is a very small seasonal creek and no flow data is available, however its flowrate is visible smaller than Fogarty Creek. The Siletz Estuary is impaired for temperature and shellfish toxins therefore the District would have additional water quality standards included as part of the new facilities NPDES permit to prevent additional impairment to the estuary. A treated effluent outfall in George Creek would not be able to comply with many of the criteria listed in OAR 340-041-0053(2)(c)(A-D) therefore this option has not been further considered.

5.4.5 Siletz River

The Siletz River is located at the very north end of the District. The Siletz River has fish and aquatic life, and recreational contact beneficial uses, and the Siletz Bay and Estuary has ocean recreational contact and shellfish harvesting beneficial uses. The Siletz River is considered essential salmonoid habitat. The Siletz River is impaired for temperature year round. The Siletz River discharges to the Siletz Bay and estuary which is protected as the Siletz Bay National Wildlife Refuge. Developing an outfall and subsequent mixing zone anywhere within the wildlife refuge is unlikely to be permitted since it would not comply with many of the criteria listed in OAR 340-041-0053(2)(c)(A-D). Therefore, all outfall option that were explored for the Siltez River are located upstream of the refuge to allow for adequate dilution before water enters the wildlife refuge.

Over the past 12 months the Siletz River has had a minimum flowrate of 65-cfs, a maximum flowrate of 15,500-cfs, and an average flowrate of 1,451-cfs as recorded at the USGS 14305500 gauging station located at river mile 44.4. (USGS, 2022) The impact of the GSD discharge to the Siletz River is likely to be greatest in the late summer and early fall when flows in the Siletz River are lowest. This period is referred by DEQ as the Critical Period.

The impact of a discharge on the receiving stream is evaluated with respect to flows likely to occur during the critical period. To standardize this analysis, DEQ makes use of three different flow statistics. Each is designed to work with a different type of water quality impact and associated water quality criteria. The nearest flow gage is located at river mile 44.4 which is approximately 30 to 40 miles upstream of a proposed outfall location, depending upon which option is selected. In order to calculate the critical flow statistic at the outfall, USGS's StreamStats web application was used. (USGS, 2022) This application uses regression models based on the watershed characteristics to calculate streams flows at a specific location on a river. These flow statistics and their application are summarized in Table 5-2 below.

The next closest wastewater facility that discharges to the Siletz River is the City of Siletz located at river mile 36.9. The Siletz Wastewater Plant is a sequencing batch reactor (SBR) with an Average Dry Weather Flow (ADWF) of 0.157 MGD with a Maximum Month Wet Weather Flow ($MMWWF_5$) of 0.411 MGD. This facility is similar in size to the future Gleneden facility which is proposed to have a ADWF of 0.249 MGD and $MMWWF_5$ of 0.413. Likewise, the Siletz service area is similar in makeup to the GSD service area, comprised primarily of residential development. The NPDES permit for the Siletz Wastewater Plant was recently updated in 2018. A copy of the Permit Evaluation Report and Fact Sheet dated May 14, 2018 is attached as Appendix F. The stream flow at the Siletz outfall is less than the streamflow at the proposed outfall locations and are shown in Table 5-3. It is therefore assumed that the impact of a comparable wastewater discharge from the proposed GSD facility will not be as great since the streamflow is greater allowing for greater dilution. The permit limits for the Siletz Wastewater Treatment Facility are included below in Table 5-4. It is expected that the District can expect, at a minimum, similar waste discharge limits.

The mixing zone for the proposed outfall will vary from the City of Siletz outfall in that the proposed outfall location is tidally influenced, while the City of Siletz outfall location is not. Functionally this only means that the mixing zone will extend both up and downstream from the outfall.

The Siletz River has special cultural and historical significance for the Confederated Tribes of the Siletz, is host to the greatest diversity in fish species on the Oregon Coast, containing all types of salmonid species and white sturgeon, particularly in the lower river and bay, and also serves as the drinking water source for several communities. Consequently, the Siletz is likely to see tighter water quality standards over time to protect beneficial uses and as more information is acquired to justify water quality impairments. It is likely that the Siletz will ultimately be impaired for dissolved oxygen but sufficient assessment has not currently been completed. It is also very likely that opposition will arise to a new wastewater outfall on the Siletz River since there are very vocal local environmental advocates that want to protect the Siletz River including organizations like Save Our Siletz, the Mid-Coast Watersheds Council, and the Confederated Tribes of the Siletz.

TABLE 5-2: SILETZ RIVER FLOW STATISTICS AT PROPOSED OUTFALL LOCATIONS

River Mile 3.45

StreamFlow Statistic	What It Is	Potential Impacts[1] Statistic is Used to Analyze	Values for the Siletz River (cfs)
1Q10	The lowest one day average flow with a recurrence frequency of once in 10 years.	Acute toxicity to aquatic life	100
7Q10	The lowest seven day average flow with a recurrence frequency of once in 10 years.	Chronic toxicity to aquatic life	100
30Q5	The lowest 30 day average flow with a recurrence frequency of once in 5 years.	Impacts to human health from toxics classified as noncarcinogens	138

[1]Impacts are evaluated with respect to pollutants for which DEQ has developed water quality criteria.

River Mile 13.17

StreamFlow Statistic	What It Is	Potential Impacts[1] Statistic is Used to Analyze	Values for the Siletz River (cfs)
1Q10	The lowest one day average flow with a recurrence frequency of once in 10 years.	Acute toxicity to aquatic life	85.5
7Q10	The lowest seven day average flow with a recurrence frequency of once in 10 years.	Chronic toxicity to aquatic life	85.5
30Q5	The lowest 30 day average flow with a recurrence frequency of once in 5 years.	Impacts to human health from toxics classified as noncarcinogens	130

[1]Impacts are evaluated with respect to pollutants for which DEQ has developed water quality criteria.

TABLE 5-3: SILETZ RIVER FLOW STATISTICS AT CITY OF SILETZ WWTF OUTFALL

Streamflow Statistic	What It Is	Potential Impacts[1] Statistic is Used to Analyze	Values for the Siletz River (cfs)
1Q10	The lowest one day average flow with a recurrence frequency of once in 10 years.	Acute toxicity to aquatic life	60
7Q10	The lowest seven day average flow with a recurrence frequency of once in 10 years.	Chronic toxicity to aquatic life	60
30Q5	The lowest 30 day average flow with a recurrence frequency of once in 5 years.	Impacts to human health from toxics classified as non-carcinogens	77

[1]Impacts are evaluated with respect to pollutants for which DEQ has developed water quality criteria.

TABLE 5-4: CITY OF SILETZ WASTEWATER TREATMENT PLANT WASTE DISCHARGE LIMITS

a. Final Permit Limits

i. May 1 – October 31: During this time period the permittee must comply with the limits in the following table:

Table A11: Summer Permit Limits

Parameter	Units	Monthly	Weekly	Daily
$CBOD_5$	mg/L	15	25	--
	lbs/day	20	29	39
	% removal	85	--	--
TSS	mg/L	20	30	--
	lbs/day	26	39	52
	%	85	--	--
E. coli	MPN	126	--	406
pH	S.U.	6.0 – 9.0		

ii. November 1 – April 30: During this time period the permittee must comply with the limits in the following table:

Table A12: Winter Limits

Parameter	Units	Monthly	Weekly	Daily
$CBOD_5$	mg/L	15	25	--
	lbs/day	46	77	93
	% removal	85	--	--
TSS	mg/L	20	30	--
	lbs/day	62	93	120
	%	85	--	--
E. coli	MPN	126	--	406
pH	S.U.	6.0 – 9.0		

The GSD collection system collects wastewater and through gravity sewer pipes and pump stations conveys the wastewater to the south end of the District to the Fogarty Creek Pump Station where the wastewater is pumped to the Depoe Bay Wastewater Treatment Facility. To develop an outfall on the Siletz River treated effluent will need to be pumped from the new wastewater treatment facility site to the north. No matter where the wastewater plant is sited within the District, water will need to be pumped as raw wastewater, or in treated water form, from the Fogarty Creek Pump Station to the Siletz River outfall, a distance of 5.6 miles. Three outfall pipeline options for a Siletz River surface water discharge were evaluated and are shown in Figure 5-8 and are discussed below. These options evaluate the outfall pipeline alignment only, and do not consider the permitting nor construction costs of the outfall itself. It is assumed that the permitting and construction costs for the outfall will be the same for any Siletz River outfall.

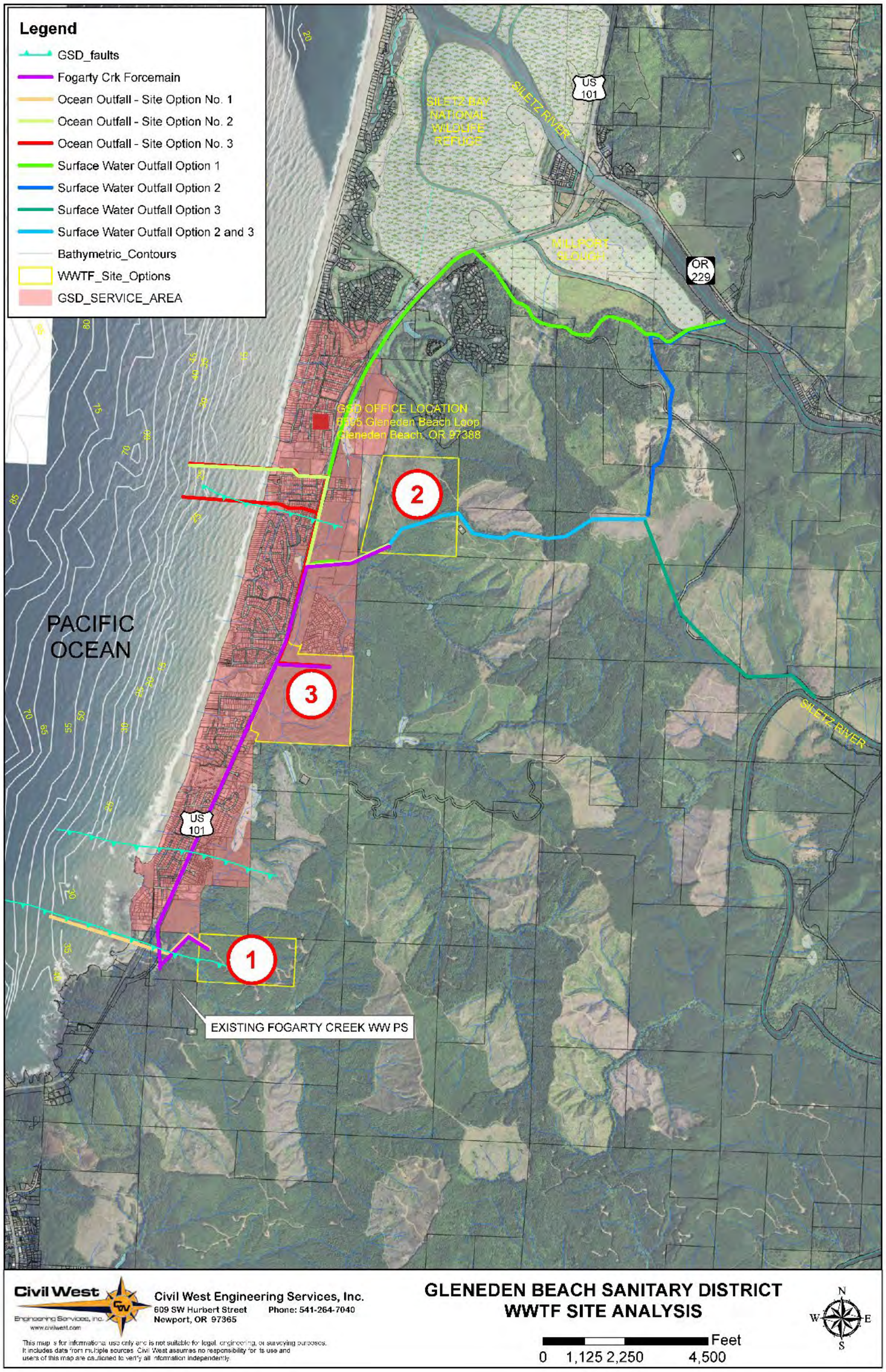

FIGURE 5-8: OUTFALL ALTERNATIVES

5.4.5.1 Siletz River Outfall Alignment: Option 1

DESCRIPTION AND SITE MAP

The alignment for Option 1 starts at the access road to site No. 3, then extends north on Hwy 101 to S. Immonen Road, then east to S. Millport Slough Road, then east to the Siletz River. See Option 1 Site Map in Figure 5-9.

- This outfall will require an effluent booster station.
- The total outfall pipeline distance is 3.9 miles.
- This outfall discharges to the Siletz at river mile 3.45.

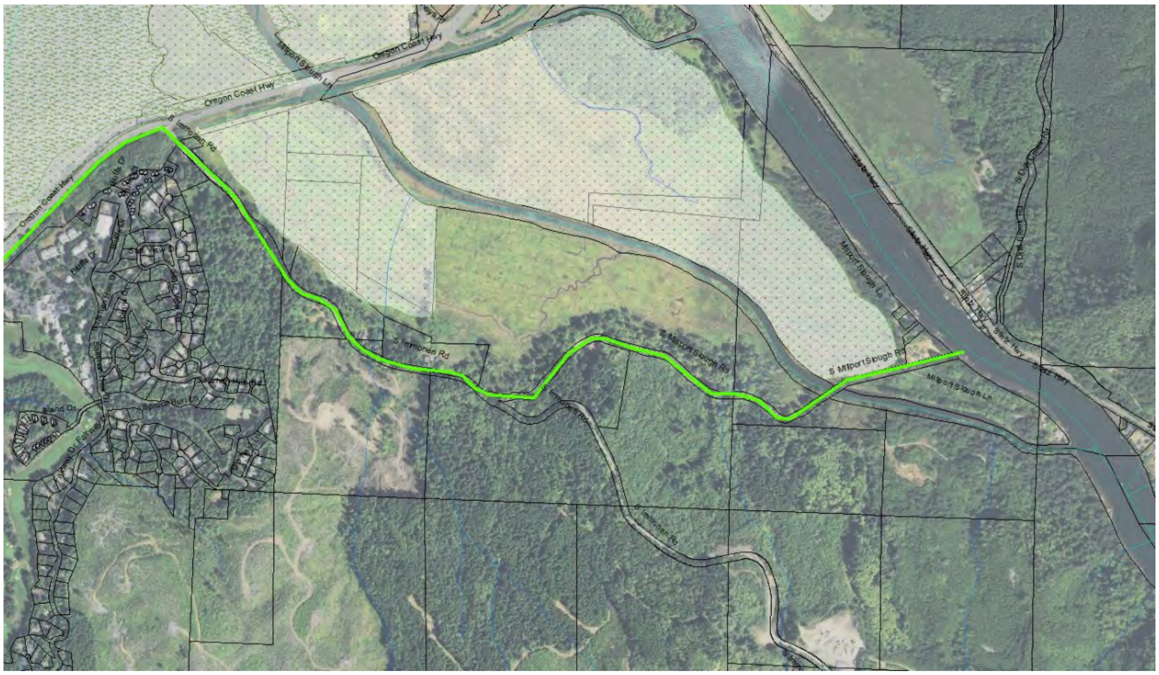

FIGURE 5-9: SILETZ RIVER OUTFALL ALIGNMENT - OPTION 1 SITE MAP

LAND REQUIREMENTS

- This alignment can be constructed fully within the public right-of-way and will require permitting through ODOT for installation on Hwy 101 and Lincoln County for installation on S Immonen Road and S. Millport Slough Road.
- The outfall pipeline, outfall and diffuser will require an easement from the Department of State Lands to cross the Siletz River to the outfall diffuser location.

POTENTIAL CONSTRUCTION PROBLEMS

This alignment extends down S Immonen Road which is the principal access for Cedar Creek Quarries. This road sees significant truck traffic and closing a portion of the road for pipeline installation may be problematic. However, the pipeline installation on Immonen is only about 3,000 feet and should only take approximately 2-weeks to install between Hwy 101 and the junction of S. Millport Slough Road. Paving and road restoration may take longer.

This alignment will be constructed in areas that are very low in elevation and may see significant groundwater. It is likely that dewatering will be necessary for the installation of the pipeline.

SUSTAINABILITY CONSIDERATIONS

- Environmental Benefits or Impacts: If all effluent quality criteria are met, there should be little impact from an outfall in this location. If the effluent limits are not met, the downstream Siletz Bay reserve could be negatively impacted.
- Social Benefits or Impacts: The Siletz River has significant cultural significance to the Confederated Tribe of the Siletz. The Tribe may react negatively to an outfall being constructed in the Siletz.
- Economic Benefits or Impacts: This option will require pumping from the new treatment plant which would cost more than a gravity flow outfall. There are no other economic impacts identified that would be influenced by an outfall in this location.

WATER AND ENERGY EFFICIENCY

This outfall location will require a pump station which is more costly and energy intensive that a gravity flow outfall.

GREEN INFRASTRUCTURE

This is not applicable to this alternative.

ENVIRONMENTAL IMPACTS AND PERMITTING

- Because the pipeline will be installed in the road right-of-way, limited environmental permitting is expected for the outfall pipeline construction since any creek crossings can be accomplished through directional drilling methods.
- A removal-fill wetland impact permit will be required to be submitted with the Oregon Department of State Lands for the installation of the outfall and diffuser. The Siletz River is considered essential salmonoid habitat and any fill or removal within a designated waterbody requires a joint permit application (JPA). The work will need to be conducted within designated work windows to prevent impacting migrating and spawning fish.
- A dewatering permit will be necessary from the Oregon Department of Water Resources.
- A discharge permit will be required with DEQ to discharge dewatering water back to the Siletz River, bay and estuary.
- 1200C Erosion and Sediment Control permit will be necessary with DEQ because the construction will encompass more than 1-acre.

COST ESTIMATE

A cost estimate for this option is included below in Table 5-5. This cost includes extending the outfall from the Hwy 101 intersection with the access road to Site 3 located at the Airport. Additional costs for the extension of additional outfall pipeline if the treatment plant site is located elsewhere are not included. Total development costs for each site, including forcemain extension from the Fogarty Creek Pump Station are included in Chapter 6.

TABLE 5-5: SILETZ RIVER OUTFALL ALIGNMENT- OPTION 1 COST ESTIMATE

				Siletz River Option 1 Airport Site - West to Hwy 101, north to Immonen Rd, east to Millport Slough Rd	
No.	*Description*	*Unit*	*Unit Cost*	*Qty*	*Cost*
1	Dewatering	LF	$86	2800	$241,345
2	10" Fittings (elbows, flanged adapters)	EA	$309	11	$3,401
3	10" HDPE transition coupler (Hymax)	EA	$1,237	22	$27,208
4	10" Fused HDPE Pipe - open cut method, CL-B Backfill	LF	$74	20750	$1,539,719
5	10" Fused HDPE Pipe - open cut method, CL-A Backfill	LF	$99	0	$0
6	10" Fused HDPE Pipe - Directional Drill Method	LF	$186	400	$74,203
7	Effluent Booster Station	EA	$3,000,000	1	$3,000,000
8	Modification to Fogarty Creek PS (Influent PS)	EA	$332,800	0	$0
9	HMAC	TN	$140	4839	$677,489
10	Aggregate Base	TN	$50	6087	$304,333
11	Sawcut asphalt pavement Full Depth	LF	$3	18493	$55,479
12	Painted Pavement Markings (4-inch wide) any color (yellow, white)	LF	$3	10085	$30,255
				Subtotal:	$5,953,433

5.4.5.3 Siletz River Outfall Alignment: Option 2

DESCRIPTION AND SITE MAP

The alignment for Option 2 begins at Site Option 2 at the airport then proceeds east generally following existing logging roads for approximately 1-1/2-miles, then north generally following the alignment of Tony Creek for approximately 1-mile to S. Millport Slough Road, then east to the Siletz River. See Option 2 Site Map in Figure 5-10.

- This alignment has approximately 800 feet of elevation change with a beginning elevation of approximately 80-feet, a high point in the middle of approximately 800-feet, and a discharge elevation at the Siletz River at approximately 0-feet.
- This outfall will require an effluent booster station.
- The total outfall pipeline distance is 2.88 miles.
- This outfall discharges to the Siletz at river mile 3.45.

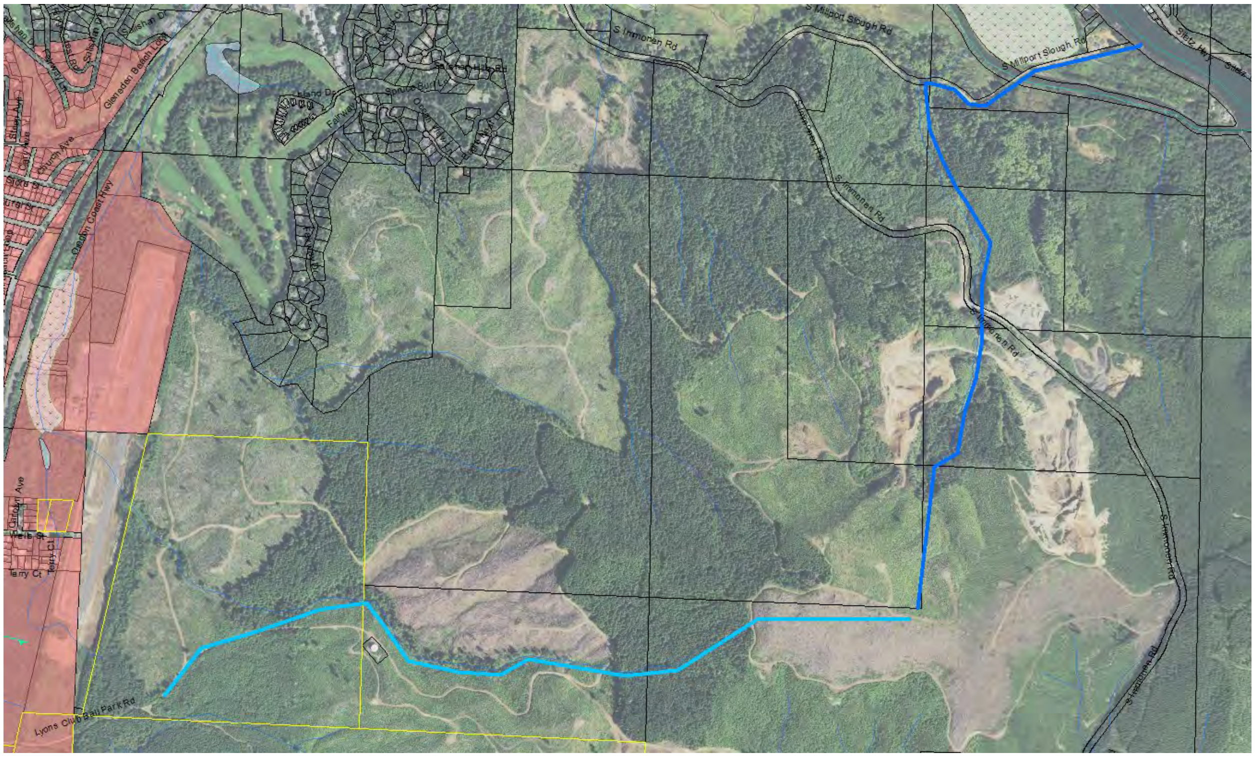

FIGURE 5-10: SILETZ RIVER OUTFALL ALIGNMENT - OPTION 2 SITE MAP

LAND REQUIREMENTS

This alignment is constructed primarily across privately owner timberland. Although the construction would prevent impacts to roads, it will be necessary to acquire easements. Properties affected include:

- Boston Timber Opportunity LLC (08-11-15-C0-00100-00)
- John Hancock Life Insurance Company (08-11-15-00-00100-00 and 08-11-00-00-00400-00)
- Iron Horse Timber LLC (08-11-00-00-00501-00)

- Hancock Timberland XI Inc (08-11-11-00-01500-00)
- The outfall pipeline, outfall and diffuser will require an easement from the Department of State Lands to cross the Siletz River to the outfall diffuser location.
- Road right-of-way of S Millport Slough Road managed by Lincoln County.

POTENTIAL CONSTRUCTION PROBLEMS

- Because the alignment follows Tony Creek then follows S. Millport Slough Road, which is low in elevation, there will likely be some dewatering necessary.
- The alignment crosses steep terrain which may make construction slow and expensive.

SUSTAINABILITY CONSIDERATIONS

- Environmental Benefits or Impacts: If all effluent quality criteria are met, there should be little impact from an outfall in this location. If the effluent limits are not met, the downstream Siletz Bay reserve could be negatively impacted.
- Social Benefits or Impacts: The Siletz River has significant cultural significance to the Confederated Tribe of the Siletz. The Tribe may react negatively to an outfall being constructed in the Siletz.
- Economic Benefits or Impacts: This option will require pumping from the new treatment plant which would cost more than a gravity flow outfall. There are no other economic impacts identified that would be influenced by an outfall in this location.

WATER AND ENERGY EFFICIENCY

This outfall location will require a pump station which is more costly and energy intensive that a gravity flow outfall.

GREEN INFRASTRUCTURE

This is not applicable to this alternative.

ENVIRONMENTAL IMPACTS AND PERMITTING

- Because the pipeline is being installed cross-country, it is likely that some environmental permitting will be required to cross creeks, wetlands, or other environmentally sensitive areas.
- A removal-fill wetland impact permit will be required to be submitted with the Oregon Department of State Lands for the installation of the outfall and diffuser. The Siletz River is considered essential salmonoid habitat and any fill or removal within a designated waterbody requires a joint permit application (JPA). The work will need to be conducted within designated work windows to prevent impacting migrating and spawning fish.
- A dewatering permit will be necessary from the Oregon Department of Water Resources.
- A discharge permit will be required with DEQ to discharge dewatering water back to the Siletz River, bay and estuary.
- 1200C Erosion and Sediment Control permit will be necessary with DEQ because the construction will encompass more than 1-acre.

COST ESTIMATE

A cost estimate for this option is included below in Table 5-6. This cost includes extending the outfall from Site 3 located at the Airport. Additional costs for the extension of additional outfall pipeline if the treatment plant site is located elsewhere are not included.

TABLE 5-6: SILETZ RIVER OUTFALL ALIGNMENT - OPTION 2 COST ESTIMATE

				Siletz River Option 2	
				Airport Site - high point N. to Siletz at Millport Slough Rd	
No.	*Description*	*Unit*	*Unit Cost*	*Qty*	*Cost*
1	Dewatering	LF	$86	7600	$655,080
2	10" Fittings (elbows, flanged adapters)	EA	$309	9	$2,783
3	10" HDPE transition coupler (Hymax)	EA	$1,237	18	$22,261
4	10" Fused HDPE Pipe - open cut method, CL-B Backfill	LF	$74	2250	$166,957
5	10" Fused HDPE Pipe - open cut method, CL-A Backfill	LF	$99	5350	$529,317
6	10" Fused HDPE Pipe - Directional Drill Method	LF	$186	400	$74,203
7	Effluent Booster Station	EA	$3,000,000	1	$3,000,000
8	Modification to Fogarty Creek PS (Influent PS)	EA	$332,800	0	$0
9	HMAC	TN	$140	381	$53,340
10	Aggregate Base	TN	$50	660	$33,000
11	Sawcut asphalt pavement Full Depth	LF	$3	2250	$6,750
12	Painted Pavement Markings (4-inch wide) any color (yellow, white)	LF	$3	0	$0
				Subtotal:	$4,543,692

5.4.5.5 Siletz River Outfall Alignment: Option 3

DESCRIPTION AND SITE MAP

The alignment for Option 3 begins at Site Option 2 at the airport then proceeds east generally following existing logging roads for approximately 1-1/2-miles, then southeast approximately 2,500-feet to S. Immonen Road, then southeast along S. Immonen Road approximately 1-mile to the Siletz River. See Option 3 Site Map in Figure 5-11

- This alignment has approximately 780 feet of elevation change with a beginning elevation of approximately 80-feet, a high point in the middle of approximately 800-feet, and a discharge elevation at the Siletz River at approximately 20-feet.
- The total outfall pipeline distance is 2.85 miles.
- This outfall discharges to the Siletz at river mile 13.17.

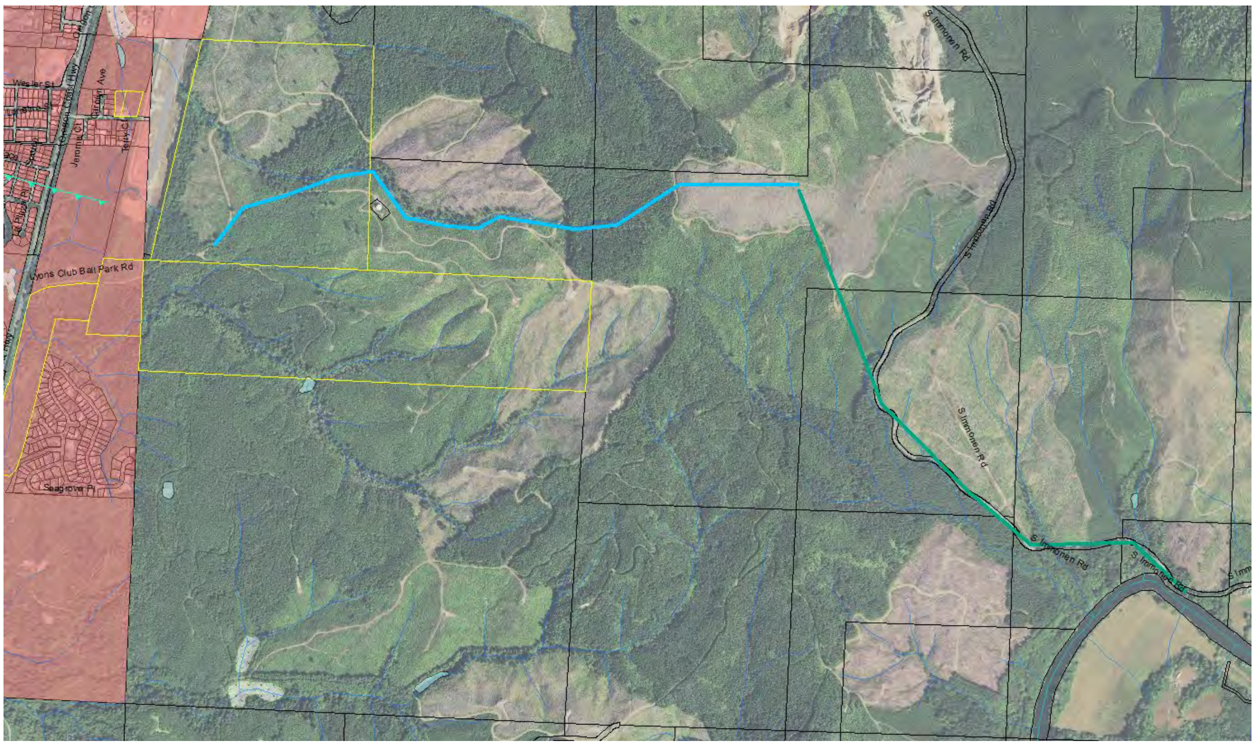

FIGURE 5-11: SILETZ RIVER OUTFALL ALIGNMENT - OPTION 3 SITE MAP

LAND REQUIREMENTS

This alignment is constructed across a combination of privately owner timberland, public right-of-way and one privately owner residential property immediately at the Siletz River. Although construction across privately owned property prevents impacts and necessary restoration to roads, it will be necessary to acquire easements. Properties affected include:

- Boston Timber Opportunity LLC (08-11-15-C0-00100-00) - timberland
- John Hancock Life Insurance Company (08-11-15-00-00100-00 and 08-11-00-00-00400-00) - timberland
- Hancock Timberland X Inc (08-11-00-00-01200-00) - timberland

- Joseph and Cathy Steere (08-11-24-00-00300-00) – private residential. This property is where the outfall pipeline reaches the Siletz River. It will be necessary to acquire an easement across this property to construct the outfall to the river.
- The outfall pipeline, outfall and diffuser will require an easement from the Department of State Lands to cross the Siletz River to the outfall diffuser location.
- Road right-of-way of S Immonen Road managed by Lincoln County.

POTENTIAL CONSTRUCTION PROBLEMS

- The alignment crosses steep terrain which may make construction slow and expensive.

SUSTAINABILITY CONSIDERATIONS

- Environmental Benefits or Impacts: If all effluent quality criteria are met, there should be little impact from an outfall in this location. If the effluent limits are not met, the downstream Siletz Bay reserve could be negatively impacted.
- Social Benefits or Impacts: The Siletz River has significant cultural significance to the Confederated Tribe of the Siletz. The Tribe may react negatively to an outfall being constructed in the Siletz.
- Economic Benefits or Impacts: This option will require pumping from the new treatment plant which would cost more than a gravity flow outfall. There are no other economic impacts identified that would be influenced by an outfall in this location.

WATER AND ENERGY EFFICIENCY

This outfall location will require a pump station which is more costly and energy intensive that a gravity flow outfall.

GREEN INFRASTRUCTURE

This is not applicable to this alternative.

ENVIRONMENTAL IMPACTS AND PERMITTING

- Because the pipeline is being installed cross-country, it is likely that some environmental permitting will be required to cross creeks, wetlands, or other environmentally sensitive areas.
- A removal-fill wetland impact permit will be required to be submitted with the Oregon Department of State Lands for the installation of the outfall and diffuser. The Siletz River is considered essential salmonoid habitat and any fill or removal within a designated waterbody requires a joint permit application (JPA). The work will need to be conducted within designated work windows to prevent impacting migrating and spawning fish.
- A dewatering permit will be necessary from the Oregon Department of Water Resources.
- A discharge permit will be required with DEQ to discharge dewatering water back to the Siletz River, bay and estuary.
- 1200C Erosion and Sediment Control permit will be necessary with DEQ because the construction will encompass more than 1-acre.

COST ESTIMATE

A cost estimate for this option is included below in Table 5-7. This cost includes extending the outfall from Site 3 located at the Airport. Additional costs for the extension of an additional outfall pipeline if the treatment plant site is located elsewhere are not included. Total development costs for each site, including forcemain extension from the Fogarty Creek Pump Station are included in Chapter 6. This outfall pipeline alignment option is the least costly primarily because it avoids areas where dewatering will be necessary.

TABLE 5-7: SILETZ RIVER OUTFAL ALIGNMENT - OPTION 3

				Siletz River Option 3	
				Airport Site - high point S. to Siletz at Immonen Rd	
No.	*Description*	*Unit*	*Unit Cost*	*Qty*	*Cost*
1	Dewatering	LF	$86	1000	$86,195
2	10” Fittings (elbows, flanged adapters)	EA	$309	3	$928
3	10" HDPE transition coupler (Hymax)	EA	$1,237	6	$7,420
4	10" Fused HDPE Pipe - open cut method, CL-B Backfill	LF	$74	4850	$359,886
5	10" Fused HDPE Pipe - open cut method, CL-A Backfill	LF	$99	2500	$247,344
6	10" Fused HDPE Pipe - Directional Drill Method	LF	$186	0	$0
7	Effluent Booster Station	EA	$3,000,000	1	$3,000,000
8	Modification to Fogarty Creek PS (Influent PS)	EA	$332,800	0	$0
9	HMAC	TN	$140	821	$114,977
10	Aggregate Base	TN	$50	1423	$71,133
11	Sawcut asphalt pavement Full Depth	LF	$3	4850	$14,550
12	Painted Pavement Markings (4-inch wide) any color (yellow, white)	LF	$3	0	$0
				Subtotal:	$3,902,434

5.6 Ocean Outfall

Many communities along the coast utilize ocean outfalls for their wastewater plants including the Cities of Florence, Yachats, Newport, Depoe Bay and Otter Crest. Lincoln City is planning to change their current outfall to Schooner Creek to an ocean outfall. There are two significant advantages for the District to use an ocean outfall:

1. The volume of water in the ocean compared to the effluent volume is considerable making it much easier to dilute within the mixing zone to a safe water quality level that will not impact aquatic organisms, beneficial uses, or impaired water quality. Consequently, water quality standards for an ocean outfall will likely be based on technology-based effluent limitations (TBELs).
2. An ocean outfall can be located within relatively close proximity to a treatment site, limiting pump station and forcemain construction and operational costs. The limiting factor for ocean outfall placement is primarily ocean access, and outfall locations were evaluated based upon continuous public land access or right-of-way access to the beach.

There are several locations where ocean access is available where an ocean outfall can be extended. For the purposes of evaluation, the closest outfall location to site options 1, 2 and 3 were evaluated.

An ocean outfall would be constructed by directional drilling a pipeline from the shore to approximately 1,500 feet offshore. The ocean outfall would have a diffuser installed at the end to promote efficient mixing of the effluent. Ocean regulatory mixing zones are limited to less than 500 feet plus the depth of the water at mean low water (low tide). Consequently, the deeper the water in the location of the diffuser means the mixing zone can be larger. Since the water quality standards, except for acute toxicity, must be met at the edge of the mixing zone, a larger mixing zone makes it easier to comply with water quality standards. The exact distance from shore and location of the diffuser is dependent upon the depth of water at the diffuser location. Preliminary analysis using Cor-Mix indicates that the mixing zone will be primarily affected by tidal influence and the difference in density between the receiving water and the effluent.

Ocean water is typically more dense than effluent water because of the salinity, causing the less dense effluent plume to rise to the surface. Sufficient diffuser depth is necessary to ensure the effluent plume can be adequately diluted to water quality standards before congregating at the surface.

The mixing zone also changes location based upon incoming or outgoing tide. Assuming a 40-foot depth at the diffuser, the mixing zone can be a maximum of 540-feet. When the tide is incoming, the mixing zone is moves between the diffuser and the shoreline. When the tide is outgoing, the mixing zone moves between the diffuser and the open ocean. The diffuser must be located far enough offshore so that the mixing zone does not influence beneficial use at the beach or coastal waters.

COST ESTIMATE

A cost estimate for the drilling of the outfall in the ocean is included below in Table 5-8. This cost is applicable to all options. The cost for extending the outfall pipeline to from the drilling pit to the proposed wastewater plant site for the various site options will need to be added to this cost for the total outfall construction cost.

A rough quotation was solicited from HDD Company, a national drilling contractor that conducted the work for the PacWAVE facility and has installed many ocean outfall projects in the United States. This number was verified by comparison with costs for directional drilling across Yaquina Bay and by costs for installing the outfall for Rockaway Beach in Tillamook County. The distance and size of the outfall were estimated for cost estimation purposes.

If Ocean Outfall Options 2 or 3 are selected then the outfall distance may be slightly farther, possibly 2000-feet to reach an equivalent 40-foot depth as was calculated for Outfall Option 1. The estimate assumes an 18” outfall but preliminary hydraulic calculations indicate that a 10” outfall pipe should be sufficient. Based upon the proposed elevations of the various site options an ocean outfall should be able to operate by gravity flow without additional pumping.

TABLE 5-8: OUTFALL AND DIFFUSER CONSTRUCTION COSTS

GSD Outfall & Diffuser

No.	Description	Unit	Qty	Unit Price	Total Price
1	MOBILIZATION	EA	1	$45,000	$45,000
2	Centrifige and Mud Plan	LS	1	$150,000	$150,000
2	DIRECTIONAL DRILL 24” OD (18” ID) HDPE	LF	1500	$695	$1,042,500
3	SURFACE CASING	LF	150	$1,400	$210,000
4	24" HDPE PIPE (18" ID)	LF	1,500	$150	$225,000
5	MARINE SUPPORT	DAY	30	$10,000	$300,000
6	RESTORATION	LS	1	$100,000	$100,000
7	DIFFUSER	EA	1	$100,000	$100,000
				Total:	**$2,172,500**

This cost estimate was checked using the EPA Technical Report, Construction Costs for Municipal Wastewater Treatment Plants: 1973-1978 for calculating First and Second order cost estimates. (US EPA, 1980) The EPA Technical Report was developed by analyzing the total costs for constructing over 737 wastewater treatment facilities across the United States between 1973 to 1978. Based upon this data, EPA was able to correlate construction costs to design flows for various process and treatment levels. Non-construction costs have broken down into three steps and have been calculated as a percentage of construction costs based upon EPA regions:

- Step 1: feasibility/preliminary design
- Step 2: design
- Step 3: Construction phase, non-construction costs

The total development cost for the process or facility is the summary of the construction cost and the three steps. This information was then adjusted by the Engineering News Record Construction Cost Index to reflect current year costs. For more information on The EPA Technical Report cost calculation process, please see Chapter 8, Section 2, Cost Estimating. Since the contractor’s quotation is for construction only, only Step 3 non-construction costs were added to the estimate.

Figure 5-12 below shows the linear relationship between design flow and process cost. Using the linear relationship described in the equation,

$$C = (3.01 \times 10^5)\ Q^{1.06}$$

Where: C = construction cost ($)

Q= Design Flow (MGD)

The outfall must be able to pass the maximum volumetric flow from the plant therefore the total construction cost of the process can be calculated from the Peak Hourly Flow (PHF) of 1.235 MGD.

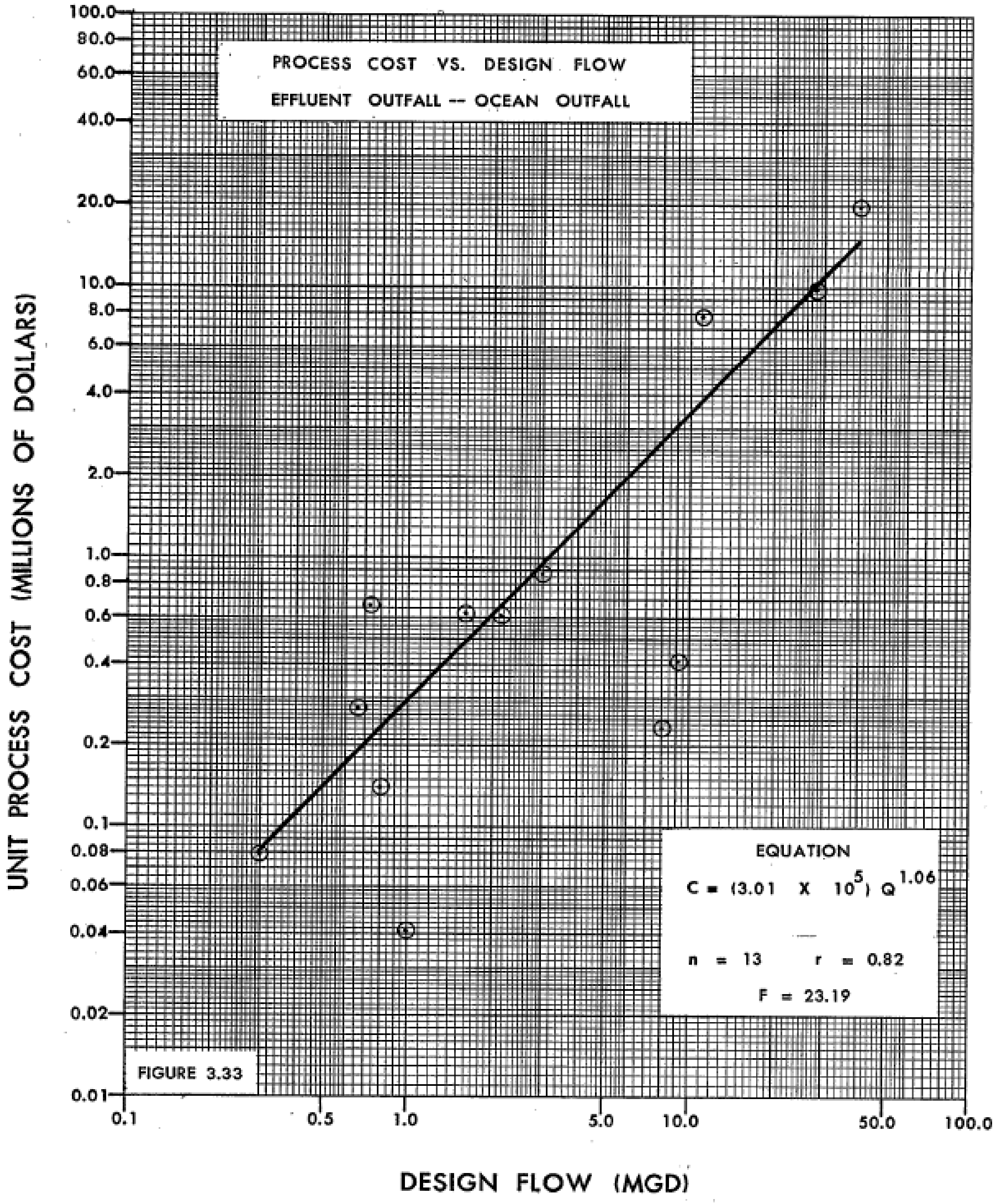

FIGURE 5-12: PROCESS COST VS. DESIGN FLOW - OCEAN OUTFALL

Non-construction costs must be added to estimate the total construction costs for the outfall. Those costs included are shown in Table 5-9 below.

TABLE 5-9: OUTFALL NON-CONSTRUCTION COSTS

Step 1 costs:	feasability/facility planning:	2.30%
Step 2 Costs:	preliminary design:	5.50%
Step 3 Costs:	non-construction, construction phase costs (Region 10) including:	
	Admin/Legal:	1.12%
	Preliminary:	1.41%
	A/E Basic Fees	4.12%
	Other A/E Fees:	2.58%
	Inspection:	4.40%
	Contingency:	3.68%
	Misc:	4.37%
	Equipment:	7.68%
	Total Step 3:	29.36%
	Total Non-Const. Overhead:	37.16%

The estimated cost based upon the EPA Second Order cost estimate methodology is shown in Table 5-10 below:

TABLE 5-10: SECOND ORDER PROCESS COST - OCEAN OUTFALL

1979 CCI:	3003	
2022 CCI:	12992	
Construction Cost Change:	332.63%	
Peak Hourly Flow (PHF):	1.235	MGD
5-year Maximum Month Wet Weather Flow ($MMWWF_5$):	0.443	MGD
10-year Maximum Month Dry Weather Flow ($MMDWF_{10}$):	0.318	MGD
Second Order Cost (1979):	$376,473	
Second Order Cost (2022):	$1,628,749	
Step 1 costs:	$37,461	
Step 2 Costs:	$89,581	
Step 3 Costs:	$478,201	
Second Order Cost:	$2,233,992	

This second order estimate is consistent with the quotation received from the contractor as shown in Table 5-8.

5.6.1 Ocean Outfall Option 1

DESCRIPTION AND SITE MAP

Ocean Outfall Option 1 is associated with Site Option 1 located east of Fogarty Creek State Park. See Chapter 6, Section 6.2.1. This outfall would be drilled from the northern parking lot of Fogarty Creek State Park, west below Hwy 101, across Fogarty Beach to the outfall diffuser location approximately 1,500 feet offshore. See Figure 5-13.

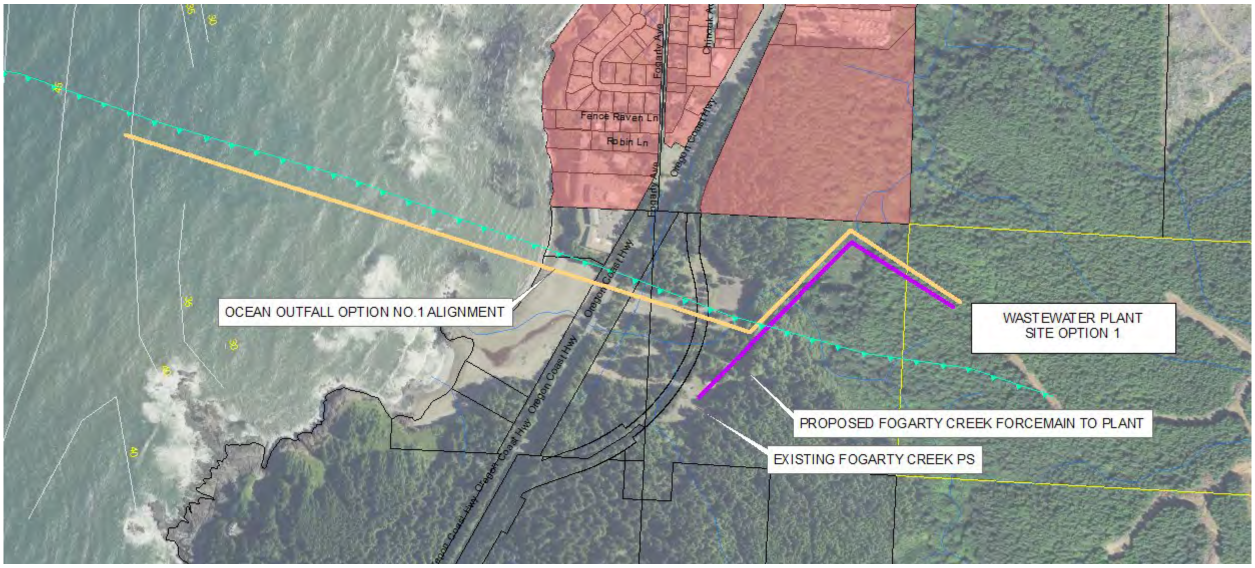

FIGURE 5-13: OCEAN OUTFALL OPTION NO. 1

LAND REQUIREMENTS

- This site will require extensive coordination with Oregon State Parks for the installation of the forcemain and ocean outfall. The ocean outfall and the north-south portion of the new forcemain will be installed by directional drilling. It will be necessary to install a large drilling pit in the Fogarty Creek State Park northern parking lot. From this location the outfall pipeline can be drilled below Hwy 101 and Fogarty Beach to the outfall diffuser location approximately 1,500 feet offshore.
- The outfall pipeline, outfall and diffuser, and forcemain will require an easement from the Department of State Lands to cross the property within Fogarty Creek State Park, the beach, and the territorial water to the outfall diffuser location.
- A utility permit and easement will also be required from ODOT for the outfall to cross below the highway.

POTENTIAL CONSTRUCTION PROBLEMS

This site will have the least impact on Hwy 101 compared to the other site alternatives. The construction work to install the outfall pipeline and ocean outfall will take place off of the highway right-of-way and utility crossings of the highway will take place through directional drilling methods. This work will have considerable construction impacts on the northern portion of Fogarty Creek State Park because it will be necessary to close part of the parking lot for use as a directional drilling staging area. Construction activity within the actively used portion of the State Park will include forcemain and outfall pipeline construction. Fogarty Creek State Park has two accesses, one on either side of Fogarty Creek. Construction will only impact the northern access and the southern access should remain relatively unaffected.

Access route and site construction is relatively isolated from other developed areas and should have limited impact on neighboring properties.

SUSTAINABILITY CONSIDERATIONS

- Environmental Benefits or Impacts: If all effluent quality criteria are met, there should be little impact from an outfall in this location. If the effluent limits are not met, the adjacent recreational beach and nearby marine reserve could be affected.
- Social Benefits or Impacts: Since this pipeline is the shortest and most of the alignment will be constructed through directional drilling, the installation of this pipeline should have the least impact on adjacent uses.
- Economic Benefits or Impacts: This outfall site will have little to no economic impact to adjacent uses..

WATER AND ENERGY EFFICIENCY

This site alternative has the shortest outfall pipeline and the plant site is the highest, representing the least energy cost of the various options because water will be moved the shortest distance via gravity without an effluent pump station.

GREEN INFRASTRUCTURE

This is not applicable to this alternative.

ENVIRONMENTAL IMPACTS AND PERMITTING

A removal-fill wetland impact permit will be required to be submitted with the Oregon Department of State Lands for the crossing of Fogarty Creek with the access road and pipelines. Fogarty Creek is considered essential salmonoid habitat and any fill or removal within a designated waterbody requires a joint permit application (JPA). The pipelines can be installed by non-invasive directional drilling techniques across the creek and wetlands, but the access road will necessitate some removal-fill within the wetland areas and culverts crossing the creek. This work will require wetland mitigation and specially designed culverts to minimize fish passage impacts.

COST ESTIMATE

The cost estimate included in Table 5-11 below is for extending the outfall pipeline from the drilling pit to Site Option No. 1. The total cost of the pipeline alignment and ocean outfall is $2,842,526.

TABLE 5-11: OUTFALL PIPELINE COSTS - SITE OPTION 1

			Ocean Outfall Option No 1	
			Fogarty Creek Site - Fogarty Beach Outfall	
No.	*Description*	*Unit*	*Qty*	*Cost*
1	Dewatering	LF	0	$0
2	10" Fittings (elbows, flanged adapters)	EA	2	$618
3	10" HDPE transition coupler (Hymax)	EA	4	$4,947
4	10" Fused HDPE Pipe - open cut method, CL-B Backfill	LF	0	$0
5	10" Fused HDPE Pipe - open cut method, CL-A Backfill	LF	1328	$131,389
6	10" Fused HDPE Pipe - Directional Drill Method	LF	2285	$423,887
7	Effluent Booster Station	EA	0	$0
8	Modification to Fogarty Creek PS (Influent PS)	EA	0	$0
9	HMAC	TN	472	$66,135
10	Aggregate Base	TN	861	$43,050
11	Sawcut asphalt pavement Full Depth	LF	0	$0
12	Painted Pavement Markings (4-inch wide) any color (yellow, white)	LF	0	$0
			Subtotal:	$670,026
			Ocean Outfall:	$2,172,500
			Total Outfall Costs:	$2,842,526

5.6.2 Ocean Outfall Option 2

DESCRIPTION AND SITE MAP

Ocean Outfall Option 2 is associated with Site Option 2 located east of the Siletz Bay State Airport. See Chapter 7, Section 7.2.2. This outfall would be drilled from the parking lot of the Gleneden Beach Recreation Site to the outfall diffuser location approximately 1,500-2,000 feet offshore. See Figure 5-14.

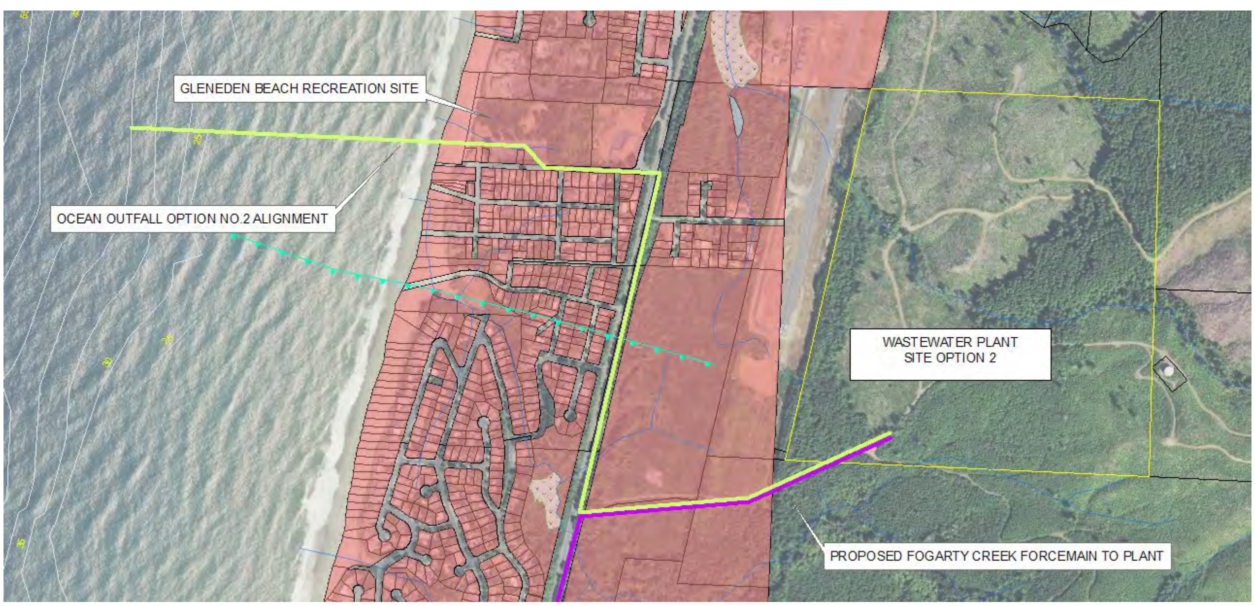

FIGURE 5-14: OCEAN OUTFALL OPTION NO. 2

LAND REQUIREMENTS

- This site will require coordination with adjacent property owners, Siletz Bay State Airport and Beton Construction Inc. & Base Enterprizes Inc for the installation of the access road, forcemain from the existing pump station, and installation of the ocean outfall. The current access easement will likely need to be modified.
- Coordination will be necessary with Oregon State Parks. The ocean outfall will be installed by directional drilling and it will be necessary to install a large drilling pit in the Gleneden Beach Recreation Site parking lot. From this location the outfall pipeline can be drilled to the outfall diffuser location approximately 1,500 feet offshore.
- The outfall pipeline, outfall and diffuser, and forcemain will require an easement from the Department of State Lands to cross the property within the Gleneden Beach Recreation Site, the beach, and the territorial water to the outfall diffuser location.
- A utility permit and easement will also be required from ODOT for the outfall to cross below the highway.

POTENTIAL CONSTRUCTION PROBLEMS

This site will have a relatively significant impact on Hwy 101 because the forcemain from the Fogarty Creek Pump Station and the outfall pipeline will need to be constructed within the right-of-way of Hwy 101. This work will likely take place through a combination of directional drilling and open cut methods. Utility crossings of the highway will take place through directional drilling methods. This site will have considerable construction impacts on the northern portion of Fogarty Creek State Park because it will be necessary to extend the force main from the Fogarty Creek Pump Station to the north through the northern driveway access of the State Park. This alternative will have considerable construction impacts on Wesler Street and the Gleneden Beach Recreation Area. The outfall forcemain will need to be installed down the Wesler Street right-of-way which will affect traffic and access. The direction drilling pit will need to be installed in the Gleneden Beach Recreation Area which will necessitate closing the parking lot of the recreation area for several months.

SUSTAINABILITY CONSIDERATIONS

This outfall alternative is constructed completely within developed right-of-way so restoration of those rights of way will be necessary, but there will be little environmental impact.

- Environmental Benefits or Impacts: If all effluent quality criteria are met, there should be little impact from an outfall in this location. If the effluent limits are not met, the adjacent recreational beach and nearby marine reserve could be affected.
- Social Benefits or Impacts: The pipe will need to be constructed down an existing residential road and the directional drilling site located in a neighborhood at a beach access parking lot. This will impact the neighboring properties during construction. The outfall should have little impact after construction.
- Economic Benefits or Impacts: This outfall site will have little to no economic impact to adjacent uses.

WATER AND ENERGY EFFICIENCY

This alternative requires the effluent be discharged via a pump station requiring initial capital cost and ongoing operation and maintenance costs.

GREEN INFRASTRUCTURE

This is not applicable to this alternative.

ENVIRONMENTAL IMPACTS AND PERMITTING

This site has the least environmental impact of the three site options. The site, access road, influent and effluent pipelines and other utilities do not cross any wetlands or protected areas until the outfall reaches the beach.

COST ESTIMATE

The cost estimate included in Table 5-12 below is for extending the outfall pipeline from the drilling pit to Site Option No. 2. The total cost of the pipeline alignment and ocean outfall is $3,150,724.

TABLE 5-12: OUTFALL PIPELINE COSTS - SITE OPTION 2

			Ocean Outfall Option No 2	
			Airport Site - Wesler St Outfall	
No.	*Description*	*Unit*	*Qty*	*Cost*
1	Dewatering	LF	0	$0
2	10” Fittings (elbows, flanged adapters)	EA	2	$618
3	10" HDPE transition coupler (Hymax)	EA	4	$4,947
4	10" Fused HDPE Pipe - open cut method, CL-B Backfill	LF	4750	$352,466
5	10" Fused HDPE Pipe - open cut method, CL-A Backfill	LF	0	$0
6	10" Fused HDPE Pipe - Directional Drill Method	LF	1600	$296,813
7	Effluent Booster Station	EA	0	$0
8	Modification to Fogarty Creek PS (Influent PS)	EA	0	$0
9	HMAC	TN	1609	$225,213
10	Aggregate Base	TN	1393	$69,667
11	Sawcut asphalt pavement Full Depth	LF	4750	$14,250
12	Painted Pavement Markings (4-inch wide) any color (yellow, white)	LF	4750	$14,250
			Subtotal:	$978,224
			Ocean Outfall:	$2,172,500
			Total Outfall Costs:	$3,150,724

5.6.3 Ocean Outfall Option 3

Ocean Outfall Option 3 is associated with Site Option 3 located south of the Seagrove Development. See Chapter 6, Section 6.2.3. There are two alternatives for the outfall pipeline. The outfall can egress at Bella Beach which would require going through the private manufactured home park of Holiday Hills. Alternatively, the outfall can travel north and travel down Wesler Street in the same alignment as Option 2. See Figure 5-15.

1. The Bella Beach outfall pipeline will be approximately 0.75 miles and will need to be extended west from Site 3 west down the access road to Hwy 101, then west down J Way to the ocean. The Holiday Hills manufactured home park has a parking area beach access where a directional drilling pit can be sited. This alignment has been used for cost estimating for Site 3, since the Wesler Street alignment is longer and consequently more costly.
2. The Wesler Street outfall pipeline will be approximately 1.2 miles and will need to be extended west from Site 3 west down the access road to Hwy 101, then north along the east shoulder to Wesler Street. The Gleneden Beach Recreation Site is located at the western end of Wesler and has a large parking lot where a directional drill staging area could be placed.

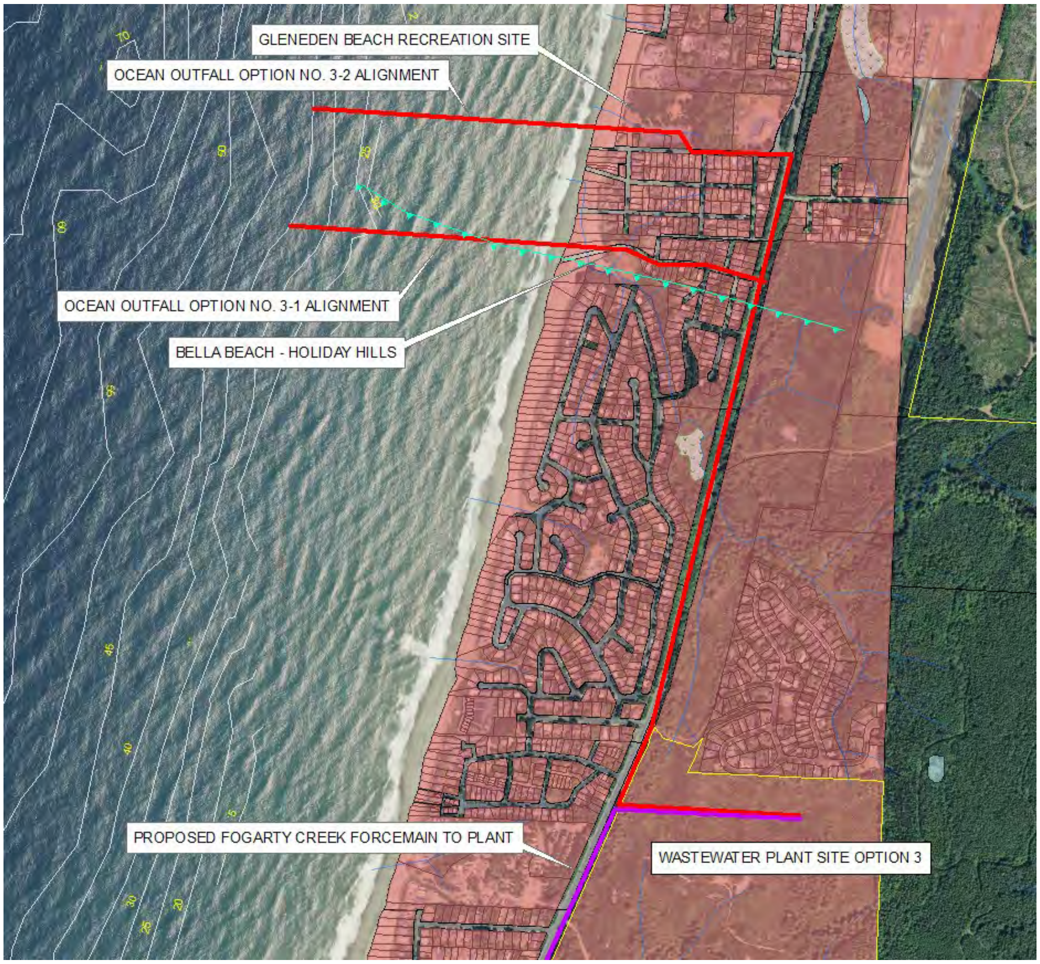

FIGURE 5-15: OCEAN OUTFALL OPTION NO. 3

LAND REQUIREMENTS

- The access to the site will need to be purchased outright or procured through an easement.
- The construction of the outfall will require a permanent easement and extensive coordination with Holiday Hills manufactured home community. It will be necessary to install a large drilling pit in the parking lot of the Holiday Hill beach access at Bella Beach.

- The outfall pipeline, outfall and diffuser will require an easement from the Department of State Lands to cross the beach and the territorial waters to the outfall diffuser location.
- A utility permit and easement will also be required from ODOT for the outfall pipeline and forcemain to be constructed in the highway right-of-way.

POTENTIAL CONSTRUCTION PROBLEMS

This outfall location will have a relatively significant impact on Hwy 101 because the forcemain from the Fogarty Creek Pump Station and the outfall pipeline will need to be constructed within the right-of-way of Hwy 101. This work will likely take place through a combination of directional drilling and open cut methods. Utility crossings of the highway will take place through directional drilling methods. This alternative will have considerable construction impacts on the Holiday Hills manufactured home community since the outfall pipeline will need to be constructed down J Way which is the primary access to the park. The direction drilling pit will need to be installed in the Bella Beach parking area access which will necessitate closing the parking lot of the for several months.

SUSTAINABILITY CONSIDERATIONS

This outfall alternative is constructed completely within developed right-of-way so restoration of those rights of way will be necessary, but there will be little environmental impact.

- Environmental Benefits or Impacts: If all effluent quality criteria are met, there should be little impact from an outfall in this location. If the effluent limits are not met, the adjacent recreational beach and nearby marine reserve could be affected.
- Social Benefits or Impacts: The pipe will need to be constructed down an existing residential road and the directional drilling site located in a neighborhood at a beach access parking lot. This will impact the neighboring properties during construction. The outfall should have little impact after construction.
- Economic Benefits or Impacts: This outfall site will have little to no economic impact to adjacent uses.

WATER AND ENERGY EFFICIENCY

This alternative requires the effluent be discharged via a pump station requiring initial capital cost and ongoing operation and maintenance costs.

GREEN INFRASTRUCTURE

This is not applicable to this alternative.

ENVIRONMENTAL IMPACTS

The access, forcemain and outfall pipeline for Site 3 will cross several small streams. It is likely these streams are considered essential salmonoid habitat and any fill or removal within a designated waterbody requires a joint permit application (JPA) removal-fill wetland permit to be submitted with the Oregon Department of State Lands. The pipelines can be installed by non-invasive directional drilling techniques across the creeks and adjacent wetlands, but the access road will necessitate some removal-fill within the wetland areas and culverts crossing the creeks. This work will require wetland mitigation and specially designed culverts to minimize fish passage impacts.

COST ESTIMATE

The cost estimate included in Table 5-13 below is for extending the outfall pipeline from the drilling pit to Site Option No. 3. The total cost of the pipeline alignment and ocean outfall is $2,722,086.

TABLE 5-13: OUTFALL PIPELINE COSTS - SITE OPTION 3

				Ocean Outfall Option No. 3	
				South of Seagrove - Bella Beach Dr	
No.	*Description*	*Unit*	*Unit Cost*	*Qty*	*Cost*
1	Dewatering	LF	$86	0	$0
2	10" Fittings (elbows, flanged adapters)	EA	$309	11	$3,401
3	10" HDPE transition coupler (Hymax)	EA	$1,237	22	$27,208
4	10" Fused HDPE Pipe - open cut method, CL-B Backfill	LF	$74	3478	$258,079
5	10" Fused HDPE Pipe - open cut method, CL-A Backfill	LF	$99	0	$0
6	10" Fused HDPE Pipe - Directional Drill Method	LF	$186	130	$24,116
7	Effluent Booster Station	EA	$3,000,000	0	$0
8	Modification to Fogarty Creek PS (Influent PS)	EA	$332,800	0	$0
9	HMAC	TN	$140	1178	$164,904
10	Aggregate Base	TN	$50	1020	$51,011
11	Sawcut asphalt pavement Full Depth	LF	$3	3478	$10,434
12	Painted Pavement Markings (4-inch wide) any color (yellow, white)	LF	$3	3478	$10,434
				Subtotal:	$549,586
				Ocean Outfall:	$2,172,500
				Total Outfall Costs:	$2,722,086

5.7 References

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6 ALTERNATIVES ANALYSIS: TREATMENT PLANT SITE

6.1 Introduction

This Chapter identifies and evaluates the various site locations available for constructing a wastewater treatment plant. The Gleneden Sanitary District (GSD) collection system currently moves wastewater from north to south via a combination of gravity sewers and pump stations. Consequently, without significant infrastructure changes and modifications to the collection system, the logical area for a future wastewater treatment plant is toward the south end of the District. Another influencing factor in selecting a preferred site is where the treated effluent outfall will be located. If the outfall was to the Siletz River, which is to the north of the District, either the untreated wastewater or the treated effluent would need to be pumped back to the north end of the District. An ocean outfall could be located anywhere north to south within the District based upon the availability of an east-west corridor between the plant and the Ocean. Finally, the site must accessible, must be flat and large enough to construct a multi-acre facility, and must be available for procurement by the District. For evaluation purposes it was decided that 4 acres is a reasonably sized property to accommodate the initially needed processes and activities at the plant and was used as the size to compare various site development costs. Sites were also evaluated on their growth potential, and development costs for expanded the sites to 8 acres were also considered.

6.2 Alternatives Considered

Multiple sites were evaluated throughout the District and are shown in Figure 6-1, *Alternatives Map*. Three sites were chosen for further evaluation and meet the criteria described above. Existing owners were queried and all sites are potentially available for purchase by the District. The three possible site locations are also shown in Figure 6-1. Each of these sites assumed an ocean outfall (see Chapter 5). Cost analysis for the various site alternatives include the following cost components:

- site access and utility extension to the site
- site grading to level the site in preparation for construction of the treatment facility
- site utilities, roads, sidewalks, site lighting and pavement
- modifications to the Fogarty Creek Pump Station and extension of the new forcemain to the site
- construction of the outfall pipeline to direction drilling pit at the beach
- Land acquisition costs. Cost per acre is based upon Lincoln County appraised land value for 2022.

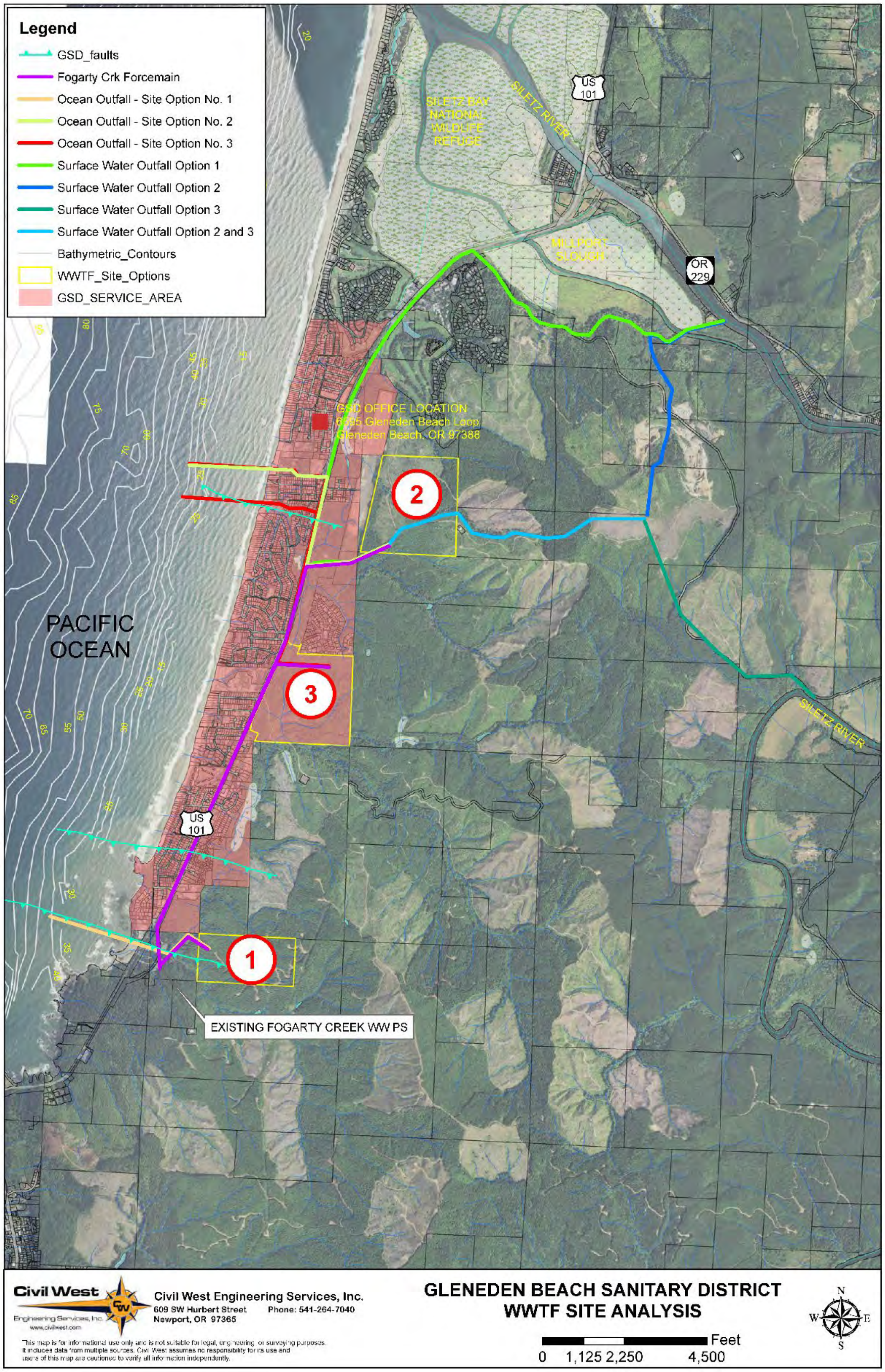


FIGURE 6-1 - GSD ALTERNATIVES MAP

6.2.1 Site Option 1 –Fogarty Creek Site

DESCRIPTION AND SITE MAP

Site 1 is located on the south end of the District just northeast of the Fogarty Creek Pump Station on land owned by System Global Timberlands, LLC of Vancouver, WA and managed locally by Hancock Forest Management. (Taxlot 08-11-33-00-00602-00) See Figure 6-2, 6-3 and 6-4. This property has recently been clearcut and has little timber value. The property is zoned as TC, Timber Conservation, and the portion of the property where the plant will be located will need to be rezoned.

The property is currently accessible from existing logging roads that connect to Hwy 101 to the north. This access will need to be widened and improved to provide adequate facility access. Since this route is more than 2 miles long, the road development costs are very expensive. An alternative route was evaluated that connects the site to Hwy 101 by going west. This route is considerably shorter at approximately ½ mile but will need to cross over Fogarty Creek and pass through property currently owned by Oregon State Parks.

Site 1 is very close to the existing Fogarty Creek Pump Station where wastewater is currently pumped to Depoe Bay. By replacing the pumps in the existing pump station wetwell the Fogarty Creek Pump Station can be modified to serve as an influent pump station for the proposed Site 1 wastewater plant. A new forcemain will need to be installed from the existing pump station in Fogarty Creek State Park and extend north, parallel to Fogarty Creek, to the proposed access road, then east to the plant site.

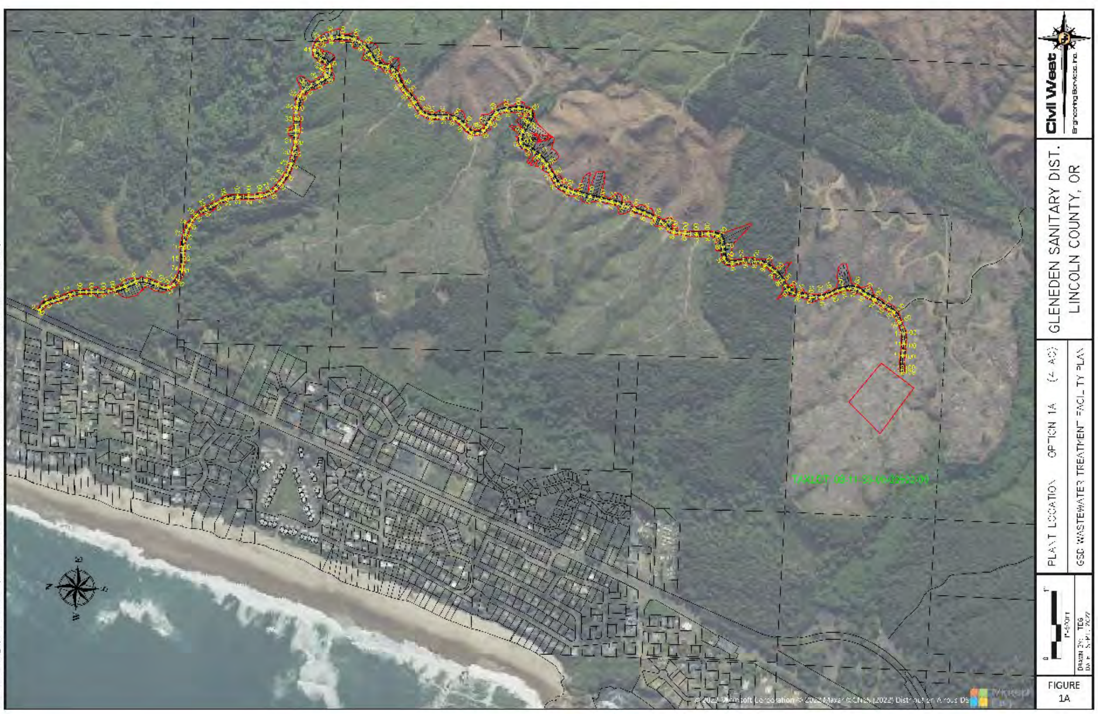


FIGURE 6-2: OPTION 1A, 4 AC

The plant outfall would run west from Site 1 down the access road and toward Hwy 101 and parallel to the influent forcemain, then south parallel to the forcemain and Fogarty Creek, then west through the Fogarty Creek Park parking lot, below Hwy 101, across Fogarty Creek Beach, and to the ocean outfall located approximately 1500' offshore. The headworks at Site 1 would be at an elevation of approximately 160 ft which will allow for a gravity flow ocean outfall.

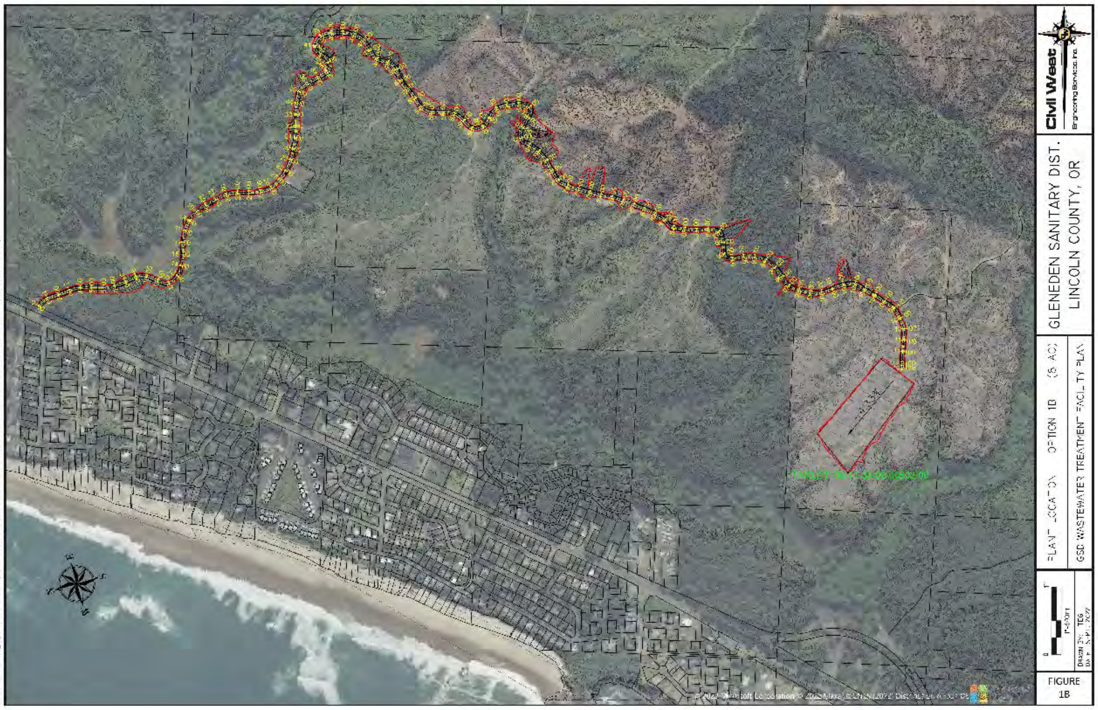


FIGURE 6-3: OPTION 1B, 8 AC

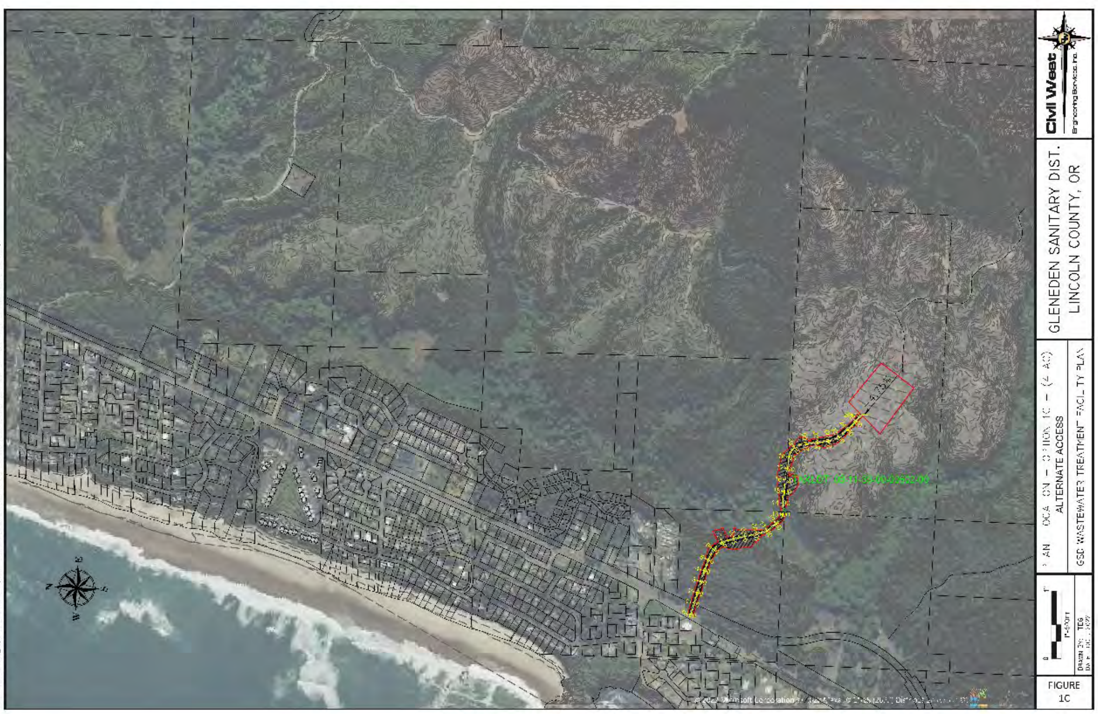


FIGURE 6-4: OPTION 1C, 4AC WITH ALT. ACCESS

LAND REQUIREMENTS

- The parent property of Site 1 will need to be split and the proposed site purchased and rezoned to P-F, Public Facility.
- This site will require extensive coordination with Oregon State Parks for the installation of the access road, forcemain from the existing pump station, and installation of the ocean outfall. The ocean outfall and the north-south portion of the new forcemain will be installed by directional drilling. It will be necessary to install a large drilling pit in the Fogarty Creek State Park northern parking lot. See Figure 6-5. From this location the outfall pipeline can be drilled below Hwy 101 and Fogarty Beach to the outfall diffuser location approximately 1,500 feet offshore.
- The outfall pipeline, outfall and diffuser, and forcemain will require an easement from the Department of State Lands to cross the property within Fogarty Creek State Park, the beach, and the territorial water to the outfall diffuser location.
- A utility permit and easement will also be required from ODOT for the outfall to cross below the highway.

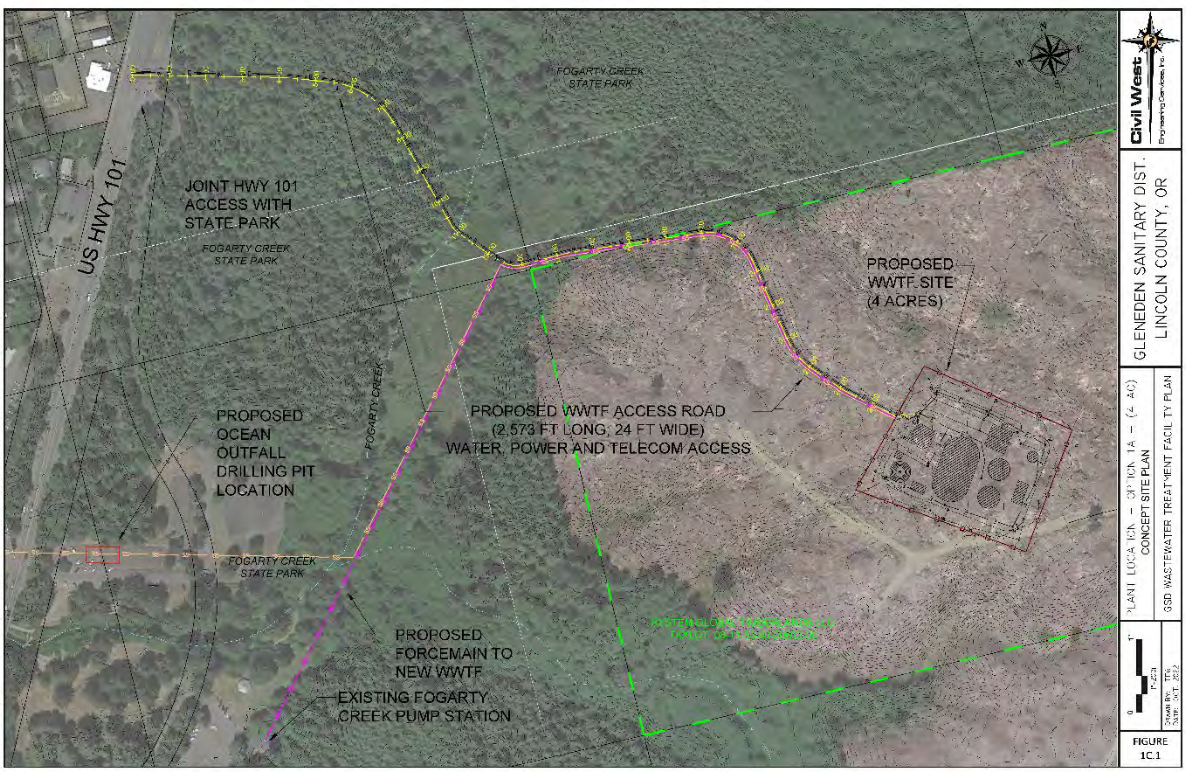


FIGURE 6-5: SITE LAYOUT OF OPTION 1C, 4AC WITH ALT. ACCESS

ENVIRONMENTAL IMPACTS

A removal-fill wetland impact permit will be required to be submitted with the Oregon Department of State Lands for the crossing of Fogarty Creek with the access road and pipelines. Fogarty Creek is considered essential salmonoid habitat and any fill or removal within a designated waterbody requires a joint permit application (JPA). The pipelines can be installed by non-invasive directional drilling techniques across the creek and wetlands, but the access road will necessitate some removal-fill within the wetland areas and culverts crossing the creek. This work will require wetland mitigation and specially designed culverts to minimize fish passage impacts.

COST ESTIMATES

In discussions with Hancock, they indicate that bare forest land is valued from anywhere between $1000/acre to $2500/acre, depending on the location, growing potential, etc. If the property has already been reforested the value may increase by $1000/acre. If the property proposed to be purchased, which is relatively flat, decreases the harvestable value of the adjacent steeper portions of the property, then Hancock recommends purchasing a larger piece of the property. In this instance, the proposed parcel has steeper harvest area immediately to the north and west so for the sake of evaluation it is assumed the District would purchase a parcel approximately 20-acres in size. The overall property Site 1 is included within is 79.53-acres and was appraised by the Lincoln County Assessor's office in 2022 at a land value of $105,770, equaling $1,330 per acre.

A cost analysis was conducted for this site considering three site alternative variations:

1. Option 1A: A developed 4-acre parcel with an improved access on the existing logging road alignment, Table 6-1
2. Option 1B: A developed 8-acre parcel with an improved access on the existing logging road alignment, Table 6-2
3. Option 1C: A developed 4-acre parcel with an alternative access constructed across Fogarty Creek to Hwy 101, Table 6-3

A typical site layout is shown in Figure 6-6 showing conceptual site development components used in cost estimates. This same layout was used for all site options to estimate site development costs.

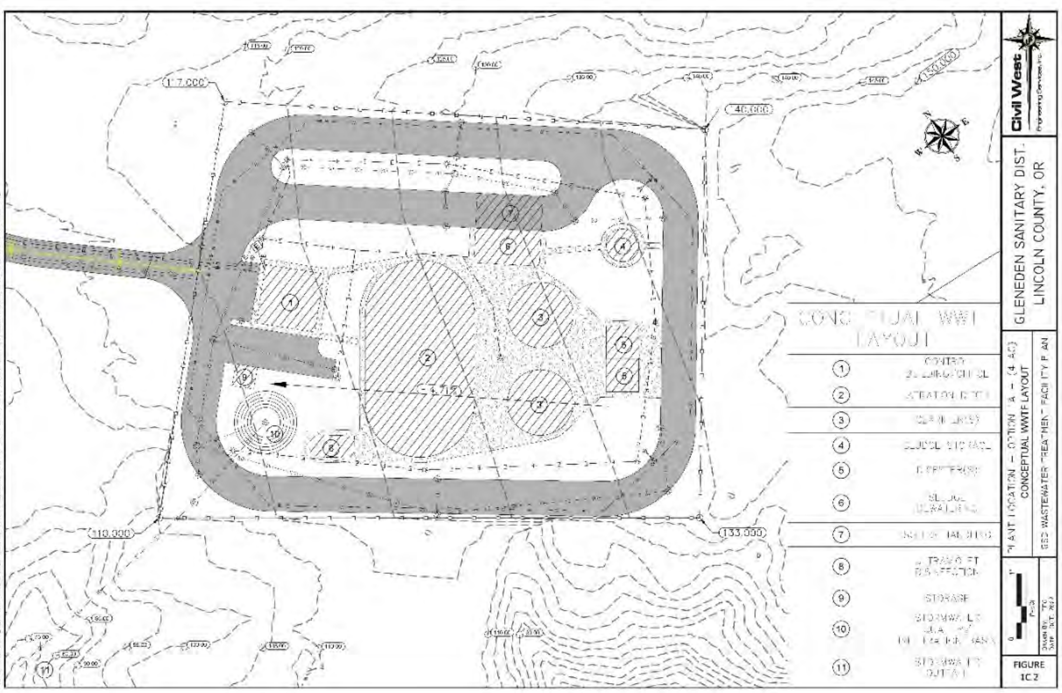


FIGURE 6-6: TYPICAL SITE LAYOUT

TABLE 6-1: OPTION 1A - 4-ACRE PARCEL WITH AN IMPROVED ACCESS ON THE EXISTING LOGGING ROAD ALIGNMENT

No.	Description	Unit	Qty	Unit Price	Total Price
1	Mobilization, Bonding, and Insurance	LS	1	11%	$664,242
2	Construction Facilities & Temporary Controls	LS	1	6%	$362,314
3	Demolition and Site Prep	LS	1	3%	$181,157
4	Traffic Control	LS	1	3%	$181,157
5	Landscape Restoration	LS	1	2%	$120,771
6	Fogarty Creek PS Modifications	EA	1	$332,800	$332,800
7	Fogarty Creek PS Forcemain	EA	1	$744,010	$744,010
8	Access Road and Site Grading	EA	1	$6,734,201	$6,734,201
9	Site Development	EA	1	$2,227,664	$2,227,664
					$11,548,318

TABLE 6-2: OPTION 1B - 8-ACRE PARCEL WITH AN IMPROVED ACCESS ON THE EXISTING LOGGING ROAD ALIGNMENT

No.	Description	Unit	Qty	Unit Price	Total Price
1	Mobilization, Bonding, and Insurance	LS	1	11%	$664,242
2	Construction Facilities & Temporary Controls	LS	1	6%	$362,314
3	Demolition and Site Prep	LS	1	3%	$181,157
4	Traffic Control	LS	1	3%	$181,157
5	Landscape Restoration	LS	1	2%	$120,771
6	Fogarty Creek PS Modifications	EA	1	$332,800	$332,800
7	Fogarty Creek PS Forcemain	EA	1	$744,010	$744,010
8	Access Road and Site Grading	EA	1	$8,034,906	$8,034,906
9	Site Development	EA	1	$2,227,664	$2,227,664
					$12,849,023

TABLE 6-3: OPTION 1C - 4-ACRE PARCEL WITH AN ALTERNATIVE ACCESS CONSTRUCTED ACROSS FOGARTY CREEK TO HWY 101

No.	Description	Unit	Qty	Unit Price	Total Price
1	Mobilization, Bonding, and Insurance	LS	1	11%	$664,242
2	Construction Facilities & Temporary Controls	LS	1	6%	$362,314
3	Demolition and Site Prep	LS	1	3%	$181,157
4	Traffic Control	LS	1	3%	$181,157
5	Landscape Restoration	LS	1	2%	$120,771
6	Fogarty Creek PS Modifications	EA	1	$332,800	$332,800
7	Fogarty Creek PS Forcemain	EA	1	$744,010	$744,010
8	Access Road and Site Grading	EA	1	$2,734,093	$2,734,093
9	Site Development	EA	1	$2,227,664	$2,227,664
					$7,548,210

POTENTIAL CONSTRUCTION PROBLEMS

This site will have the least impact on Hwy 101 compared to the other site alternatives. With the exception of the access drive connection to the highway, the construction work for developing Site 1 will take place off of the highway right-of-way and utility crossings of the highway will take place through directional drilling methods. This site will have considerable construction impacts on the northern portion of Fogarty Creek State Park because it will be necessary to close part of the parking lot for use as a directional drilling staging area. Construction activity within the actively used portion of the State Park will include forcemain and outfall pipeline construction. Fogarty Creek State Park has two accesses, one on either side of Fogarty Creek. Construction will only impact the northern access and the southern access should remain relatively unaffected.

Access route and site construction is relatively isolated from other developed areas and should have limited impact on neighboring properties.

SUSTAINABILITY CONSIDERATIONS

This site alternative can reuse the existing Fogarty Creek pump station as an influent pump station if the pumps are replaced and slight modifications are done to the station. No other modifications to the existing collection system are needed. This site also will have the shortest forcemain feeding the wastewater plant and is high enough that it will likely not require an effluent booster station, resulting in less construction costs and energy consumption than the other site alternatives. This site has recently been clearcut so site preparation costs and impacts to existing vegetation are minimized.

6.2.2 Site Option 2 – Airport Site

DESCRIPTION AND SITE MAP

Site 2 is located just southeast of the Siletz Bay State Airport on a property owned by Boston Timber Opportunity LLC and managed locally by Hancock Forest Management (Taxlot 08-11-15-C0-00100-00). See Figure 6-7 and 6-8. This property is zoned TC, Timber Conservation, and the portion of the property where the site will be located will need to be rezoned. The property is accessed by an existing logging road that extends west to Hwy 101, crossing properties owned by the Siletz Bay State Airport (Taxlot 08-11-21-AA-00100-00) and Beton Construction Inc & Base Enterprizes Inc (Taxlot 08-11-21-AA-00200-00). This existing road is approximately ½ mile long and will need to be widened and improved to provide sufficient access for a wastewater facility. The Road is contained within an existing 40’ wide access easement listed in Road Book 188 page 90. This easement has not been pulled from the Lincoln County Recorder’s Office but it is likely an access easement only and will need to be modified to allow for utilities and other improvements.

This site is approximately 2.75 miles north of the existing Fogarty Creek Pump Station and will require the forcemain between to be extended from the pump station north through the State Park, then north along the eastern shoulder of Hwy 101, then east along the wastewater plant access road to Site 2. This work will take place through a combination of open cut and directional drilling methods.

The outfall pipeline is approximately 0.9 miles and will need to be extended west from Site 2 west down the access road to Hwy 101, then north along the east shoulder to either Wallace Street or Wesler Street, which are the closest two public right-of-way that extend all the way from Hwy 101 to the ocean. The Gleneden Beach Recreation Site is located at the western end of Wesler and has a large parking lot where a directional drill staging area could be placed. For this reason, the Wesler alignment was used for estimating outfall costs for Site 2.

FIGURE 6-7: OPTION 2A, 4 ACRES

FIGURE 6-8: OPTION 2B, 8 ACRES

The headworks at Site 2 would be at an elevation of approximately 100 to 110 ft which may allow for a gravity flow ocean outfall at higher flows rates. It may be necessary to construct an effluent booster station to keep a diffuser from plugging with sand at lower flowrates. It will be necessary to conduct further analysis when the final diffuser design is completed.

LAND REQUIREMENTS

- The parent property of Site 2 will need to be split and the proposed site purchased and rezoned to P-F, Public Facility.
- This site will require coordination with adjacent property owners, Siletz Bay State Airport and Beton Construction Inc. & Base Enterprizes Inc for the installation of the access road, forcemain from the existing pump station, and installation of the ocean outfall. The current access easement will likely need to be modified.
- Coordination will be necessary with Oregon State Parks. The ocean outfall will be installed by directional drilling and it will be necessary to install a large drilling pit in the Gleneden Beach Recreation Site parking lot. From this location the outfall pipeline can be drilled to the outfall diffuser location approximately 1,500 feet offshore.
- The outfall pipeline, outfall and diffuser, and forcemain will require an easement from the Department of State Lands to cross the property within the Gleneden Beach Recreation Site, the beach, and the territorial water to the outfall diffuser location.
- A utility permit and easement will also be required from ODOT for the outfall to cross below the highway.

ENVIRONMENTAL AND AIRPORT IMPACTS

This site has the least environmental impact of the three site options. The site, access road, influent and effluent pipelines and other utilities do not cross any wetlands or protected areas until the outfall reaches the beach.

This site is located immediately adjacent to the Siletz Bay State Airport and will affect some components of the treatment process. Because the wastewater plant would be located close to the flight path of aircraft, the site will need to be planned to limit vector attraction, the attraction of birds. This may require that tanks be covered or other special precautions to limit birds congregating to open water and other attractants like sludge storage.

COST ESTIMATES

Like Site 1, Site 2 is owned by timber investors and a small land purchase would likely de-value adjacent timber. Therefore, it is assumed the District would also purchase a parcel approximately 20-acres in size. The overall property Site 2 is included within is 144.82-acres and was appraised by the Lincoln County Assessor’s office in 2022 at a land value of $278,780, equaling $1,925 per acre.

A cost analysis was conducted for this site considering two site alternative variations:

1. Option 2A: A developed 4-acre parcel with an improved access on the existing logging road alignment, Table 6-4
2. Option 2B: A developed 8-acre parcel with an improved access on the existing logging road alignment, Table 6-5

TABLE 6-4: OPTION 2A - 4-ACRE PARCEL WITH AN IMPROVED ACCESS ON THE EXISTING LOGGING ROAD ALIGNMENT

No.	*Description*	*Unit*	*Qty*	*Unit Price*	*Total Price*
1	Mobilization, Bonding, and Insurance	LS	1	11%	$664,242
2	Construction Facilities & Temporary Controls	LS	1	6%	$362,314
3	Demolition and Site Prep	LS	1	3%	$181,157
4	Traffic Control	LS	1	3%	$181,157
5	Landscape Restoration	LS	1	2%	$120,771
6	Fogarty Creek PS Modifications	EA	1	$332,800	$332,800
7	Fogarty Creek PS Forcemain	EA	1	$2,495,014	$2,495,014
8	Access Road and Site Grading	EA	1	$1,435,500	$1,435,500
9	Site Development	EA	1	$2,227,664	$2,227,664
					$8,000,620

TABLE 6-5: OPTION 2B - 8-ACRE PARCEL WITH AN IMPROVED ACCESS ON THE EXISTING LOGGING ROAD ALIGNMENT

No.	*Description*	*Unit*	*Qty*	*Unit Price*	*Total Price*
1	Mobilization, Bonding, and Insurance	LS	1	11%	$664,242
2	Construction Facilities & Temporary Controls	LS	1	6%	$362,314
3	Demolition and Site Prep	LS	1	3%	$181,157
4	Traffic Control	LS	1	3%	$181,157
5	Landscape Restoration	LS	1	2%	$120,771
6	Fogarty Creek PS Modifications	EA	1	$332,800	$332,800
7	Fogarty Creek PS Forcemain	EA	1	$2,495,014	$2,495,014
8	Access Road and Site Grading	EA	1	$2,033,720	$2,033,720
9	Site Development	EA	1	$2,227,664	$2,227,664
					$8,598,840

POTENTIAL CONSTRUCTION PROBLEMS

This site will have a relatively significant impact on Hwy 101 because the forcemain from the Fogarty Creek Pump Station and the outfall pipeline will need to be constructed within the right-of-way of Hwy 101. This work will likely take place through a combination of directional drilling and open cut methods. Utility crossings of the highway will take place through directional drilling methods. This site will have considerable construction impacts on the northern portion of Fogarty Creek State Park because it will be necessary to extend the force main from the Fogarty Creek Pump Station to the north through the northern driveway access of the State Park. This alternative will have considerable construction impacts on Wesler Street and the Gleneden Beach Recreation Area. The outfall forcemain will need to installed down the Wesler Street right-of-way which will affect traffic and access. The direction drilling pit will need to be installed in the Gleneden Beach Recreation Area which will necessitate closing the parking lot of the recreation area for several months.

Access route and site construction is relatively isolated from other developed areas and should have limited impact on neighboring properties.

SUSTAINABILITY CONSIDERATIONS

This site alternative can reuse the existing Fogarty Creek pump station as an influent pump station if the pumps are replaced and slight modifications are made to the station. No other modifications to the existing collection system are needed. Approximately ½ of this site has recently been clearcut so site preparation costs and impacts to existing vegetation are minimized.

6.2.3 Site Option 3 – South Seagrove Site

DESCRIPTION AND SITE MAP

Site 3 is located just south of the Seagrove Development on a property owned by Beton Construction Inc. & Base Enterprizes Inc (Taxlot 08-11-21-00-00500-00). See Figure 6-9 and 6-10. On the western side the property is zoned R1, Single Family Residential, and on the eastern side TC, Timber Conservation. The proposed development area is in the TC zoning portion of the property and will need to be rezoned. The property fronts Hwy 101 but there is currently no access road.

This site is approximately 2 miles north of the existing Fogarty Creek Pump Station and will require the forcemain between to be extended from the pump station north through the State Park, then north along the eastern shoulder of Hwy 101, then east along the wastewater plant access road to Site 3. This work will take place through a combination of open cut and directional drilling methods.

There are two alternatives for the outfall pipeline. The outfall can egress at Bella Beach which would require going through the private manufactured home park of Holiday Hills. Alternatively, the outfall can travel north and travel down Wesler Street in the same alignment as Site 2.

1. The Bella Beach outfall pipeline will be approximately 0.75 miles and will need to be extended west from Site 3 west down the access road to Hwy 101, then west down J Way to the ocean. The Holiday Hills manufactured home park has a parking area beach access where a directional drilling pit can be sited. This alignment has been used for cost estimating for Site 3, since the Wesler.Street alignment is longer and consequently more costly.
2. The Wesler Street outfall pipeline will be approximately 1.2 miles and will need to be extended west from Site 3 west down the access road to Hwy 101, then north along the east shoulder to Wesler Street. The Gleneden Beach Recreation Site is located at the western end of Wesler and has a large parking lot where a directional drill staging area could be placed.

The headworks at Site 3 would be at an elevation of approximately 90-100 ft which may allow for a gravity flow ocean outfall at higher flows rates. It may be necessary to construct an effluent booster station to keep a diffuser from plugging with sand at lower flowrates. It will be necessary to conduct further analysis when the final diffuser design is completed.

FIGURE 6-9: SITE OPTION 3A WITH 4-ACRES

FIGURE 6-10: SITE OPTION 3B WITH 8 ACRES

LAND REQUIREMENTS

- The parent property of Site 3 will need to be split and the proposed site purchased and rezoned to P-F, Public Facility.
- The access to the site will need to be purchased outright or procured through an easement.
- The construction of the outfall will require a permanent easement and extensive coordination with Holiday Hills manufactured home community. It will be necessary to install a large drilling pit in the parking lot of the Holiday Hill beach access at Bella Beach.
- The outfall pipeline, outfall and diffuser will require an easement from the Department of State Lands to cross the beach and the territorial waters to the outfall diffuser location.
- A utility permit and easement will also be required from ODOT for the outfall pipeline and forcemain to be constructed in the highway right-of-way.

ENVIRONMENTAL IMPACTS

The access, forcemain and outfall pipeline for Site 3 will cross several small streams. It is likely these streams are considered essential salmonoid habitat and any fill or removal within a designated waterbody requires a joint permit application (JPA) removal-fill wetland permit to be submitted with the Oregon Department of State Lands. The pipelines can be installed by non-invasive directional drilling techniques across the creeks and adjacent wetlands, but the access road will necessitate some removal-fill within the wetland areas and culverts crossing the creeks. This work will require wetland mitigation and specially designed culverts to minimize fish passage impacts.

COST ESTIMATES

Site 3 is owned by a private investor and is partially zoned residential. Consequently, the value of land per acre is higher. However, to maintain consistency in cost estimating, it is assumed the District would also purchase a parcel approximately 20-acres in size. The overall property Site 2 is included within is 40-acres and was appraised by the Lincoln County Assessor's office in 2022 at a land value of $514,250, equaling $12,856 per acre.

A cost analysis was conducted for this site considering two site alternative variations:

3. Option 3A: A developed 4-acre parcel with a new road alignment, Table 6-6
4. Option 3B: A developed 8-acre parcel with a new road alignment, Table 6-7

TABLE 6-6: SITE OPTION 3A WITH 4-ACRES

No.	Description	Unit	Qty	Unit Price	Total Price
1	Mobilization, Bonding, and Insurance	LS	1	11%	$664,242
2	Construction Facilities & Temporary Controls	LS	1	6%	$362,314
3	Demolition and Site Prep	LS	1	3%	$181,157
4	Traffic Control	LS	1	3%	$181,157
5	Landscape Restoration	LS	1	2%	$120,771
6	Fogarty Creek PS Modifications	EA	1	$332,800	$332,800
7	Fogarty Creek PS Forcemain	EA	1	$1,809,621	$1,809,621
8	Access Road and Site Grading	EA	1	$1,253,734	$1,253,734
9	Site Development	EA	1	$2,227,664	$2,227,664
					$7,133,462

TABLE 6-7: SITE OPTION 3B WITH 8-ACRES

No.	Description	Unit	Qty	Unit Price	Total Price
1	Mobilization, Bonding, and Insurance	LS	1	11%	$664,242
2	Construction Facilities & Temporary Controls	LS	1	6%	$362,314
3	Demolition and Site Prep	LS	1	3%	$181,157
4	Traffic Control	LS	1	3%	$181,157
5	Landscape Restoration	LS	1	2%	$120,771
6	Fogarty Creek PS Modifications	EA	1	$332,800	$332,800
7	Fogarty Creek PS Forcemain	EA	1	$1,809,621	$1,809,621
8	Access Road and Site Grading	EA	1	$2,194,559	$2,194,559
9	Site Development	EA	1	$2,227,664	$2,227,664
					$8,074,287

POTENTIAL CONSTRUCTION PROBLEMS

This site will have a relatively significant impact on Hwy 101 because the forcemain from the Fogarty Creek Pump Station and the outfall pipeline will need to be constructed within the right-of-way of Hwy 101. This work will likely take place through a combination of directional drilling and open cut methods. Utility crossings of the highway will take place through directional drilling methods. This site will have considerable construction impacts on the northern portion of Fogarty Creek State Park because it will be necessary to extend the force main from the Fogarty Creek Pump Station to the north through the northern driveway access of the State Park.

This alternative will have considerable construction impacts on the Holiday Hills manufactured home community since the outfall pipeline will need to be constructed down J Way which is the primary access to the park. The direction drilling pit will need to be installed in the Bella Beach parking area access which will necessitate closing the parking lot of the for several months.

Access route and site construction is relatively isolated from other developed areas and should have limited impact on neighboring properties.

SUSTAINABILITY CONSIDERATIONS

This site alternative can reuse the existing Fogarty Creek pump station as an influent pump station if the pumps are replaced and slight modifications are made to the station. No other modifications to the existing collection system are needed.

As Site 3 is partially zoned as residential, this alternative could have cause issues with current and future home owners of surrounding residential taxlots and may be a source of problems for the city in the future.

7 ALTERNATIVES ANALYSIS: TREATMENT PROCESS

7.1 Introduction

The process of selecting the appropriate size and type of treatment equipment is dependent upon many factors. The primary considerations for equipment analysis and recommendations are based upon the following:

- Projected flow and loading through the planning period
- Expected water quality effluent limits determined by the outfall location
- Redundancy and Reliability Requirements
- Site constraints (size, topography, climate, proximity to other uses, etc.)
- Solids processing and handling constraints

7.1.1 Projected Flow and Loading Rates

For the purpose of evaluating treatment systems, it is necessary to define the projected wastewater flow and loading through the planning period. Chapter 4 of this report discusses the design criteria and has developed projections which are reproduced below in Table 7-1 through Table 7-3.

TABLE 7-1: GSD PER-CAPITA FLOW RATE PROJECTIONS

Parameter	Current Flow Rates (MGD)	Flow per EDU (gal/EDU)	Estimated 2045 Flow Rates (MGD)
Annual Flow Rates			
AAF	0.270	121	0.283
Dry Weather Flow Rates			
ADWF	0.239	107	0.251
Base Sewerage	0.239	107	0.251
MMDWF	0.318	143	0.334
Wet Weather Flow Rates			
AWWF	0.305	137	0.320
MMWWF	0.443	199	0.465
Peak Week (PWF)	0.558	251	0.585
Peak Day (PDAF)	0.919	413	0.964
Peak Hourly (PHF)	1.178	529	1.235

TABLE 7-2: LOADING RATE COMPARISON

Constituent	Loading Rate (ppcd)		Loading Rate for Analysis (ppcd)
	Measured	Literature[1]	
BOD5	0.08	0.20	0.20
COD	0.29	0.50	0.50
TSS	0.066	0.19	0.19
TKN	0.025	0.31	0.31
Ammonia-N	0.016	0.017	0.017
Total Phosphorous	0.0033	0.0048	0.0048

[1]Typical per capita loading rate with ground up kitchen waste from Table 3-13 (Metcalf & Eddy, 2014).

TABLE 7-3: CURRENT AND PROJECTED LOADING RATES

Population 4900

EXISTING CONDITIONS (2021)

Parameter	ppd	ppcd
Five-Day Biochemical Oxygen Demand (BOD5)		
Annual Average	980.0	0.20
Max Month	1274.0	0.26
Peak Day	2450.0	0.50
Chemical Oxygen Demand (COD)		
Annual Average	2450.0	0.50
Max Month	3185.0	0.65
Peak Day	6125.0	1.25
Total Suspended Solids (TSS)		
Annual Average	931.0	0.19
Max Month	1238.2	0.25
Peak Day	2699.9	0.55
Total Kjedhal Nitrogen (TKN)		
Annual Average	1519.0	0.310
Max Month	2126.6	0.434
Peak Day	3189.9	0.651
Ammonia		
Annual Average	83.3	0.017
Max Month	108.3	0.022
Peak Day	125.0	0.026
Total Phosphorous		
Annual Average	23.5	0.0048
Max Month	30.6	0.0062
Peak Day	37.6	0.0077

Population 5136

FUTURE CONDITIONS (2045)

Parameter	ppd	ppcd
Five-Day Biochemical Oxygen Demand (BOD5)		
Annual Average	1027.2	0.20
Max Month	1335.4	0.26
Peak Day	2568.0	0.50
Chemical Oxygen Demand (COD)		
Annual Average	2568.0	0.50
Max Month	3338.4	0.65
Peak Day	6420.0	1.25
Total Suspended Solids (TSS)		
Annual Average	975.8	0.19
Max Month	1297.9	0.25
Peak Day	2829.9	0.55
Total Kjedhal Nitrogen (TKN)		
Annual Average	159.2	0.031
Max Month	222.9	0.043
Peak Day	334.4	0.065
Ammonia		
Annual Average	92.4	0.018
Max Month	120.2	0.023
Peak Day	138.7	0.027
Total Phosphorous		
Annual Average	24.7	0.0048
Max Month	32.0	0.0062
Peak Day	39.4	0.0077

7.1.2 Expected Water Quality Limits

Effluent limitations serve as the primary mechanism in NPDES permits for controlling discharges of pollutants to receiving waters. Effluent limitations can be based on either the best technology available to control the pollutants or limits that are protective of the water quality standards for the receiving water including beneficial uses and compliance with anti-degradation policy. These two types of permit limits are referred to as technology-based effluent limitations (TBELs) and water quality-based effluent limits (WQBELs) respectively.

TBELs are likely to be the most stringent if the receiving stream is large relative to the discharge, and WQBELs are likely to be the most stringent when the receiving stream is small or does not meet water quality standards. In some cases, both a TBEL and a WQBEL will be developed for a particular parameter. Permit writers must include the more stringent of the two in the permit. (OR DEQ, 2018)

Based upon the challenges and costs associated with developing an inland surface water outfall, the analysis of wastewater equipment was premised upon developing an ocean outfall. Refer to Chapter 5 for more information on outfall analysis. An ocean outfall would likely result in effluent water quality limits being driven by a combination of water quality based and technology based effluent limits. Ocean beneficial uses include shellfish harvesting and recreation contact for which water quality based limits will apply. All other limits will be technology based limits. Estimated effluent limits are listed below in Table 7-4.

TABLE 7-4: ESTIMATED EFFLUENT WATER QUALITY LIMITS FOR AN OCEAN OUTFALL

Parameter	Units	Average Monthly	Average Weekly	Daily Maximum	Basis
BOD_5 (May 1 - Oct. 31)	mg/L	20	30	-	Applies the dry season and wet season effluent requirements for the Mid-Coast Basin (OAR 340-041-0225(4)) as they were applied in the Depoe Bay STP NPDES Permit (No. 101383). Note: OAR 340-041-0225(4)(b) appears to only require direct ocean discharges to implement secondary treatment; however, the more restrictive effluent requirements were imposed on the Depoe Bay STP and have been retained here for conservative planning.
	lb/day*	114	170	230	
	% Removal	85			
BOD_5 (Nov 1 - April 30)	mg/L	30	45	-	
	lb/day**	200	300	400	
	% Removal	85			
TSS (May 1 - Oct. 31)	mg/L	20	30	-	
	lb/day*	114	170	230	
	% Removal	85			
TSS (Nov 1 - April 30)	mg/L	30	45	-	
	lb/day**	200	300	400	
	% Removal	85			
Fecal Coliform	#/100 mL	A median concentration of 14 organisms per 100 mL. No more than ten percent of the samples may exceed 43 organisms per 100 mL.			Numeric criteria for designated shellfish harvesting areas for bacteria per OAR 340-041-0009(1)(c).
Enterrococci Bacteria	#/100 mL	A monthly geometric mean of 35 enterococcus organisms per 100 mL. No more than ten percent of the samples may exceed 130 organisms per 100 mL.			Numeric criteria for designated coastal water contact recreation areas for bacteria per OAR 340-041-0009(6)(a).
pH	S.U.	Shall be within the range of 6.0 - 9.0.			Review of other Mid-Coast Basin Municipal WWTP NPDES discharge permit requirements for facilities with ocean outfalls.
Excess Thermal Load	million kcal/day	No limit anticipated			
Ammonia	mg/L	No limit anticipated			
Residual Chlorine	mg/L	Reasonable potential analysis should be completed if chlorine-based disinfection process is proposed as an effluent limit may be imposed. Provisions for dechlorination should be considered during planning in the event a residual chlorine effluent limit is imposed.			Review of other Mid-Coast Basin WWTP NPDES discharge permit requirements for facilities with ocean outfalls. NPDES permits for the City of Newport STP and the Otter Crest Water Treatment Facility include residual chlorine effluent limit.

*Ten-Year Maximum Month Dry Weather Flow Rate (MMDWF$_{10}$) of 0.318 MGD and the Five-Year Maximum Month Wet Weather Flow Rate (MMWWF$_{5}$) of 0.443 MGD. Mass loads will be individually assigned based on what the plant can reasonably achieve and the highest monthly average discharge flow with a two year recurrence at the 20 year design of the facility (MMWWF5).

7.1.3 Redundancy and Reliability Requirements

The Gleneden Wastewater Treatment Plant will likely be classified as a Class II facility since the proposed outfall is in the Pacific Ocean. The facility will have to comply with the requirement of EPA Technical Bulletin, *Design Criteria for Electrical, Mechanical, and Fluid Systems and Component Reliability* (EPA, 1974) which dictates what the facility must contain and be able to do to prevent failures. This document requires a Class II treatment facility to include:

- Trash removal or a grinder (comminutor)
- Grit removal
- Provisions for removal of settled solids
- Diversions around treatment works for peak flows
- Bypassing of treatment unit components

The Technical Bulletin also require the following redundant systems:

- Backup bar screen/trash removal
- Comminutor bypass (if applicable) with bar screen
- Backup pumps for each set of pumps that perform the same function
- At least two (2) aeration vessels
- Backup blowers/mechanical aerators

- Redundant air diffusers (if applicable)
- Secondary chemical mixing tank
- At least two (2) flocculation basins
- Chlorination basin: sufficient units so that if the primary is out of service the design flow and be disinfected
- Primary and Final Sedimentation Basins and Trickling Filters: this means that the primary treatment process shall be sized in such a way that with the largest unit bypassed, sufficient capacity remains in secondary unit(s) to treat at least 50% of the design flow.

Solids handling is similar in that critical components must include backups or redundancy to ensure continued operation without environmental harm if part of the system fails. The Technical Bulletin does allow identification of an alternative methods of solids removal and disposal if backup systems are not provided.

7.1.4 Site Constraints

Site analysis is discussed in detail in Chapter 6. For the purposes of equipment analysis, Site Option No. 1 with a 4-acre plant site has been used.

7.1.5 Solids processing and handling constraints

It is assumed that land application of solids and drying beds are not viable options based upon climate and location. For the purpose of equipment selection, it is assumed that solids will have to be trucked off site to either the landfill, or another solids handling facility. In order to meet reliability requirements for a Class II Facility a backup must be provided for solids handling per 7.1.3 above.

7.2 Cost Estimating

Assuming the District will use an ocean outfall, cost estimating has been limited to process equipment that will handle the projected flow and loading through the planning period, meet the expected water quality effluent limits determined by the outfall location, provide required redundancy and reliability, conform with the site constraints (size, topography, climate, proximity to other uses, etc.), and handle the solids processing and handling constraints.

Construction costs have been analyzed and reported by three levels of detail. The most general, called First Order costs, is for complete treatment plants of various types. All construction costs are included. The second level of detail, the Second Order costs, is for specific unit processes, such as clarifiers, chlorination, etc. The last level, the Third Order costs, is for the costs of various components required: excavation, electrical, instrumentation, etc. It is necessary to add associated non-construction costs to each cost order.

EPA Technical Report, Construction Costs for Municipal Wastewater Treatment Plants: 1973-1978 was used for calculating First and Second order cost estimates. (US EPA, 1980) Third order cost estimates were calculated using a combination of quotes solicited from equipment vendors and the EPA Technical Report. Non-construction costs were calculated a percentage of construction costs based upon EPA guidance in the technical report.

The EPA Technical Report was developed by analyzing the total costs for constructing over 737 wastewater treatment facilities across the United States between 1973 to 1978. Based upon this data, EPA was able to correlate construction costs to design flows for various process and treatment levels. Non-construction costs have broken down into three steps and have been calculated as a percentage of construction costs based upon EPA regions:

- Step 1: feasibility/preliminary design
- Step 2: design
- Step 3: Construction phase, non-construction costs

The total development cost for the facility is the summary of the construction cost and the three steps. This information was then adjusted by the Engineering News Record Construction Cost Index to reflect current year costs.

The EPA defines the level of treatment in the technical bulletin as:

TABLE 7-5: EPA LEVELS OF TREATMENT (US EPA, 1980)

DEFINITION OF LEVELS OF TREATMENT

Treatment Level	Definition
Secondary Treatment	BOD_5 = 30 mg/l
	(BOD_5 = 25 mg/l where a State definition is more stringent than the EPA definition)
Advanced Secondary Treatment	BOD = 24 mg/l - 11 mg/l
Advanced Wastewater Treatment	BOD $\leq$ 10 mg/l
Nitrification	Reduction of ammonia nitrogen to 5.0 mg/l or less
Phosphorus Removal	Reduction of total phosphorus to 3.0 mg/l or less.

Based upon projected effluent water quality permit limits, this facility will have Advanced Secondary Treatment, but will not have nitrification nor phosphorus removal.

7.2.1 First Order Wastewater Treatment Plant Costs – Total Plant Cost

First order calculation of wastewater facility costs is for development of the treatment facility site only. Costs for outfall pipeline, outfall, existing system modifications, forcemain extension, road construction, and other improvements that are not located within the immediate site are calculated separately.

A graph illustrating the linear relationship between design flow and construction cost for advanced secondary treatment is show below in Figure 7-1.

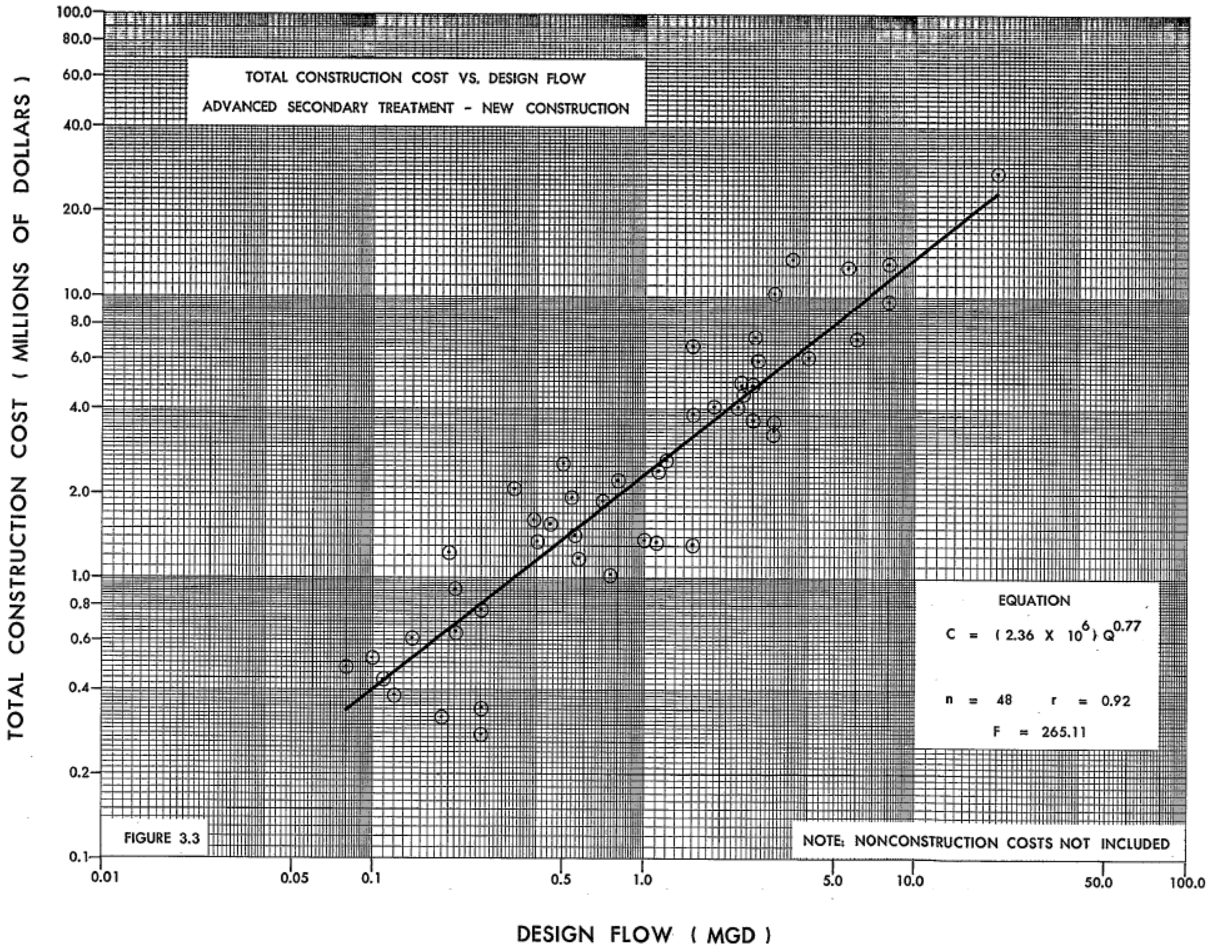


FIGURE 7-1: TOTAL CONSTRUCTION COST VS. DESIGN FLOW - ADVANCED SECONDARY TREATMENT (US EPA, 1980)

Using the linear relationship described in the equation,

$C = (2.36 \times 10^6)\ Q^{0.77}$

Where: C = construction cost ($)

Q = Design Flow (MGD)

The total construction cost of the facility can be calculated from the 5-year Maximum Month Wet Weather Flow (MMWWF5) of 0.443 MGD.

The average non-construction cost ratios for new construction of wastewater plants (Step 3 costs) are included in Table 7-6 below. GSD is within EPA Region 10. The ratios for Step 1 and 2 costs are included at the bottom of the table.

TABLE 7-6: NON-CONSTRUCTION COST RATIOS - NEW WWTF CONSTRUCTION (US EPA, 1980)

TABLE 3.1

AVERAGE NONCONSTRUCTION COST RATIOS FOR WASTEWATER TREATMENT PLANTS

NEW CONSTRUCTION
NONCONSTRUCTION COST/TOTAL CONSTRUCTION COSTS

STEP III NONCONSTRUCTION & COST CATEGORY	REG. 01	REG. 02	REG. 03	REG. 04	REG. 05	REG. 06	REG. 07	REG. 08	REG. 09	REG. 10	NATIONAL	SAMPLE SIZE
Administration/Legal	.0119	.0167	.0201	.0068	.0088	.0092	.0071	.0127	.0094	.0112	.0117	320
Preliminary	.0316	.0101	---	---	.0116	---	.0053	.0106	.0072	.0141	.0120	25
Land, Structures, Right-of-Way	.0144	.0296	.0193	.0186	.0364	.2851	.0760	.1115	.0370	.0338	.0442	83
A/E Basic Fees	.1128	.0652	.1135	.0571	.0759	.0481	.0423	.0757	.0925	.0412	.0739	300
Other A/E Fees	.0342	.0509	.0112	.0236	.0386	.0166	.0156	.0252	.0286	.0258	.0287	178
Inspection	.0516	.0614	.0444	.0227	.0254	.0261	.0416	.0433	.0536	.0440	.0405	138
Land Development	---	---	.0096	---	---	---	---	---	---	---	.0096	1
Relocation	.0097	---	---	.0049	.0104	---	---	.0048	---	.0004	.0068	6
Relocation Payments	---	---	---	.0049	---	---	---	---	---	---	.0049	1
Demolition & Removal	---	---	---	---	.0100	---	---	---	---	.0454	.0277	2
Bond Interest	.0214	---	.0311	.0258	---	.0096	---	.0287	---	---	.0224	12
Contingency	.0564	.0608	.0497	.0693	.0286	.0378	.0517	.0520	.0623	.0368	.0470	321
Indirect Costs	---	.0048	.0022	---	---	---	---	---	.0059	---	.0037	7
Miscellaneous	.0164	---	---	.0431	---	.0072	.0385	.0051	.0418	.0437	.0297	25
Equipment	---	---	.0117	.0070	.0180	.0065	.0250	.0191	.0090	.0768	.0309	28
ELIGIBLE SUBTOTAL	.3604	.2995	.3128	.2838	.2637	.4462	.3031	.3887	.3473	.3732	.3937	---
Ineligible Costs	.0273	.0423	.1168	.0400	---	.0292	.1292	.2621	---	.0472	.1083	51
TOTALS	.3877	.3418	.4296	.3238	.2637	.4754	.4323	.6508	.3473	.4204	.5020	1498
									STEP 1/TCC		2.33	
									STEP 2/TCC		5.55	

Not all non-construction lines are applicable in this instance. Non-construction costs used in total cost calculations are as shown in Table 7-7:

TABLE 7-7: NON-CONSTRUCTION WASTEWATER TREATMENT PLANT COSTS

Step 1 Costs:	feasability/facility planning:	2.30%
Step 2 Costs:	preliminary design:	5.50%
Step 3 Costs:	non-construction, construction phase costs (Region 10) including:	
	Admin/Legal:	1.12%
	Preliminary:	1.41%
	A/E Basic Fees	4.12%
	Other A/E Fees:	2.58%
	Inspection:	4.40%
	Coningency:	3.68%
	Misc:	4.37%
	Equipment:	7.68%
	Total Step 3:	29.36%

The EPA Technical Reference includes outfall costs which are calculated separately in this Facility Plan. Outfall costs calculated using the Second order cost estimate method have therefore been removed from the total treatment plant cost so that they are not considered twice. Total First order wastewater construction costs are therefore estimated as follows as shown in Table 7-8:

TABLE 7-8: FIRST ORDER WASTEWATER TREATMENT PLAN COSTS

1979 CCI:	3003	
2022 CCI:	12992	
Construction Cost Change:	332.63%	
5-year Maximum Month Wet Weather Flow ($MMWWF_5$):	0.443	MGD
10-year Maximum Month Dry Weather Flow ($MMDWF_{10}$):	0.318	MGD
First Order Cost (1979):	$1,260,790	
First Order Cost (2022):	$5,454,608	(includes outfall)
Outfall	($1,628,749)	
First Order Subtotal:	$3,825,859	
Step 1 Costs:	2.30%	
Step 2 Costs:	5.50%	
Step 3 Costs:	29.36%	
Total WWTF First Order Cost:	$5,247,548	(without outfall)

7.2.3 Second Order Wastewater Treatment Plant Costs – Unit Process Costs

Second order cost estimate methods were used to calculate the various treatment processes and miscellaneous costs used in the construction of the wastewater plant. Costs for primary treatment, secondary treatment, and sludge management include concrete, equipment, process piping, and steel costs. All other costs are broken out as individual construction component costs. As with the First order construction estimating method, it is necessary to add non-construction costs to get a full construction cost estimate.

Second order cost estimates for various treatment methods are included below in Table 7-9 through Table 7-14.

TABLE 7-9 SECOND ORDER COST ESTIMATE ACTIVATED SLUDGE

Activated Sludge	
Screening	$149,830
Influent Pumping	$339,333
Grit Removal	$293,619
Chemical Addition	$0
Flow Equalization	$0
Activated Sludge	$1,219,245
Gravity Thickening/Clarifier	$169,076
Chlorination	$161,319
Aerobic Digestion	$456,214
Sludge Thickening*	$459,971
Sludge Storage	$161,049
Control/Lab/Maintenance Building	$520,705
Total Unit Process Costs:	$3,930,361
Moblilization	$156,397
Electrical	$398,760
Controls and Instrumentation	$178,359
Yard Piping	$279,103
HVAC	$108,057
Total Const. Component Costs:	$1,120,677
Second Order Cost Subtotal (2022):	$5,051,039
Step 1 Costs:	2.30%
Step 2 Costs:	5.50%
Step 3 Costs:	29.36%
Total WWTF Second Order Cost:	$6,928,005

TABLE 7-10 SECOND ORDER COST ESTIMATE OXIDATION DITCH

Oxidation Ditch	
Screening	$149,830
Influent Pumping	$339,333
Grit Removal	$293,619
Chemical Addition	$0
Flow Equalization	$0
Oxidation Ditch	$1,272,966
Gravity Thickening/Clarifier	$169,076
Chlorination	$161,319
Aerobic Digestion	$456,214
Sludge Thickening*	$459,971
Sludge Storage	$161,049
Control/Lab/Maintenance Building	$520,705
Total Unit Process Costs:	$3,984,082
Moblilization	$156,397
Electrical	$398,760
Controls and Instrumentation	$178,359
Yard Piping	$279,103
HVAC	$108,057
Total Const. Component Costs:	$1,120,677
Second Order Cost Subtotal (2022):	$5,104,760
Step 1 Costs:	2.30%
Step 2 Costs:	5.50%
Step 3 Costs:	29.36%
Total WWTF Second Order Cost:	$7,001,688

TABLE 7-11: SECOND ORDER COST ESTIMATE ROTATING BIOLOGICAL CONTACTOR

Rotating Biological Contactor	
Screening	$149,830
Influent Pumping	$339,333
Grit Removal	$293,619
Chemical Addition	$0
Flow Equalization	$614,514
Rotating Biological Contactor	$1,407,566
Gravity Thickening/Clarifier	$169,076
Chlorination	$161,319
Aerobic Digestion	$456,214
Sludge Thickening*	$459,971
Sludge Storage	$161,049
Control/Lab/Maintenance Building	$520,705
Total Unit Process Costs:	$4,733,197
Moblilization	$156,397
Electrical	$398,760
Controls and Instrumentation	$178,359
Yard Piping	$279,103
HVAC	$108,057
Total Const. Component Costs:	$1,120,677
Second Order Cost Subtotal (2022):	$5,853,874
Step 1 Costs:	2.30%
Step 2 Costs:	5.50%
Step 3 Costs:	29.36%
Total WWTF Second Order Cost:	$8,029,174

TABLE 7-12: SECOND ORDER COST ESTIMATE TRICKLING FILTER

Trickling Filter	
Screening	$149,830
Influent Pumping	$339,333
Grit Removal	$293,619
Chemical Addition	$112,601
Flow Equalization	$614,514
Trickling Filter	$1,088,798
Gravity Thickening/Clarifier	$169,076
Chlorination	$161,319
Aerobic Digestion	$456,214
Sludge Thickening*	$459,971
Sludge Storage	$161,049
Control/Lab/Maintenance Building	$520,705
Total Unit Process Costs:	$4,527,030
Moblilization	$156,397
Electrical	$398,760
Controls and Instrumentation	$178,359
Yard Piping	$279,103
HVAC	$108,057
Total Const. Component Costs:	$1,120,677
Second Order Cost Subtotal (2022):	$5,647,707
Step 1 Costs:	2.30%
Step 2 Costs:	5.50%
Step 3 Costs:	29.36%
Total WWTF Second Order Cost:	$7,746,395

TABLE 7-13: SECOND ORDER COST ESTIMATE MEMBRANE BIOREACTOR

Membrane Bioreactor	
Screening	$149,830
Influent Pumping	$339,333
Grit Removal	$293,619
Chemical Addition	$112,601
Flow Equalization	$614,514
MBR	$2,626,078
Gravity Thickening/Clarifier	$169,076
Chlorination	$161,319
Aerobic Digestion	$456,214
Sludge Thickening*	$459,971
Sludge Storage	$161,049
Control/Lab/Maintenance Building	$520,705
Total Unit Process Costs:	$6,064,310
Moblilization	$156,397
Electrical	$398,760
Controls and Instrumentation	$178,359
Yard Piping	$279,103
HVAC	$108,057
Total Const. Component Costs:	$1,120,677
Second Order Cost Subtotal (2022):	$7,184,987
Step 1 Costs:	2.30%
Step 2 Costs:	5.50%
Step 3 Costs:	29.36%
Total WWTF Second Order Cost:	$9,854,928

7.2.4 Third Order Wastewater Treatment Plant Costs – Vendor Quotes and Unit Process Costs

Third order costs estimates use a combination of quotes from vendors for various processes combined with second order costs to provide a complete cost estimate. Quotes from vendors vary somewhat in format and scope from EPA estimating techniques. Therefore, in some instances it was necessary to add costs to vendor quotes in order to provide an equivalent estimate of the complete system cost. For example, vendors provided quotes for clarifier/gravity thickening equipment only and it was necessary to add concrete costs for the tank.

Planning level quotes were solicited for headworks, secondary treatment, solids handling, and disinfection systems. Quotes were received for secondary treatment equipment for oxidation ditches, membrane bioreactors (MBR), and sequencing bioreactors (SBR).

When vendor costs were available, they were inserted into the chart. When those costs were unavailable, second order costs were used. In several instances several quotes were received for a similar process. Therefore, costs were calculated for maximum, minimum, and median (average) costs received.

Third order costs are summarized below in tables Table 7-14 to Table 7-19.

TABLE 7-14 THIRD ORDER ACTIVATED SLUDGE COST

	Activated Sludge		
	Max.	**Min.**	**Median**
Screening	$880,939	$531,154	$650,016
Influent Pumping	$339,333	$339,333	$339,333
Grit Removal	$637,392	$251,301	$472,372
Chemical Addition	$0	$0	$0
Flow Equalization	$0	$0	$0
Activated Sludge	$1,219,245	$1,219,245	$1,219,245
Gravity Thickening/Clarifier	$1,209,900	$1,195,700	$1,202,800
Disinfection	$162,250	$80,000	$124,717
Aerobic Digestion	$1,535,973	$1,535,973	$1,535,973
Sludge Thickening	$459,971	$459,971	$459,971
Sludge Storage	$161,049	$161,049	$161,049
Control/Lab/Maintenance Building	$520,705	$520,705	$520,705
Total Unit Process Costs:	$7,126,757	$6,294,432	$6,686,181
Moblilization	$156,397	$156,397	$156,397
Electrical	$398,760	$398,760	$398,760
Controls and Instrumentation	$178,359	$178,359	$178,359
Yard Piping	$279,103	$279,103	$279,103
HVAC	$108,057	$108,057	$108,057
Total Const. Component Costs:	$1,120,677	$1,120,677	$1,120,677
Third Order Cost Subtotal (2022):	$8,247,434	$7,415,109	$7,806,858
Step 1 Costs:	2.30%	2.30%	2.30%
Step 2 Costs:	5.50%	5.50%	5.50%
Step 3 Costs:	29.36%	29.36%	29.36%
Total WWTF Third Order Cost:	$11,312,180	$10,170,563	$10,707,887

TABLE 7-15 THIRD ORDER OXIDATION DITCH COST

	Oxidation Ditch/Activated Sludge		
	Max.	**Min.**	**Median**
Screening	$880,939	$531,154	$650,016
Influent Pumping	$339,333	$339,333	$339,333
Grit Removal	$637,392	$251,301	$472,372
Chemical Addition	$0	$0	$0
Flow Equalization	$0	$0	$0
Oxidation Ditch/Activated Sludge	$2,092,657	$1,226,001	$1,659,329
Gravity Thickening/Clarifier	$1,209,900	$1,195,700	$1,202,800
Disinfection	$162,250	$80,000	$124,717
Aerobic Digestion	$1,535,973	$1,535,973	$1,535,973
Sludge Thickening	$459,971	$459,971	$459,971
Sludge Storage	$161,049	$161,049	$161,049
Control/Lab/Maintenance Building	$520,705	$520,705	$520,705
Total Unit Process Costs:	$8,000,169	$6,301,188	$7,126,265
Moblilization	$156,397	$156,397	$156,397
Electrical	$398,760	$398,760	$398,760
Controls and Instrumentation	$178,359	$178,359	$178,359
Yard Piping	$279,103	$279,103	$279,103
HVAC	$108,057	$108,057	$108,057
Total Const. Component Costs:	$1,120,677	$1,120,677	$1,120,677
Third Order Cost Subtotal (2022):	$9,120,846	$7,421,865	$8,246,942
Step 1 Costs:	2.30%	2.30%	2.30%
Step 2 Costs:	5.50%	5.50%	5.50%
Step 3 Costs:	29.36%	29.36%	29.36%
Total WWTF Third Order Cost:	$12,510,152	$10,179,830	$11,311,506

TABLE 7-16 THIRD ORDER SEQUENCING BIOREACTOR COSTS

	Sequencing Batch Reactor (SBR)		
	Max.	**Min.**	**Median**
Screening	$880,939	$531,154	$650,016
Influent Pumping	$339,333	$339,333	$339,333
Grit Removal	$637,392	$251,301	$472,372
Chemical Addition	$0	$0	$0
Flow Equalization	$0	$0	$0
Sequencing Batch Reactor (SBR)	$2,485,258	$1,121,342	$1,745,650
Gravity Thickening/Clarifier	$0	$0	$0
Disinfection	$162,250	$80,000	$124,717
Aerobic Digestion	$1,535,973	$1,535,973	$1,535,973
Sludge Thickening	$459,971	$459,971	$459,971
Sludge Storage	$161,049	$161,049	$161,049
Control/Lab/Maintenance Building	$520,705	$520,705	$520,705
Total Unit Process Costs:	$7,182,870	$5,000,829	$6,009,787
Moblilization	$156,397	$156,397	$156,397
Electrical	$398,760	$398,760	$398,760
Controls and Instrumentation	$178,359	$178,359	$178,359
Yard Piping	$279,103	$279,103	$279,103
HVAC	$108,057	$108,057	$108,057
Total Const. Component Costs:	$1,120,677	$1,120,677	$1,120,677
Third Order Cost Subtotal (2022):	$8,303,548	$6,121,506	$7,130,464
Step 1 Costs:	2.30%	2.30%	2.30%
Step 2 Costs:	5.50%	5.50%	5.50%
Step 3 Costs:	29.36%	29.36%	29.36%
Total WWTF Third Order Cost:	$11,389,146	$8,396,258	$9,780,144

TABLE 7-17 - THIRD ORDER TRICKLING FILTER COSTS

	Trickling Filter		
	Max.	**Min.**	**Median**
Screening	$880,939	$531,154	$650,016
Influent Pumping	$339,333	$339,333	$339,333
Grit Removal	$637,392	$251,301	$472,372
Chemical Addition	$112,601	$112,601	$112,601
Flow Equalization	$614,514	$614,514	$614,514
Trickling Filter	$1,088,798	$1,088,798	$1,088,798
Gravity Thickening/Clarifier	$1,209,900	$1,195,700	$1,202,800
Disinfection	$162,250	$80,000	$124,717
Aerobic Digestion	$1,535,973	$1,535,973	$1,535,973
Sludge Thickening	$459,971	$459,971	$459,971
Sludge Storage	$161,049	$161,049	$161,049
Control/Lab/Maintenance Building	$520,705	$520,705	$520,705
Total Unit Process Costs:	$7,723,425	$6,891,100	$7,282,849
Moblilization	$156,397	$156,397	$156,397
Electrical	$398,760	$398,760	$398,760
Controls and Instrumentation	$178,359	$178,359	$178,359
Yard Piping	$279,103	$279,103	$279,103
HVAC	$108,057	$108,057	$108,057
Total Const. Component Costs:	$1,120,677	$1,120,677	$1,120,677
Third Order Cost Subtotal (2022):	$8,844,102	$8,011,777	$8,403,526
Step 1 Costs:	2.30%	2.30%	2.30%
Step 2 Costs:	5.50%	5.50%	5.50%
Step 3 Costs:	29.36%	29.36%	29.36%
Total WWTF Third Order Cost:	$12,130,570	$10,988,953	$11,526,277

TABLE 7-18 – THIRD ORDER ROTATING BIOLOGICAL CONTACTOR COSTS

	Rotating Biological Contactor		
	Max.	**Min.**	**Median**
Screening	$880,939	$531,154	$650,016
Influent Pumping	$339,333	$339,333	$339,333
Grit Removal	$637,392	$251,301	$472,372
Chemical Addition	$112,601	$112,601	$112,601
Flow Equalization	$614,514	$614,514	$614,514
Rotating Biological Contactor	$1,407,566	$1,407,566	$1,407,566
Gravity Thickening/Clarifier	$1,209,900	$1,195,700	$1,202,800
Disinfection	$162,250	$80,000	$124,717
Aerobic Digestion	$1,535,973	$1,535,973	$1,535,973
Sludge Thickening	$459,971	$459,971	$459,971
Sludge Storage	$161,049	$161,049	$161,049
Control/Lab/Maintenance Building	$520,705	$520,705	$520,705
Total Unit Process Costs:	$8,042,192	$7,209,868	$7,601,617
Moblilization	$156,397	$156,397	$156,397
Electrical	$398,760	$398,760	$398,760
Controls and Instrumentation	$178,359	$178,359	$178,359
Yard Piping	$279,103	$279,103	$279,103
HVAC	$108,057	$108,057	$108,057
Total Const. Component Costs:	$1,120,677	$1,120,677	$1,120,677
Third Order Cost Subtotal (2022):	$9,162,870	$8,330,545	$8,722,294
Step 1 Costs:	2.30%	2.30%	2.30%
Step 2 Costs:	5.50%	5.50%	5.50%
Step 3 Costs:	29.36%	29.36%	29.36%
Total WWTF Third Order Cost:	$12,567,792	$11,426,175	$11,963,499

TABLE 7-19 - THIRD ORDER MEMBRANE BIOREACTOR (MBR) COSTS

	Membrane Bioreactor	
	Max.	**Min.**
Screening	$0	$531,154
Influent Pumping	$339,333	$339,333
Grit Removal	$0	$251,301
Chemical Addition	$112,601	$112,601
Flow Equalization	$614,514	$614,514
Membrane Bioreactor	$5,778,132 *	$2,626,078
Gravity Thickening/Clarifier	$0	$1,195,700
Disinfection	$162,250	$80,000
Aerobic Digestion	$0	$0
Sludge Thickening	$459,971	$459,971
Sludge Storage	$161,049	$161,049
Control/Lab/Maintenance Building	$520,705	$520,705
Total Unit Process Costs:	$8,148,555	$6,892,407
Moblilization	$156,397	$156,397
Electrical	$398,760	$398,760
Controls and Instrumentation	$178,359	$178,359
Yard Piping	$279,103	$279,103
HVAC	$108,057	$108,057
Total Const. Component Costs:	$1,120,677	$1,120,677
Third Order Cost Subtotal (2022):	$9,269,232	$8,013,084
Step 1 Costs:	2.30%	2.30%
Step 2 Costs:	5.50%	5.50%
Step 3 Costs:	29.36%	29.36%
Total WWTF Third Order Cost:	$12,713,679	$10,990,746

*Max. MBR quote is a packaged system (including tankage) for screens, primary treatment, AS and MBR system

7.3 References

DEQ, O. (1996). *Guidelines for Making Wet-Weather and Peak Flow Projections for Sewage Treatment in Western Oregon.*

EPA, U. (1974). *Design Criteria for Electrical, Mechanical, and Fluid Sysytems and Component Reliability (EPA-430-99-74-001).*

Metcalf & Eddy, A. (2014). Wastewater Engineering; Treatment and Resource Recovery, 5th Edition. McGraw-Hill, Inc.

OR DEQ. (2018). *National Pollutant Discharge Elimination System: Permit Evaluation Report and Fact Sheet.*

US EPA. (1980). *Construction Costs for Municipal Wastewater treatment Plants: 1973-1978.* Washington, D.C.: Facility Requirements Division.

Water Environment Federation. (2018). Design of Water Resource Recovery Facilities, Sixth Edition. New York: McGraw-Hill Education.

8 SELECTION OF ALTERNATIVES

8.1 Introduction

This chapter focuses on evaluating various plant and outfall sites, and treatment process options identified in other chapters. Summaries of site development costs and treatment process development costs are included below. Sites are also compared based upon non-monetary considerations that may affect the decision making of the District.

8.2 Evaluation Criteria

The initial cost of the proposed improvements is an important consideration, however other factors should also be given careful consideration before settling on a site, outfall location, or treatment process. Operating costs, equipment sophistication, and the ability of a process to adapt to changing influent conditions, among other considerations, may influence the decision making process.

8.2.1 Development and Capital Construction Costs

A summary of the costs to develop the various sites considered in this report are included below in Table 8-1. The three least costly sites are highlighted in green. Details on outfalls and site alternatives are included in Chapters 5 and 6 respectively. Since the cost to develop an outfall to the Siletz River is so high, the higher water quality standards that would be required with an inland discharge to the Siletz were not given significant consideration when evaluating treatment processes. Water quality standards associated with an ocean outfall would likely be met by a variety of treatment process options.

TABLE 8-1: WWTF SITE ALTERNATES - SITE DEVELOPMENT COST

	Site Option No. 1			Site Option No. 2		Site Option No. 3	
	4 acres	8 acres	4 acres Alt. Access	4 acres	8 acres	4 acres	8 acres
Ocean Outfall	$24,055,734	$26,229,993	$17,369,154	$18,640,588	$19,640,572	$16,474,535	$18,047,218
Siletz Outfall - Opt 1	$38,441,391	$40,615,650	$31,754,811	$28,340,396	$29,340,380	$29,486,097	$30,486,082
Siletz Outfall - Opt 2	$37,444,201	$39,618,459	$30,757,621	$27,343,205	$28,343,190	$28,488,907	$29,488,892
Siletz Outfall - Opt 3	$36,372,274	$38,546,533	$29,685,694	$26,271,279	$27,271,263	$27,416,981	$28,416,965

A summary of the costs to develop the various treatment processes considered in this report are included below in Table 8-2. The three least costly treatment processes are highlighted in green. Details on process alternatives are included in Chapter 7. Depoe Bay currently uses an activated sludge process, while many of the neighboring wastewater systems employ SBR's.

TABLE 8-2: TREATMENT PROCESS - DEVELOPMENT COST

	Max.	Min.	Median
Activated Sludge	$11,312,180	$10,170,563	$10,707,887
Oxidation Ditch/Activated Sludge	$12,510,152	$10,179,830	$11,311,506
Sequencing Batch Reactor (SBR)	$11,389,146	$8,396,258	$9,780,144
Rotating Biological Contactor	$12,567,792	$11,426,175	$11,963,499
Trickling Filter	$12,130,570	$10,988,953	$11,526,277
Membrane Bioreactor	$12,713,679	$10,990,746	$11,852,213

8.2.2 Life Cycle Costs

This report has only identified recommendations on the type of treatment process, not the specific manufacturer or specific sizing of that process. In general, operating costs for various processes are compared in Figure 10-3 as low, medium and high but specific operating costs are not determined. Analysis of life cycle costs will need to be completed at the preliminary design phase.

8.2.3 Non-Monetary Factors and Operational Costs

Several non-monetary issues were reviewed to compare various outfall and plant site locations. Each site was rated on a scale of 1 to 3, with a 1 indicating that the proposed location has relatively low difficulty in addressing that issue, and a 3 indicting that it will be difficult to overcome that issue with the proposed location. The option that scores the lowest will, in theory, be the easiest to permit and construct. Figure 8-1 evaluates various outfall locations while Figure 8-2 evaluates the various treatment plant site locations.

FIGURE 8-1: OUTFALL NON-MONETARY CONSIDERATIONS

		Environmental Implications/ Permitting	Cultural/ Historical/ Archeological Impact	Available space for construction	Land Acquisition	Public Impact During Construction	Water Quality Requirements	Total
Ocean Outfall Option No 1:	Fogarty Beach Outfall	2[a]	1	1	2[f]	1	1	**8**
Ocean Outfall Option No 2:	Wesler St Outfall	1	1	1	2[f]	3[h]	1	**9**
Ocean Outfall Option No. 3:	Bella Beach Dr	1	1	2[d]	3[g]	3[h]	1	**11**
Siletz River Option 1:	West to Hwy 101, north to Immonen Rd, east to Millport Slough Rd	3[b]	3[c]	2[e]	1	3[i]	3[k]	**15**
Siletz River Option 2:	High point N. to Siletz at Millport Slough Rd	3[b]	3[c]	2[e]	1	2[j]	3[k]	**14**
Siletz River Option 3:	High point S. to Siletz at Immonen Rd	3[b]	3[c]	2[e]	3g	2[j]	3[k]	**16**

severe/high difficulty	3
moderate difficulty	2
low difficulty	1

a: pipeline crosses creek and is installed in wetland area.
b: permitting discharge to Siletz will be lengthy and challenging
c: Siletz River has significant cultural/historiacl/archeological significance
d: Beach access is privately owned and space is tight
e: Outfall location is within ROW between prvately owned properties
f: property owned by State Parks
g: privately owned property
h: parking/beach access closed during const./work required within Hwy 101
i: work required within Hwy 101 and County Rd.
j: work required within County Rd.

FIGURE 8-2: SITE LOCATION NON-MONETARY CONSIDERATIONS

	Environmental Implications/ Permitting	Cultural/ Historical/ Archeological Impact	Available space for construction	Land Acquisition	Public Impact During Construction	Land Use Requirements	Total
Option 1: E. of Fogarty Creek State Park Site	2[a]	1	1	1	1	1	7
Option 2: E. of Airport Site	1	1	1	1	1	1	6
Option 3: S. of Seagrove Site	3[b]	2[c]	2[d]	2[e]	2[f]	2[g]	13

severe/high difficulty	3
moderate difficulty	2
low difficulty	1

a: access to site crosses stream and wetland
b: site and access bounded by wetland
c: unknown/undeveloped land
d: wetlands limit space available for development
e: privately owned/not investment forestry
f: immediately south of developed neighborhood
g: currently zoned residential - WWTF may not be considered compatable use to adjacent zoning

Treatment plant processes are evaluated in Figure 8-3 below. Only processes considered within this report are reviewed.

FIGURE 8-3: TREATMENT PROCESS NON-MONETARY CONSIDERATIONS

TREATMENT PROCESS	PERFORMANCE				OPERATIONAL CONSIDERATIONS			
	BOD	TSS	AMMONIA	PHOSPHORUS	PRO'S	CON'S	FOOT PRINT	OPERATING COST
ACTIVATED SLUDGE (AS)	Good	Require separate system (Clarifiers)	Good	Poor	• Well known technology	• Requires high efficiency aeration system • Continuous flow mode requires external stage following the AS unit • Requires closely controlled operational conditions	medium	$$
OXIDATION DITCH	Good	Require separate system (Clarifiers)	Good	Poor	• Low energy for aeration	• Requires aeration system • Requires external clarification stage following aeration • Requires closely controlled operational conditions	medium	$$
SEQUENCING BATCH REACTOR (SBR)	Good	Good	Good	Poor	• Flexibility • Does not require external clarification stage	• Requires high efficiency aeration system • Requires closely controlled operational conditions • Changes in loading require intervention • Requires skilled operator	medium	$$
ROTATING BIOLOGICAL CONTRACTOR (RBC)	Good	Require separate system (Clarifiers)	Variable	Poor	• Low energy for aeration	• Requires external clarification stage following the RBC unit • Requires electrical supply for shaft motor • Requires closely controlled operational conditions • Sensitive to environmental conditions and fluctuations in influent quality (e.g., temperature, pH, flow, concentrations, etc.)	medium	$
TRICKLING FILTER	Good	Require separate system (Clarifiers)	Poor	Poor	• Minimal operation and maintenance requirements	• Requires pre-treatment (primary settling) • Sensitive to cold climate issues	medium	$
MEMBRANE BIOREACTOR (MBR)	Good	Very Good	Good	Good	• Tertiary quality effluent • Operation easily followed remotely • Retain bacteria such as E. Coli	• Requires pre-treatment • Requires aeration system • Performance closely linked to maintenance quality • Risk of membrane fouling (redundancy required)	small	$$$

(Mabarex Technologies, 2023)

8.3 Wastewater Treatment Approach Evaluation

The least cost alternative of developing each site was added to the cost to develop the two least costly treatment processes and is shown in Table 8-3 below. The two least cost options are highlighted in green.

TABLE 8-3: LEAST COST OPTION COMPARISON

	Site Comparision Rating	Outfall Location Comparison Rating	Activated Sludge	Sequencing Batch Reactor
Site Option No. 1	7	8	$28,077,041	$27,149,298
Site Option No. 2	6	9	$29,348,475	$28,420,732
Site Option No. 3	13	11	$27,182,422	$26,254,679

$ range:	$3,093,796
% range:	12%
median:	$27,738,775

The least costly option is Site No. 3 using a Sequencing Batch Reactor (SBR). However, Site 3 and the associated outfall location are also the most difficult to develop. The second least costly option is Site No.1 also using an SBR. This site and outfall location have less obstacles to development.

Activated sludge and SBR's processes are relatively equivalent in their ability to produce good water quality, respond favorably to variable influent conditions, and in their level of sophistication to operate. SBR processes, since they are running batches of wastewater through various treatment stages, by their nature require significant automation. Activated sludge systems don't necessarily require the same level of automation, but practically speaking modern activated sludge plants are extensively automated. Although sophisticated, Supervisory Control and Data Acquisition (SCADA) systems can reduce operator hours, improve reporting accuracy, reduce reporting time, and improve compliance due to continuous monitoring.

Based upon this evaluation, it is recommended that the District consider pursuing the development of a new treatment plant facility at Site No. 1 using a Sequencing Batch Reactor.

8.4 References

Engineering New Record. (2023, January 31). *Construction Cost Index History - Annual Average.* Retrieved from Engineering News Record: https://www.enr.com/economics/historical_indices/construction_cost_annual_average

Mabarex Technologies. (2023, 1 31). *Mabarex Water Treatment Solutions.* Retrieved from https://www.mabarex.com/en/secteurs/municipalities

9 PROPOSED PROJECT (RECOMMENDED ALTERNATIVE)

9.1 Introduction

Based upon this evaluation, it is recommended that the District consider pursuing the development of a new treatment plant facility at Site No. 1 using a Sequencing Batch Reactor with an ocean outfall located at Fogarty Creek.

9.2 Preliminary Project Design

DESCRIPTION AND SITE MAP

Site 1 is located on the south end of the District just northeast of the Fogarty Creek Pump Station on land owned by System Global Timberlands, LLC of Vancouver, WA and managed locally by Hancock Forest Management. (Taxlot 08-11-33-00-00602-00) See Figure 9-1, 9-2 and 9-3. This property has recently been clearcut and has little timber value. The property is zoned as TC, Timber Conservation, and the portion of the property where the plant will be located will need to be rezoned.

The property is currently accessible from existing logging roads that connect to Hwy 101 to the north. This access will need to be widened and improved to provide adequate facility access. Since this route is more than 2 miles long, the road development costs are very expensive. An alternative route was evaluated that connects the site to Hwy 101 by going west. This route is considerably shorter at approximately ½ mile but will need to cross over Fogarty Creek and pass through property currently owned by Oregon State Parks.

Site 1 is very close to the existing Fogarty Creek Pump Station where wastewater is currently pumped to Depoe Bay. By replacing the pumps in the existing pump station wetwell the Fogarty Creek Pump Station can be modified to serve as an influent pump station for the proposed Site 1 wastewater plant. A new forcemain will need to be installed from the existing pump station in Fogarty Creek State Park and extend north, parallel to Fogarty Creek, to the proposed access road, then east to the plant site.

The plant outfall would run west from Site 1 down the access road and toward Hwy 101 and parallel to the influent forcemain, then south parallel to the forcemain and Fogarty Creek, then west through the Fogarty Creek Park parking lot, below Hwy 101, across Fogarty Creek Beach, and to the ocean outfall located approximately 1500' offshore. The headworks at Site 1 would be at an elevation of approximately 160 ft which will allow for a gravity flow ocean outfall. See Figure 9-1.

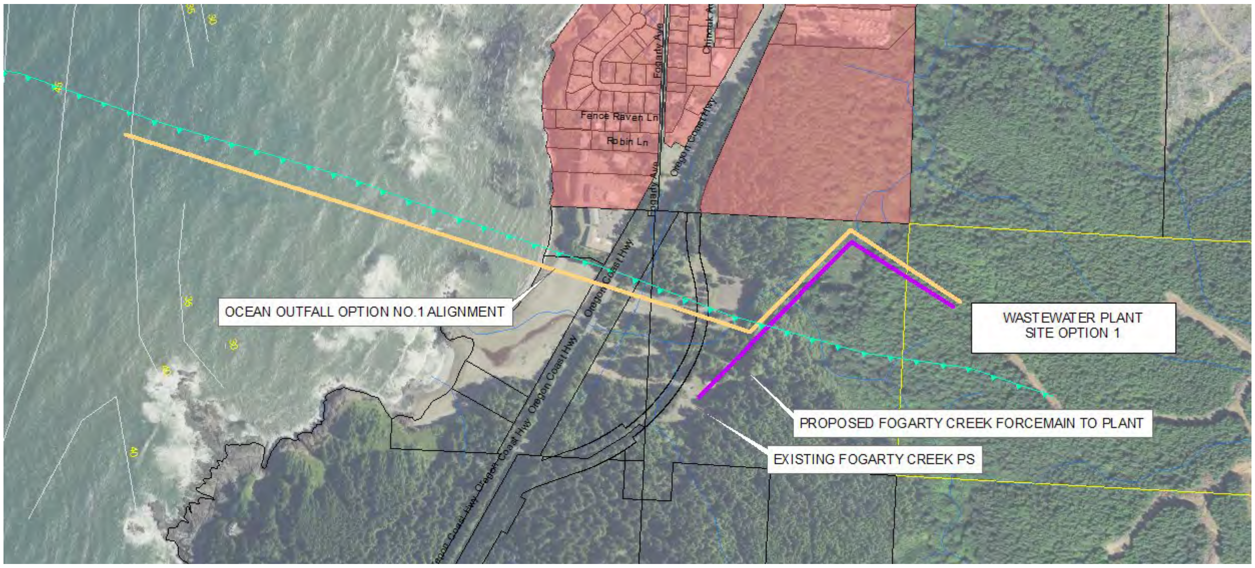


FIGURE 9-1: OCEAN OUTFALL OPTION NO. 1

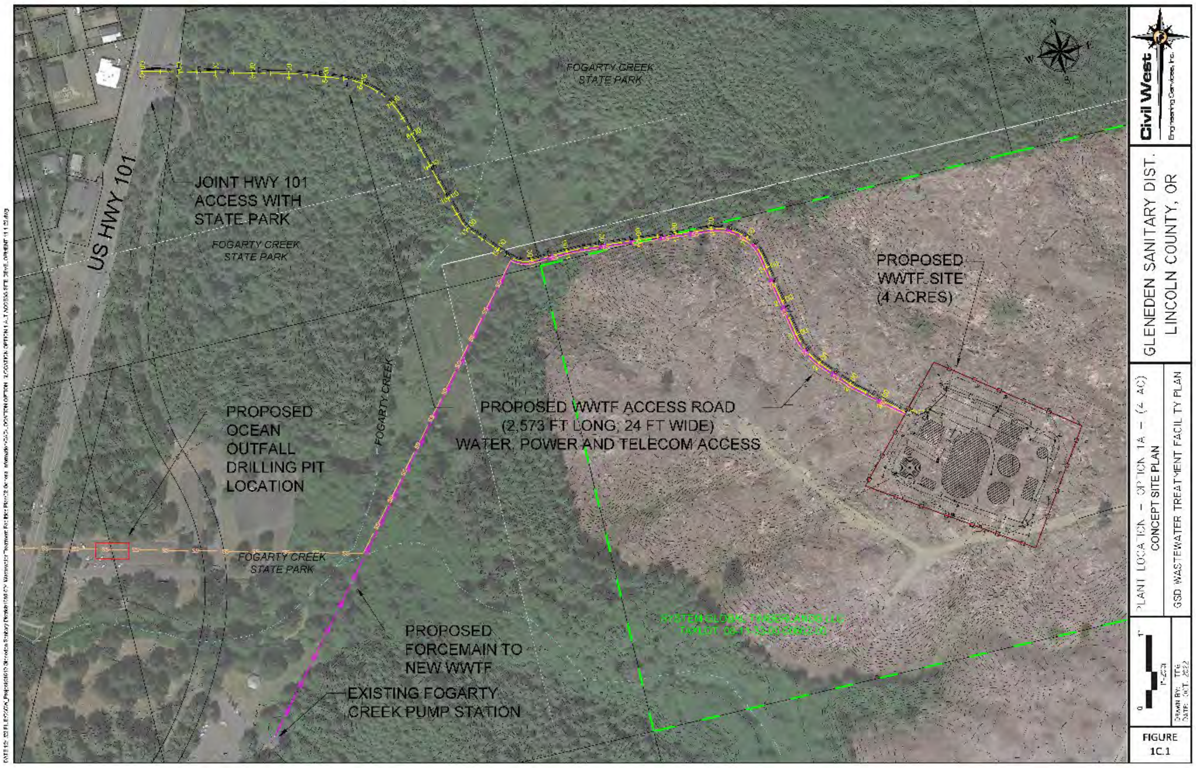


FIGURE 9-2: SITE LAYOUT OF OPTION 1C, 4AC WITH ALT. ACCESS

A typical site layout is shown in in Figure 9-3 showing conceptual site development components used in cost estimates.

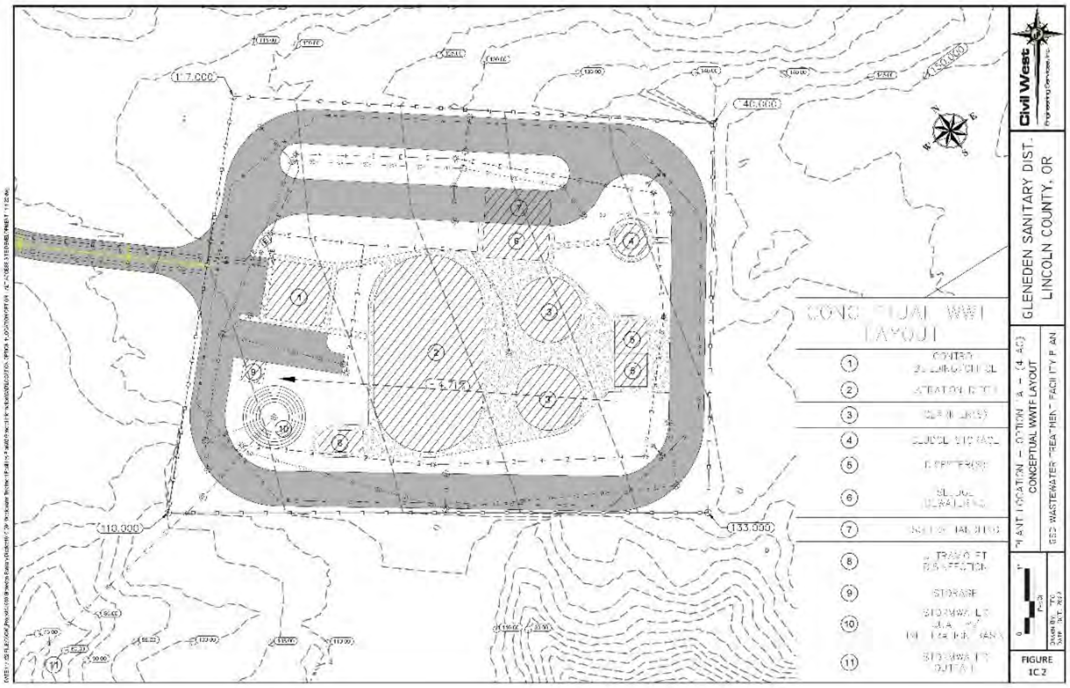


FIGURE 9-3: TYPICAL SITE LAYOUT

LAND REQUIREMENTS

- The parent property of Site 1 will need to be split and the proposed site purchased and rezoned to P-F, Public Facility.
- This site will require extensive coordination with Oregon State Parks for the installation of the access road, forcemain from the existing pump station, and installation of the ocean outfall. The ocean outfall and the north-south portion of the new forcemain will be installed by directional drilling. It will be necessary to install a large drilling pit in the Fogarty Creek State Park northern parking lot. See Figure 9-1. From this location the outfall pipeline can be drilled below Hwy 101 and Fogarty Beach to the outfall diffuser location approximately 1,500 feet offshore.
- The outfall pipeline, outfall and diffuser, and forcemain will require an easement from the Department of State Lands to cross the property within Fogarty Creek State Park, the beach, and the territorial water to the outfall diffuser location.
- A utility permit and easement will also be required from ODOT for the outfall to cross below the highway.
- This site will require extensive coordination with Oregon State Parks for the installation of the forcemain and ocean outfall. The ocean outfall and the north-south portion of the new forcemain will be installed by directional drilling. It will be necessary to install a large drilling pit in the Fogarty Creek State Park northern parking lot. From this location the outfall pipeline can be drilled below Hwy 101 and Fogarty Beach to the outfall diffuser location approximately 1,500 feet offshore.

- The outfall pipeline, outfall and diffuser, and forcemain will require an easement from the Department of State Lands to cross the property within Fogarty Creek State Park, the beach, and the territorial water to the outfall diffuser location.
- A utility permit and easement will also be required from ODOT for the outfall to cross below the highway.

POTENTIAL CONSTRUCTION PROBLEMS

This site will have the least impact on Hwy 101 compared to the other site alternatives. With the exception of the access drive connection to the highway, the construction work for developing Site 1 will take place off of the highway right-of-way and utility crossings of the highway will take place through directional drilling methods. This site will have considerable construction impacts on the northern portion of Fogarty Creek State Park because it will be necessary to close part of the parking lot for use as a directional drilling staging area. Construction activity within the actively used portion of the State Park will include forcemain and outfall pipeline construction. Fogarty Creek State Park has two accesses, one on either side of Fogarty Creek. Construction will only impact the northern access and the southern access should remain relatively unaffected.

Access route and site construction is relatively isolated from other developed areas and should have limited impact on neighboring properties.

9.3 Project Schedule – Permit Requirements

PROJECT SCHEDULE

- July 2023 — Approval of Facility Plan
- July-October 2023 — Finalize Project Financing
- October-November 2023 — Procure Project Site
- October-December 2023 — Issue Consulting RFQ/Select Design Team
- January -December 2024 — Preliminary Design
- October 2024 — Permitting
- January- July 2024 — Final Design
- June 2024 — Advertise for Construction
- September 2024 – July 2025 — Construction
- July 2025 — Facility Startup and Commissioning

ENVIRONMENTAL IMPACTS AND PERMITTING

A removal-fill wetland impact permit will be required to be submitted with the Oregon Department of State Lands for the crossing of Fogarty Creek with the access road and pipelines. Fogarty Creek is considered essential salmonoid habitat and any fill or removal within a designated waterbody requires a joint permit application (JPA). The pipelines can be installed by non-invasive directional drilling techniques across the creek and wetlands, but the access road will necessitate some removal-fill within the wetland areas and culverts crossing the creek.

This work will require wetland mitigation and specially designed culverts to minimize fish passage impacts.

A removal-fill wetland impact permit will be required to be submitted with the Oregon Department of State Lands for the crossing of Fogarty Creek with the access road and pipelines. Fogarty Creek is considered essential salmonoid habitat and any fill or removal within a designated waterbody requires a joint permit application (JPA). The pipelines can be installed by non-invasive directional drilling techniques across the creek and wetlands, but the access road will necessitate some removal-fill within the wetland areas and culverts crossing the creek. This work will require wetland mitigation and specially designed culverts to minimize fish passage impacts.

9.4 Sustainability Considerations

- This site alternative will reuse the existing Fogarty Creek pump station as an influent pump station by replacing the pumps. No other modifications to the existing collection system are needed.
- Environmental Benefits or Impacts: If all effluent quality criteria are met, there should be little impact from an outfall in this location. If the effluent limits are not met, the adjacent recreational beach and nearby marine reserve could be affected.
- Social Benefits or Impacts: Since this pipeline is the shortest and most of the alignment will be constructed through directional drilling, the installation of this pipeline should have the least impact on adjacent uses. Since surrounding properties are all investment forest properties, there will be no economic loss nor social issues with a neighboring wastewater plant.
- Economic Benefits or Impacts: This outfall site will have little to no economic impact to adjacent uses.

9.5 Water and Energy Efficiency

This site has the shortest forcemain feeding the wastewater plant of all considered alternatives and utilizes an existing pump station. The site is high enough that it will not require an effluent booster station, resulting in less construction costs and energy consumption than the other site alternatives. This site has recently been clearcut so site preparation costs and impacts to existing vegetation are minimized.

Process equipment alternatives can be evaluated during preliminary design to identify energy saving/reducing alternatives to minimize life cycle costs.

9.6 Green Infrastructure

The development of the site may use green infrastructure to protect water quality surrounding the site. Green infrastructure alternatives will be considered during preliminary design.

9.7 Total Project Cost Estimate

The 2022 cost to develop Site No. 1 with a Sequencing Batch Reactor is estimated to be $27,149,298. At this level of planning, it is recommended to include a 30% contingency. ***The 2022 development cost including 30% contingency is $35,295,000***. Knowing it will take several years for the District to develop this facility, Table 9-1 below shows the development cost change over time adjusted by the average annual change in the Engineering News Record Construction Cost Index since 2006. (Engineering New Record, 2023)

TABLE 9-1: DEVELOPMENT COST INFLATIONARY CHANGE

17-yr Average CCI change: 3.19%

	2022 Preferred Option development cost	$27,149,298
	30% Contingency	$8,144,789
	2022 Total Cost	**$35,294,087**
Year 1	2023	$36,419,969
Year 2	2024	$37,581,766
Year 3	2025	$38,780,624
Year 4	2026	$40,017,726
Year 5	2027	$41,294,291
Year 6	2028	$42,611,579
Year 7	2029	$43,970,889
Year 8	2030	$45,373,560
Year 9	2031	$46,820,977
Year 10	2032	$48,314,566

9.8 Annual Operating Budget

Details on operating budget and revenues are detailed in Chapter 10.

9.9 Income

Details on operating budget and revenues are detailed in Chapter 10.

9.10 Annual Operating Costs

Annual operating costs were determined using EPA Technical Bulletin MCD-39 Analysis of Operations & Maintenance Costs for Municipal Wastewater Treatment Systems (US Environmental Protection Agency, 1978) and adjusting the cost by the consumer price index (CPI). Since operating costs for SBR's were not detailed in the report, Figure E 2-17 was used to calculate total O&M costs vs. actual flow for activated sludge secondary treatment in Region X. See Figure 9-4 - O&M Costs vs. Flow. Likewise, total staff requirements were determined using Figure E 1-3 comparing staff size to actual flow. See Figure 9-5. Total estimated annual operating costs in 2022 are projected as follows:

1979 (Consumer Price Index) CPI:	72.6
2022 CPI:	317.3
Construction Cost Change:	337.05%

5-year Maximum Month Wet Weather Flow ($MMWWF_5$):	0.443	MGD
10-year Maximum Month Dry Weather Flow ($MMDWF_{10}$):	0.318	MGD

Projected O&M Costs (1979):	$49,788
Projected O&M Costs (2022):	$217,600

Projected Staffing:	4

FIGURE 9-4 - O&M COSTS VS. FLOW

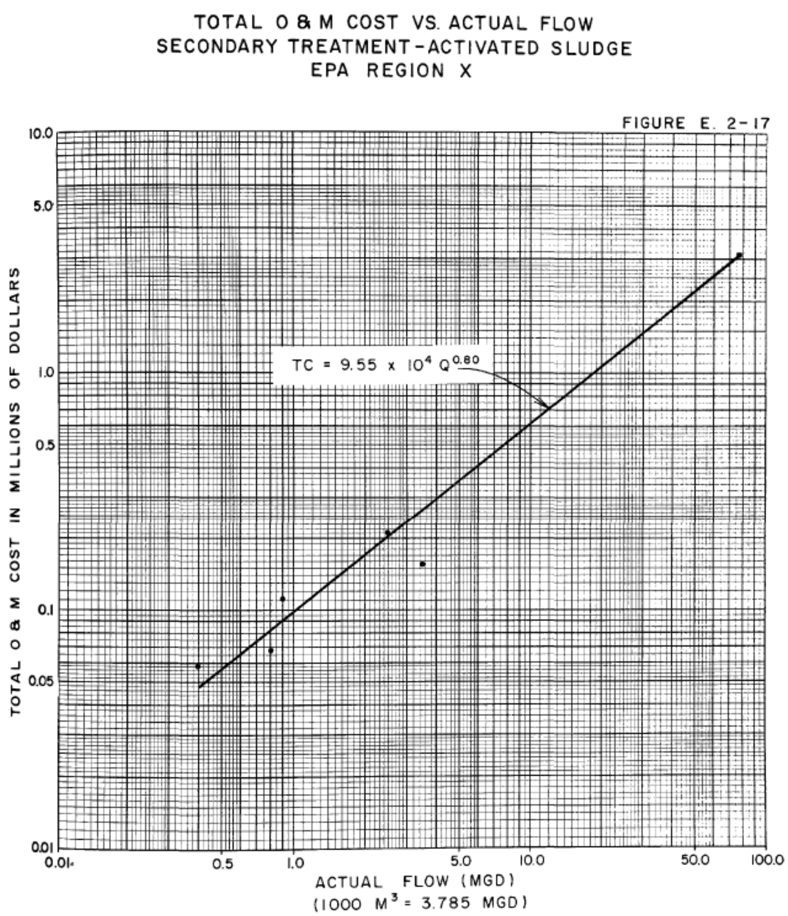
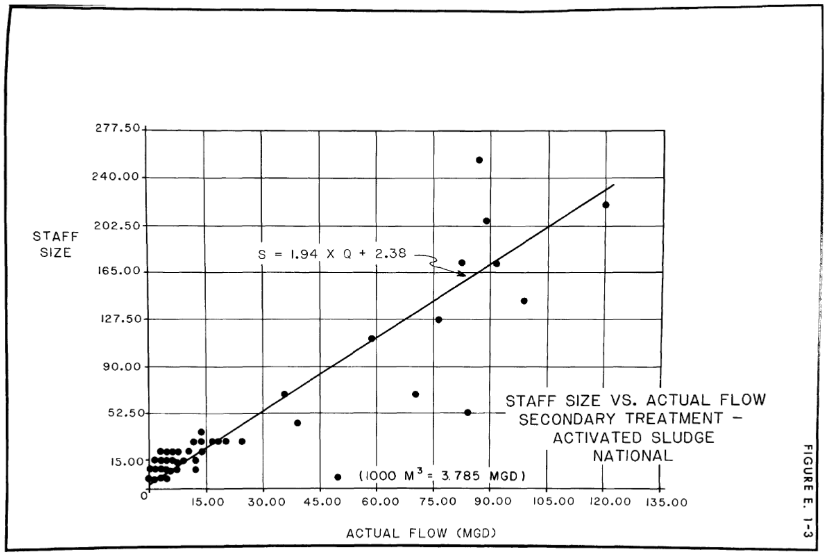


FIGURE 9-5 - STAFF SIZE VS. FLOW



9.11 Debt Repayments

Details on project financing are detailed in Chapter 10.

9.12 Reserves

Details on project financing are detailed in Chapter 10.

9.13 References

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US Environmental Protection Agency. (1978). *MCD-39 Analysis of Operations & maintenance Costs for Municipal Wastewater Treatment Systems.* Washington DC: Office of Water Program Operations.

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10 FINANCING AND CAPITAL IMPROVEMENT PLAN

10.1 Introduction

This chapter summarizes the costs associated with the recommended wastewater capital project and provides an anticipated cost impact for rate payers. Also included is a discussion on potential funding resources and a summary of the current rate structure of the District. The rate impacts included in this section should not be used for the long-term establishment of system user rates. User rates should be set once final funding package terms and the actual cost of providing service are known.

The project cost used for this analysis is $35,295,000. As discussed in Section 9.7, costs will increase annually approximately in relation to the annual average increase in the Construction Cost Index. See Table 9-1.

10.2 Current Financial Status – User Rates and Debt Service

10.2.1 User Rates

There are currently 2221 active services in the community. Present 2022 sewer user rates are:

- Single Family Dwelling: $54 per month flat rate
- Multi-family/Commercial: $54 per month for 1,000 gallons or less – overage is billed at $18 for each 1,000-gallon unit
- Out of District (1.5x above rates): $81 for 1,000 gallons or less – overage is billed at $27 per 1,000-gallon unit

10.2.2 Debt Service

The District currently only has one loan. Recently the District acquired a loan from Oregon Department of Environmental Quality's Clean Water State Revolving Fund Loan Program (CWSRF) for collection system improvements. Table 10-1 below summarizes the details of the loan and the projects to be completed with the loans include new pump stations and pressure main. The debt payoff of this loan is accounted for in the current wastewater base rate of $54 per month.

TABLE 10-1: EXISTING DEBT

CWSRF LOAN NO. 1	
Original Loan Inception and Loan Term	2021/ 30-years
Original Loan Amount	$ 4,370,000.00
Annual Payment	$144,739
Remaining Time (years)	30
Remaining Balance	$4,370,000
Funding Agency	DEQ

10.3 SDC's

One of the principal sources of revenue for financing new public facilities or expansions to existing facilities is a one-time charge imposed at the time of connection to the system. This charge is generally referred to as a system development charge (SDC), impact fee, or capital contribution fee. These charges are designed to pay for, or recover, all, or a portion, of the capital investment made by a local government to provide sufficient capacity in public infrastructure to serve new users. System development charges are typically collected when new users or developers connect to a utility system, when new development permits are issued, or when users change the usage of their property. (City of Springfield, 2000)

10.3.1 Oregon SDC Legislation

In Oregon, the development and implementation of SDCs is regulated by ORS 223.297-314. This legislation, which became effective on July 1, 1991, authorizes local governments to assess SDCs for the following types of capital improvements:

- Water supply, treatment, and distribution
- Wastewater collection, transmission, treatment, and disposal
- Drainage and flood control (stormwater)
- Transportation
- Parks and recreation

The legislation provides guidelines regarding the calculation of SDCs, accounting requirements to track SDC revenues, and the adoption of administrative review procedures. (City of Springfield, 2000)

10.3.2 SDC Components

An SDC may be a reimbursement fee, an improvement fee, or a combination of the two.

Reimbursement Fee

The reimbursement fee is based on the costs of capital improvements already constructed or under construction. The legislation requires that the reimbursement fee be established by an ordinance or resolution that sets forth the methodology used to calculate the charge. This methodology must consider the cost of existing facilities, prior contributions by existing users, the value of unused capacity, ratemaking principles employed to finance the capital improvements, and other relevant factors. The objective of the methodology must be that future system users contribute no more than an equitable share of the capital costs of existing facilities. (City of Springfield, 2000)

Improvement Fee

The improvement fee is designed to recover the costs of planned capital expansions. The improvement fee methodology must also be specified in an ordinance or resolution and must consider the costs of projected capital improvements needed to increase the capacity of the system. The legislation further requires that a credit be provided for the construction of "qualified public improvements." Qualified public improvements are improvements that are required as a condition of development approval, identified in the system's capital improvement program, and either (1) not located on or contiguous to the property being developed, or (2) located in whole or in part on or contiguous to property that is the subject of development approval and required to be built larger or with greater capacity than is necessary for the particular development project to which the improvement fee is related.

Revenues generated through the improvement fees are dedicated to capacity-increasing capital improvements or the repayment of debt on such improvements. An increase in capacity is established if an improvement increases the level of service provided by existing facilities or provides new facilities. The portion of such improvements funded by improvement fees must be related to current or projected development. (City of Springfield, 2000)

Combined Fee

The combined fee is simply the sum of the reimbursement and improvement fee.

10.3.3 Other Provisions

Other provisions of the legislation require:

- Development of a capital improvement program (CIP) or comparable plan that lists the improvements that may be funded with improvement fee revenues and the estimated timing and cost for each improvement.
- Deposit of SDC revenues into dedicated accounts and annual accounting of revenues and expenditures.
- Creation of an administrative appeal procedure whereby a citizen or other interested party may challenge an expenditure of SDC revenues.
- Preclusion against challenging the SDC methodology after 60 days from enactment of or revision to the SDC ordinance or resolution.

The provisions of the legislation are invalidated if they are construed to impair the local government's bond obligations or the ability of the local government to issue new bonds or other financing. (City of Springfield, 2000)

The District's existing SDC rates are shown in Table 10-2.

TABLE 10-2: EXISTING SDC CHARGES PER WATER METER CONNECTION

GLENEDEN SANITARY DISTRICT Systems Development Charges (SDC) Rate Schedule Effective 9-12-19 per Resolution 19-03		
Meter Size	**SDC Fee**	**EDU's**
¾" Meter	$5,394.00	1.0
1" Meter	$13,225.00	2.5
1 ½" Meter	$26,278.00	4.9
2" Meter	$41,941.00	7.8
3" Meter	$83,709.00	15.5
4" Meter	$130,698.00	24.2

For the purpose of this analysis, the SDC's associated with a new wastewater treatment plant will be based upon the improvement fee methodology. The improvement fee is calculated using a capital improvement plan (CIP) based approach. Under the CIP approach the SDC cost basis is derived from a capital improvement plan that identifies specific growth-related projects to be built in the future. The reimbursement fee is based on the value of available capacity in the existing system available to serve new development. For the purpose of calculating SDC's for a new wastewater treatment plant, the available capacity would be the difference in plant costs between what is needed for capacity today, compared to what is needed for capacity at the end of the 2045 planning period. The steps used in determining the wastewater SDC is as follows:

1. Determine the capacity needs of growth
2. Determine the SDC cost basis
3. Calculate the SDC unit cost
4. Develop the SDC schedule

10.3.4 Step 1 – Determine the Capacity Needs of Growth

Local wastewater system capacity is defined in terms of equivalent dwelling units (EDUs). Equivalent dwelling units are a way of characterizing the total capacity need in the sewer system as if the City was made up entirely of single family dwellings. The total existing EDUs are estimated to be 2,221 EDUs. Further information on population estimates and EDU calculations are included in Section 1.4.2.

Growth EDUs are estimated based on the estimated future growth, and the current proportion of EDUs to dwelling units. The existing number of residential dwelling units (including single family, multifamily, and mobile homes) is 2,168. Therefore, the ratio of EDUs to dwelling units currently is 1.02.

The total residential dwelling units projected through build-out are estimated to be 2,279. Assuming the same mix of development occurs in the future as currently exists, the total EDUs are estimated to be 2,335 (1.02 times 2,279) at the end of the 2045 planning period.

10.3.5 Step 2 – Determine the SDC Cost Basis

The SDC improvement fee cost basis is the growth-allocable portion of planned wastewater system capital improvements. The total estimated project cost for a new wastewater treatment facility for buildout conditions in 2045 is estimated to be $35,295,000. The growth-allocable portion of the project was estimated by determining the percentage increase in EDU's over the planning period. The increase in EDUs is 114, representing an increase of 5.1%. Therefore, the estimated percentage of project costs attributed to growth is 5.1%, or $1,800,045.

10.3.6 Step 3 – Calculate the SDC Unit Cost

The improvement fee unit cost is calculated by dividing the improvement fee cost basis ($1,800,045) by the anticipated growth through buildout (114 EDUs), resulting in an improvement fee unit cost of **$15,790 per EDU**. This SDC rate is for the improvements for the wastewater treatment plant only and will need to be added to the existing SDC rates if the District chooses to implement these additional SDC's.

10.3.7 Step 4 – Define the SDC Schedule

The District has already employed an SDC schedule methodology for their existing SDC rates. This methodology is based upon meter size which generally corresponds to the amount of water that will be used by each connection. Single family homes, which represent one EDU, are typically served by a ¾" meter (Table 10-2). The equivalent dwelling units associated with each meter size is based upon the ratio of the SDC fee compared to the SDC fee for a single EDU. This EDU ration is then multiplied by the single EDU SDC rate for the new wastewater treatment plant improvements for each meter size. The SDC schedule calculated for new wastewater treatment plant improvement is shown below in Table 10-3.

TABLE 10-3: NEW WWTF SDC SCHEDULE

Proposed Wastewater Treatment Plant SDC Schedule		
Meter Size	**SDC Fee**	**EDU's**
¾" Meter	$15,970.00	1.0
1" Meter	$39,155.22	2.5
1 ½" Meter	$77,801.20	4.9
2" Meter	$124,174.60	7.8
3" Meter	$247,836.99	15.5
4" Meter	$386,957.19	24.2

The combined total SDCs including existing SDC as shown in Table 10-2 and proposed SDCs as shown in Table 10-3 are included below in Table 10-4.

TABLE 10-4: COMBINED EXISTING AND PROPOSED SDC SCHEDULE

Combined Existing and Proposed SDC Schedule		
Meter Size	**SDC Fee**	**EDU's**
¾" Meter	$21,364.00	1.0
1" Meter	$52,380.22	2.5
1 ½" Meter	$104,079.20	4.9
2" Meter	$166,115.60	7.8
3" Meter	$331,545.99	15.5
4" Meter	$517,655.19	24.2

10.4 Potential Financial Obligation and Wastewater Rate Adjustment

10.4.1 New Wastewater Treatment Plant User Impacts

The information presented in the preceding sections have been used to develop a probable rate adjustment for the District based on the recommended wastewater treatment project. To proceed with the recommended project, the District will need to secure funding. Some grant funding may be available to the District; however, loans or the use of available cash reserves may be required for a significant portion of the cost. The final user rate will depend on the funding package secured by the District including, interest rates, current construction costs, and other variables.

Table 10-5 and Table 10-6 provide a summary of the potential rate impacts the proposed wastewater treatment plant project may have. Table 10-2 shows the annual Operation and Maintenance cost per EDU for a new wastewater treatment facility.

TABLE 10-5: ANNUAL OPERATING COSTS PER EDU

O&M Costs	
Annual Operating Cost:	$217,600
Number of EDUs (Current)	2221
Monthly O&M Cost per EDU	**$8.16**

Table 10-6 shows a series of potential funding scenarios depending upon the financing methodology and the impact to user rates. It may be possible, and advantageous, to combine multiple funding programs in order to leverage the most grant and/or loan forgiveness funds available. The following criteria were used in the user rate calculations:

- Connections = 2221
- Loan Interest Rate = 1.42%
- Loan Period = 30-years
- Estimated Project Costs: $35,295,000

TABLE 10-6: WATER TREATMENT PLANT FINANCING COSTS

Project Financing	100% Loan, No Grant	50% Loan	30% Loan
Capital Cost	$35,295,000	$35,295,000	$35,295,000
Loan Needed	$35,295,000	$17,647,500	$10,588,500
Interest Rate*	1.420%	1.420%	1.420%
Loan Period (yrs)	30	30	30
Annual Annuity	$1,453,043	$726,521	$435,913
Monthly Income Required	$121,087	$60,543	$36,326
Monthly Income Reqd' w/ 10% reserve	$133,196	$66,598	$39,959
Number of EDUs (Current)	2221	2221	2221
Monthly Financing Cost per EDU	**$59.97**	**$29.99**	**$17.99**
Monthly O&M Cost per EDU**	**$8.16**	**$8.16**	**$8.16**
Current Monthly WW Base Fee	$54.00	$54.00	$54.00
New Monthly Wastewater Fee	**$122.14**	**$92.15**	**$80.16**

*https://www.oregon.gov/deq/wq/cwsrf/Pages/CWSRF-Rates.aspx (as of December 2, 2022)

** Activated sludge w/4 operators

10.4.2 Wastewater Collection System Improvements User Impacts

The following tables were taken directly from the 2018 Facilities Plan Update prepared by HHPR. (Harper Houf Peterson Righellis, Inc., 2018) Table 10-1 summarizes improvements that have recently been completed as part of the recent CWSRF loan. Table 10-7 and Table 10-8 summarize recommended capital improvement projects needed in the collection system that remain to be completed.

TABLE 10-7: COLLECTION SYSTEM NEEDED IMPROVEMENTS – MID TERM

Table 7-2
Recommended Mid-Term Improvements and Estimates of Probable Costs (March 2018 Dollars)

Project Description	Probable Construction Cost	Probable Project Cost
1. Telemetry System Installations (4 sites) (1)	$32,000	$34,000 (2)
2. Replacements of PS Controls (4 sites) (1)	$100,000	$105,000 (2)
3. Searidge PS (#6)	$264,000	$330,000
4. South Coronado PS (#10)	$990,000	$1,240,000
5. Wells Street PS (#14)	$212,000	$265,000
Total – Mid-Term Projects	**$1,598,000**	**$1,974,000**

TABLE 10-8: COLLECTION SYSTEM NEEDED IMPROVEMENTS - LONG TERM

Table 7-3
Recommended Long-Term Improvements and Estimates of Probable Costs (March 2018 Dollars)

Project Description	Probable Construction Cost	Probable Project Cost
1. Evergreen Ridge PS (#7)	$230,000	$290,000
2. Trend West PS (#15)	$236,000	$295,000
3. Willark West Gravity Sewer Extension (remove PS #4)	$92,000	$115,000
4. Pacific Palisades PS (#3)	$332,000	$415,000
5. Holiday Hills PS (#9)	$332,000	$415,000
6. Rush Place PS (#8)	$260,000	$325,000
Total – Long-Term Projects	**$1,482,000**	**$1,855,000**

Table 10-9 shows the probable user rate impacts associated with the remaining recommended collection system projects. A 2018 to 2023 Construction Cost Index increase of 18% was applied to account for inflation and other recent economic impacts. Collection system costs are summarized as follows:

Mid-Term =	$1,974,000
Long-Term =	$1,855,000
Subtotal =	$3,829,000
Total w/ 30% increase (rounded up) =	$4,520,000

TABLE 10-9: COLLECTION SYSTEM CIP COSTS

Project Financing	100% Loan, No Grant	50% Loan	30% Loan
Capital Cost	$4,520,000	$4,520,000	$4,520,000
Loan Needed	$4,520,000	$2,260,000	$1,356,000
Interest Rate*	1.420%	1.420%	1.420%
Loan Period (yrs)	30	30	30
Annual Annuity	$186,082	$93,041	$55,825
Monthly Income Required	$15,507	$7,753	$4,652
Monthly Income Reqd' w/ 10% reserve	$17,057	$8,529	$5,117
Number of EDUs (Current)	2221	2221	2221
Monthly Financing Cost per EDU	**$7.68**	**$3.84**	**$2.30**
Current Monthly WW Base Fee	$54.00	$54.00	$54.00
New Monthly Wastewater Fee	**$61.68**	**$57.84**	**$56.30**

10.4.3 Combined WWTP Project and Collection Improvements User Impacts

Table 10-10 shows the probable user impact based on completing all the recommended collection system improvements combined with a new wastewater treatment plant.

TABLE 10-10: COMBINED WWTP AND COLLECTION SYSTEM CIP COSTS

Project Financing	100% Loan, No Grant	50% Loan	30% Loan
Capital Cost	$39,815,000	$39,815,000	$39,815,000
Loan Needed	$39,815,000	$19,907,500	$11,944,500
Interest Rate*	1.420%	1.420%	1.420%
Loan Period (yrs)	30	30	30
Annual Annuity	$1,639,124	$819,562	$491,737
Monthly Income Required	$136,594	$68,297	$40,978
Monthly Income Reqd' w/ 10% reserve	$150,253	$75,127	$45,076
Number of EDUs (Current)	2221	2221	2221
Monthly Financing Cost per EDU	**$67.65**	**$33.83**	**$20.30**
Monthly O&M Cost per EDU**	**$8.16**	**$8.16**	**$8.16**
Current Monthly WW Base Fee	$54.00	$54.00	$54.00
New Monthly Wastewater Fee	**$129.82**	**$95.99**	**$82.46**

10.5 Financing Mechanisms

10.5.1 General Obligation Bonds

General Obligation (GO) bonds have the full faith and resources of the District behind them including property taxes, rate income, and other revenues to ensure that obligations are met. Because of this backing, GO bonds often have a lower interest rate and are generally considered to have lower risk and are a more attractive investment in the municipal bond market. For a community to undertake a project funded with a GO bond, citizens within the District service boundary must vote in favor of selling the bonds. The approved value of the GO bond is distributed to the tax base within the District based upon a fixed amount per $1,000 of taxable value. For example, if the taxable unit value of the GO bond is $0.63/$1,000 of taxable value, then a home assessed for $100,000 will owe $63 per year in additional taxes to pay their share of the GO Bond obligation. GO Bonds can vary in length and are typically 20 or 30 years.

10.5.2 Revenue Bonds

Revenue Bonds (RB) are repaid through revenues obtained through user rates and charges. They do not have the full faith of the community behind them in that property taxes and other forms of revenue are not pledged to retire the debt. As such, they are considered as a higher risk and often have slightly higher interest rates associated with them. However, as property taxes are not obligated, a vote of the public is not required for selling revenue bonds to fund a project. This often makes revenue bonds easier to acquire and a preferred choice for public improvements.

Bonds sales, regardless of type, have several requirements and processes that must be met for the bond sale to move forward. These requirements vary but generally include:

- Project documentation to prove feasibility of the project and the funding plan.
- Assistance from a bond counsel agent.

- Retain a year of payments, in reserve, to provide a level of confidence that the District will not default on their debt payments.
- The bond process includes issuance costs that increase the overall cost of a project.
- Other requirements and steps to negotiate the process of obtaining funding.

10.5.3 Improvement Bonds

Improvement (Bancroft) bonds can be issued under an Oregon law called the Bancroft Act. These bonds are an intermediate form of financing that is less than full-fledged general obligation or revenue bonds. This type of bond is quite useful, especially for smaller issuers or for limited purposes.

An improvement bond is payable only from the receipts of special benefit assessments, not from general tax revenues. Such bonds are issued only where certain properties are recipients of special benefits not accruing to other properties. For a specific improvement, all property within the improvement area is assessed on an equal basis, regardless of whether it is developed or undeveloped. The assessment becomes a direct lien against the property, and owners have the option of either paying the assessment in cash or applying for improvement bonds. If the improvement bond option is taken, the District sells Bancroft improvement bonds to finance the construction, and the assessment is paid over 20 years in 40 semiannual installments with interest. Cities and special districts are limited to improvement bonds not exceeding 3% of true cash value.

With improvement bond financing, an improvement district is formed, boundaries are established, and the benefiting properties and property owners are determined. The engineer usually determines an approximate assessment, either on a square foot or front-foot basis. Property owners are then given an opportunity to object to the project assessments. The assessments against the properties are usually not levied until the actual cost of the project is determined. Since this determination is normally not possible until the project is completed, funds are not available from assessments for making monthly payments to the contractor. Therefore, some method of interim financing must be arranged, or a pre-assessment program based on the estimated total costs must be adopted. Commonly, warrants are issued to cover debts, with the warrants to be paid when the project is complete.

The primary disadvantage to this source of revenue is that the property to be assessed must have a true cash value at least equal to 50% of the total assessments to be levied. Thus, owners of undeveloped properties usually require a substantial cash payment. In addition, the development of an assessment district is very cumbersome and expensive when facilities for an entire community are contemplated. In comparison, general obligation bonds can be issued in lieu of improvement bonds and are usually more favorable.

10.5.4 System Development Charges

System Development Charges (SDC's) are fees collected as previously undeveloped property is developed. The fees are used to finance the necessary capital improvements and municipal services required by the development. Such fees can only be used to recover the capital costs of infrastructure improvements. Operating, maintenance, and replacement costs cannot be financed through SDC's.

Two types of charges are permitted under the Oregon Systems Development Charges Act:

(1) improvement fees and (2) reimbursement fees. SDC's that are charged before a project is undertaken are considered improvement fees and are used to finance capital improvements to be constructed. After construction, SDC's are considered reimbursement fees and are collected to recapture the costs associated with capital improvements already constructed or under construction. A reimbursement fee represents a charge for utilizing excess capacity in an existing facility paid for by others. The revenue generated by this fee is typically used to pay back existing loans for improvements.

Under the Oregon SDC Act, methodologies for deriving improvement and reimbursement fees must be documented and available for review by the public. A capital improvement plan must also be prepared which lists the capital improvements that may be funded with improvement fee revenues. The estimated cost and timing of each improvement also must be included in the capital improvement plan. Thus, revenue from the collection of SDC's can only be used to finance specific items listed in a capital improvement plan. In addition, SDC's cannot be assessed on portions of the project paid for with grant funding.

10.5.5 Ad Valorem Taxes

Ad valorem property taxes are often used as a revenue source for utility improvements. Property taxes may be levied on real estate, personal property, or both. Historically, ad valorem taxes were the traditional means of obtaining revenue to support all local governmental functions.

A major advantage of these taxes is the simplicity of the system. It requires no monitoring program for developing charges, additional accounting and billing work is minimal, and default on payments is rare. In addition, ad valorem taxation provides a means of financing that reaches all property owners that benefit from a wastewater system, whether a property is developed or not. The construction costs for a project are shared proportionally among all property owners based on the assessed value of each property.

Depending on the project, ad valorem taxation may result in property owners paying a disproportionate share of the project costs compared to the benefits received. Public hearings and an election with voter approval would be required to implement ad valorem taxation.

10.5.6 System User Fees

System user fees can be used to retire general obligation bonds and are commonly the sole source of revenue used to retire revenue bonds and to finance operation and maintenance of a system. System user fees represent charges of all residences, businesses and other users that are connected to the wastewater system. These fees are established by resolution and may be modified as needed to account for increased or decreased operating and maintenance costs. User fees may be based on a metered volume of water consumption and/or on the type of user (i.e., residential, commercial, industrial, etc.).

10.6 Potential Grant and Loan Services

The CIP adds up to a substantial dollar figure. In order to make the needed and necessary improvements, assistance from a funding agency(s) will be necessary (or petition to the State for any possible appropriations).

Funding for wastewater system capital improvements occurs with loans, grants, principal forgiveness, bonds, or a combination thereof. Parameters such as the local and State median household income (MHI), existing debt service, wastewater use rates, low/moderate income level percentages, financial stability, and project need are used by funding agencies to evaluate the types and levels of funding assistance that can be received by a community. Likely sources for financial assistance are Business Oregon, DEQ, and USDA-Rural Development.

10.6.1 Business Oregon

Business Oregon administers resources aimed at community development activities primarily in the wastewater and water infrastructure areas. The Business Oregon Regional Coordinator for Lincoln County is Melissa Murphy (503-983-8857) and any application process will begin by contacting her. The funding programs through Business Oregon include:

1. Community Development Block Grants (CDBG)
2. Special Public Works Funds
3. Wastewater/Water Financing

10.6.2 DEQ Clean Water State Revolving Fund Program (CWSRF)

Guidelines governing this funding program are laid out in the Oregon Revised Statues, Chapter 340, Division 54. There is financing available for projects “that enhances, protects or restores water quality.” Also, CWSRF “promotes loan affordability by offering below-market interest rates.” The financing scenario above uses this program.

10.6.2.1 Bipartisan Infrastructure Law (BIL)

The Bipartisan Infrastructure Law, or BIL, is a federal infrastructure funding package that was signed into law on Nov. 15, 2021. In part, the law provides the U.S. Environmental Protection Agency with funds that can be awarded to states for water quality infrastructure projects for five years, from May 2022 – 2026, through State Revolving Fund programs. To ensure that all communities benefit equitably from this historic investment in water infrastructure, a significant portion of funds will be provided as forgivable loans, with environmental justice and economic factors as considerations.

Some details of BIL:

- Oregon allocation of appropriations supplemental BIL stimulus for FFY2022:
  - CWSRF = up to $20.2 million
  - Increasing amounts for four years thereafter
- Project and borrower eligibilities will be the same for BIL-funded projects as the base CWSRF program.
- Applications are accepted year-round, but projects will be reviewed, scored, and ranked after submission deadlines. The next upcoming deadline for receiving applications is April 14, 2023.

This is still an evolving program. DEQ will continue to post more information as EPA provides updates.

10.6.3 USDA

Block Grant assistance for the District may be possible due to possibly meeting the national objectives for low and moderate-income persons.

USDA provides wastewater system development loans at 2.00% for 30 years.

10.6.4 Funding Agencies One-Stop

A One-Stop Financing Roundtable is where all relevant and possible funding agencies meet together to discuss the proposed project. The agencies and the District would discuss the need of the project and together discuss possible funding scenarios. One-stop participants will benefit from the combined experience of participants and gain valuable contacts. As a result of the one-stop, participants will walk away with an understanding of the next steps needed for the project and be provided a variety of funding scenarios.

The District should request a One-Stop meeting as soon as possible to discuss financing possibilities and eligibilities. The project user rates presented above may change depending on the actual financing received.

10.7 Conclustion and Next Steps

The wastewater project improvements are a significant undertaking. A project of this magnitude will require strong public support and financial assistance. This Plan provides sufficient technical and financial information to prospective funding agencies for their initial review and consideration.

Some initial next steps include:

1. A One-Stop meeting with Business Oregon, USDA Rural Development, DEQ, and other funding agencies should be scheduled to work through options. Project funding and financing options and opportunities will be researched, and a level of comfort obtained that financial assistance is available. To make this project manageable, grants and loan-forgiveness money is important.
2. Public outreach regarding the overall project improvements.

10.8 References

City of Springfield. (2000). *System Development Charge Methodology.*

Harper Houf Peterson Righellis, Inc. (2018). *Gleneden Sanitary District Wastewater Collection System Facilities Plan Update.*

Water Environment Federation. (2018). Design of Water Resource Recovery Facilities, Sixth Edition. New York: McGraw-Hill Education.

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