KITSAP COUNTY

CENTRAL KITSAP GENERAL SEWER PLAN UPDATE

January 2025

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Central Kitsap General Sewer Plan Update

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January 2025

ECOLOGY DRAFT

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Acronyms & Abbreviations

A	
AAF	Average annual flow – the average daily flow for the calendar year
AACE	Association for the Advancement of Cost Engineering
ABAC	Ammonia-based aeration control
ADA	Americans with Disabilities Act
AKART	all known, available, and reasonable methods of prevention, control, and treatment
ASIL	Acceptable Source Impact Levels
ATS	Automatic Transfer Switch
B	
BNR	Biological nutrient removal
BOD	Biochemical oxygen demand
BOD_5	Five-day biochemical oxygen demand
BPA	Bonneville Power Administration
C	
CARA	Critical Aquifer Recharge Areas
$CBOD_5$	Carbonaceous Five-day biochemical oxygen demand
CCTV	Closed circuit television
CFR	Code of Federal Regulations
CIP	Capital improvement plan
CMMS	Computerized maintenance management system
CMOM	Capacity Management Operations and Maintenance
CMU	Concrete masonry unit
CNGC	Cascade Natural Gas Corporation
CoF	Consequence of failure
County	Kitsap County
CPU	Central processing unit
CWA	Clean Water Act
D	
DCD	Kitsap County Department of Community Develop
DHI	Danish Hydraulic Institute
DI	Ductile Iron
District	Silverdale Water District
DMR	Discharge Monitoring Report
DNR	Department of Natural Resources
DO	Dissolved oxygen
DoD	Department of Defense
DoDI	DoD Instruction
DOH	Washington State Department of Health

E	
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
ERU	Equivalent Residential Unit
ESA	Endangered Species Act
F	
FM	Force main
FOG	Fats, Oils, and Grease
fps	feet per second
FTE	Full-Time Equivalent
G	
GIS	Geographic Information Systems
GMA	Growth Management Act
gpcpd	Gallons per Capita Per Day
gpd	gallons per day
gpd/sf	Gallons per day per square foot
gpm	gallons per minute
H	
H/H	Hydraulic and hydrologic
H_2S	Hydrogen Sulfide
HDPE	High-Density Polyethylene
HP	Horsepower
HPA	Hydraulic Project Approval
HRR	Heat reservoir return
HVAC	Heating, ventilation, and air conditioning
I	
I&I	Infiltration and inflow
I/O	Input/output
IBC	International Building Code
IFC	International Fire Code
IMC	International Machine Code
IMLR	Internal mixed liquor recycle
IPS	Individual Pump Stations
ISI	Industrial Systems Inc.
K	
KCCP	Kitsap County Comprehensive Plan
KPUD	Kitsap Public Utility District
kV	Kilovolt
kW	kilowatt
L	
LAMIRD	Limited Area of More Intense Rural Development
Lbs	Pounds

lb/hr	Pounds per hour
LED	Light Emitting Diode
LF	Linear Feet
LHW	Liquid Hauled Waste
LUV	Land Use Vision
M	
MCC	Motor control center
MG	million gallons
mg/L	Milligrams per liter
MGD	million gallons per day
mL	Milliliter
MLLW	Mean lower low water
MLSS	Mixed liquor suspended solids
mm	millimeter
MMDWF	Maximum month dry weather flow – the largest volume of flow during a continuous 30-day period in dry weather season, expressed as a daily average
MMWWF	Maximum month wet weather flow – the largest volume of flow during a continuous 30-day period in wet weather season
MOV	Most open valve
MPN	Most Probable Number
N	
NASSCO	National Association of Sewer Service Companies
NEC	National Electrical Code
NFPA	National Fire Protection Association
NHPA	National Historic Preservation Act
NOC	Notice of Construction
NPDES	National Pollutant Discharge Elimination System
NSR	New Source Review
O	
O&M	operation and maintenance
OCI	Overall Condition Index
OFM	Washington State Office of Financial Management
OIT	Operator interface terminal
OPPC	Opinions of probable project cost
Orange Book	Washington State Department of Ecology's Criteria for Sewage Works Design
P	
PDF	Peak day flow – the largest volume of flow during a one-day period, expressed as a daily average
PER	Preliminary Engineering Report
PFAS	Per- and polyfluoroalkyl substances
PHF	Peak hour flow – the largest flow rate during a one-hour-period, over the metered time period
PIN	Personal identification number

Plan	General Sewer Plan Update
PLC	Programmable Logic Controllers
POTW	Publicly Owned Treatment Works
ppd	pounds per day
PSCAA	Puget Sound Clean Air Agency
PSD	Prevention of Significant Deterioration
PSNGP	Puget Sound Nutrient General Permit
PSRC	Puget Sound Regional Council
PVRV	Pressure and vacuum relief valve
R	
RAS	Return activated sludge
RCW	Revised Code of Washington
RDT	Rotary Drum Thickener
RNG	Renewable natural gas
S	
SCADA	Supervisory Control and Data Acquisition
SEPA	State Environmetal Policy Act
SERP	Washington State Environmental Review Process
SHPO	State Historic Preservation Officer
SIU	Significant industrial user
SOP	Standard Operating Procedure
SR	State Route
SRT	Solids retention time
SSO	Sanitary Sewer Overflow
SWDP	State waste discharge permit
T	
TAC	Toxic air contaminants
TAZ	Traffic Analysis Zones
TIN	Total Inorganic Nitrogen
TKN	Total Kjeldahl Nitrogen
TM	Technical Memorandums
TSS	Total suspended solids
TWAS	Thickened waste activated sludge
U	
UGA	Urban Growth Area
UOS	Unstable old landslides
UPC	Uniform Plumbing Code
UPS	Uninterruptible power supply
URS	Unstable recent slides
USACE	United States Army Corps of Engineers
UTA	Urban Transition Area
UV	Ultraviolet

UVT	UV transmittance
V	
VFD	variable frequency drive
VHF	Very high frequency
W	
WAC	Washington Administrative Code
WAS	Waste activated sludge
WRIA	Water Resource Inventory Area
WWTP	Wastewater Treatment Plant

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Executive Summary

ES.1 Introduction

Since the 1950s, Kitsap County (County) has worked to protect aquifers, surface water, and the Puget Sound by providing wastewater collection, treatment, and discharge. This Central Kitsap General Sewer Plan Update (Plan) provides a road map for the Central Kitsap service area's long-term wastewater infrastructure needs for the next 20 years. Planning the wastewater infrastructure needs of a dynamic and fast-growing region is challenging. Expanding populations in the County will require sewer service and the County will be responsible for appropriately collecting, conveying, and treating increasing wastewater flows. Infrastructure design and implementation will be strategically planned to maximize limited fiscal resources. Federal, State, and Locate regulations all contribute to a need to be on the cutting edge of emerging technologies and require the utility to continually think ahead. Planning at this level involves weighing a complicated array of interconnected—and often conflicting—factors and variables. This Plan provides a framework for the County to continue to manage growth within the context of a countywide wastewater service network and achieve the overall goal of providing sewerage service to protect public health and the quality of Kitsap and the Puget Sound's water resources.

The State of Washington adopted the Growth Management Act (GMA) with the intent of creating a consistent and unified growth planning process. The GMA requires that the County create and enact a Comprehensive Plan to provide a 20-year blueprint for local policy, planning and capital facility investment. A Comprehensive Plan is used as a guide for local governments through the establishment of vision statements, goals, objectives, policies, and implementing actions. This Plan constitutes the sewer capital facilities element of the Kitsap County Comprehensive Plan (KCCP). At the time of adoption, this Plan is consistent with the other elements of the KCCP.

This Plan is based on planning horizons of a six-year period (2023 to 2028), and a 20-year period (2029 to 2042). An updated KCCP is currently in progress and will cover a 20-year planning period from 2024 to 2044. Therefore, the recommendations and conclusions presented in this Plan have been reviewed to confirm alignment with the 2044 planning horizon of the KCCP.

This Plan is also aligned with the County's Water as a Resource policy, adopted in 2009 and reaffirmed in 2016. The Water as a Resource policy aims to conserve groundwater resources, restore the natural hydrologic flow in local streams and creeks, and reduce water pollution. Implementation of the projects presented in this Plan are a direct expression of the County's guiding principle to view water as a valuable resource worthy of protection and careful stewardship.

Organization of the Plan

The Plan is organized into twelve sections that cover the Central Kitsap wastewater system:

- Section 1: Introduction provides an overview of the Central Kitsap service area, ownership of the system, and contents of the Plan.
- Section 2: Service Area Characterization reviews the physical and administrative characteristics of the Central Kitsap wastewater collection basin.

- Section 3: Population, Flow, and Load Projections estimates the current sewer system population, analyzes the impact of projected population growth, and estimates future wastewater flows and loads within the Central Kitsap service area.
- Section 4: Regulatory Requirements identifies relevant federal, state, and local regulatory requirements that affect planning and operations of the wastewater system.
- Section 5: Collection and Conveyance Existing Conditions evaluates existing conditions of the system's gravity sewers, pump stations, and force mains based on site visits, video inspections of pipes, and discussion with County staff.
- Section 6: Wastewater Treatment Facilities Existing Conditions evaluates existing conditions of the Central Kitsap Wastewater Treatment Plant (WWTP) facilities, processes, and equipment based on site visits, discussion with plant operators, historical plant performance, and modeling of the plant processes.
- Section 7: Collection and Conveyance System Analysis analyzes sewer system capacity and alternatives for improvements to the system using a hydraulic model and evaluating system performance during a 25-year, 24-hour storm event.
- Section 8: Wastewater Treatment System Analysis analyzes improvements needed to maintain and upgrade the Central Kitsap WWTP based on condition deficiencies, capacity inadequacies, and regulatory requirements.
- Section 9: Recycled Water evaluates opportunities for recycled water reuse so that water treated at the Central Kitsap WWTP can be used for beneficial purposes instead of discharged to the Puget Sound.
- Section 10: Operations and Maintenance documents the County's management structure, details the wastewater system operation and maintenance practices, and makes suggestions to improve utility operation practices.
- Section 11: Capital Improvement Plan provides a 20-year plan for implementing capital improvement plan (CIP) projects that improve the operation of the collection and conveyance system and Central Kitsap WWTP.
- Section 12: Financial Strategy identifies financial approaches to fund the CIP.

General Sewer Plan Requirements

This Plan meets the Washington State Department of Ecology (Ecology) regulations for general sewer plans contained in the Washington Administrative Code (WAC) 173-240-050. **Table ES-1** summarizes the requirements and the sections in the 2024 CSP where the requirements are addressed.

Table ES-1 | WAC 173-240-050 Requirements

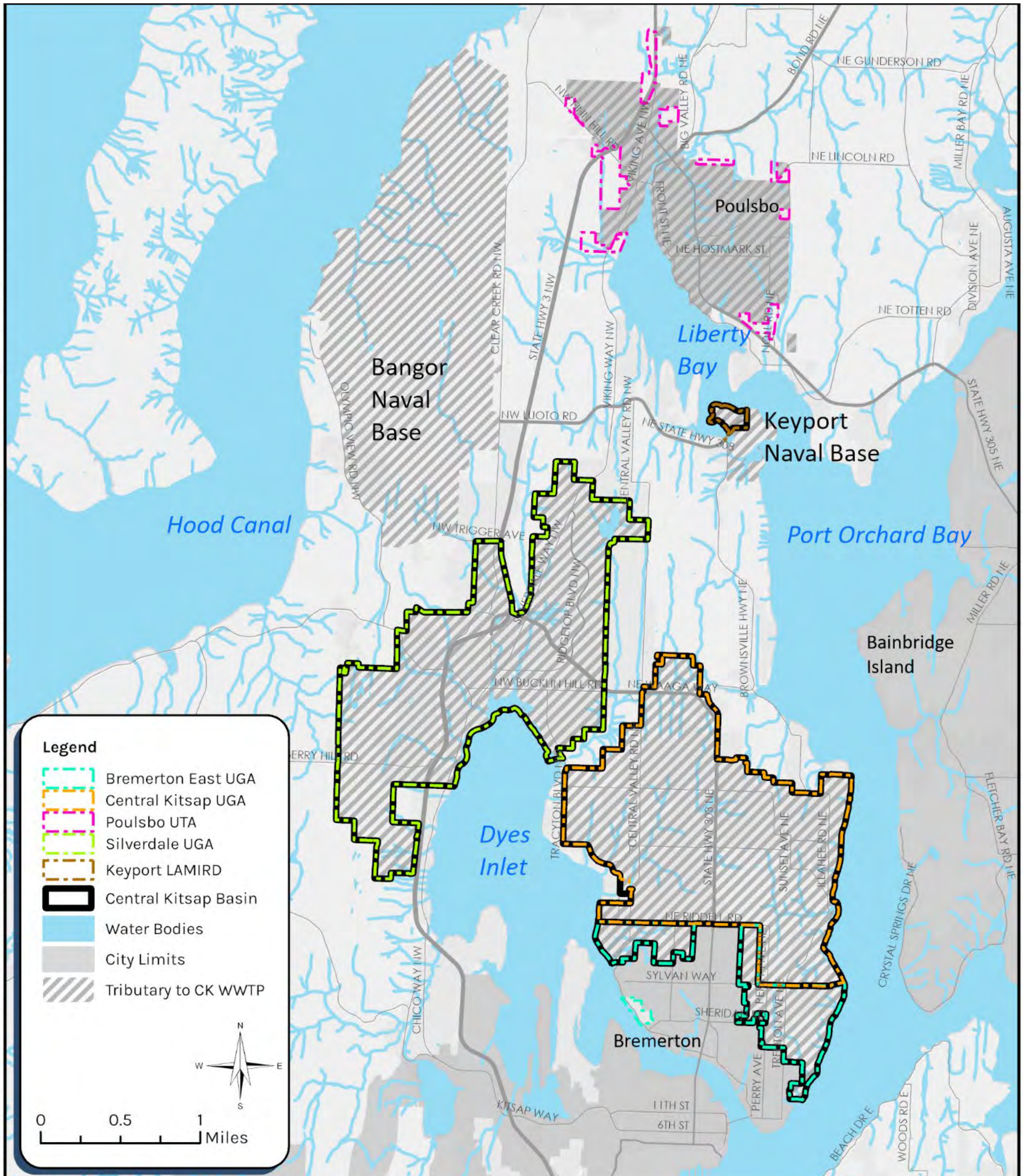
Section	Section Description	Location in Plan
3.a	The purpose and need for the proposed plan.	Section 1.2
3.b	A discussion of who will own, operate, and maintain the systems.	Section 1.5
3.c	The existing and proposed service boundaries.	Figure 2-1
3.d.i	Boundaries. The boundary lines of the municipality or special district to be sewered, including a vicinity map;	Figure 2-1
3.d.ii	Existing sewers. The location, size, slope, capacity, direction of flow of all existing trunk sewers, and the boundaries of the areas served by each;	Section 5 and Section 6

Section	Section Description	Location in Plan
3.d.iii	Proposed sewers. The location, size, slope, capacity, direction of flow of all proposed trunk sewers, and the boundaries of the areas to be served by each;	Section 11
3.d.iv	Existing and proposed pump stations and force mains. The location of all existing and proposed pumping stations and force mains, designated to distinguish between those existing and proposed;	Section 5, Section 11
3.d.v	Topography and elevations. Topography showing pertinent ground elevations and surface drainage must be included, as well as proposed and existing streets;	Figure 2-2
3.d.vi	Streams, lakes, and other bodies of water. The location and direction of flow of major streams, the high and low elevations of water surfaces at sewer outlets, and controlled overflows, if any. All existing and potential discharge locations should be noted;	Figure 2-4
3.d.vii	Water systems. The location of wells or other sources of water supply, water storage reservoirs and treatment plants, and water transmission facilities.	Figure 2-5
3.e	The population trend as indicated by available records, and the estimated future population for the stated design period. Briefly describe the method used to determine future population trends and the concurrence of any applicable local or regional planning agencies.	Section 3
3.f	Any existing domestic or industrial wastewater facilities within twenty miles of the general plan area and within the same topographical drainage basin containing the general plan area.	Figure 1-1
3.g	A discussion of any infiltration and inflow problems and a discussion of actions that will alleviate these problems in the future.	Section 3.4.3
3.h	A statement regarding provisions for treatment and discussion of the adequacy of the treatment.	Section 6
3.i	List of all establishments producing industrial wastewater, the quantity of wastewater and periods of production, and the character of the industrial wastewater insofar as it may affect the sewer system or treatment plant. Consideration must be given to future industrial expansion.	Section 4
3.j	Discussion of the location of all existing private and public wells, or other sources of water supply, and distribution structures as they are related to both existing and proposed domestic wastewater treatment facilities.	Figure 2-5
3.k	Discussion of the various alternatives evaluated, and a determination of the alternative chosen, if applicable.	Section 7 and Section 8
3.l	A discussion, including a table, that shows the cost per service in terms of both debt service and operation and maintenance costs, of all facilities (existing and proposed) during the planning period.	Section 10, Section 11, and Section 12
3.m	A statement regarding compliance with any adopted water quality management plan under the Federal Water Pollution Control Act as amended.	Section 4
3.n	A statement regarding compliance with the State Environmental Policy Act (SEPA) and the National Environmental Policy Act (NEPA), if applicable.	Section 4

ES.2 Service Area Characterization

The County provides sewer service to several areas within the Central Kitsap basin. The Central Kitsap basin map is shown in **Figure ES-1**, with the sewer tributary areas identified. The Central Kitsap basin spans approximately 12,700 acres and is bounded on the east by Port Orchard Bay and on the southwest by Dyes Inlet. The basin is bordered to the north and west by unincorporated rural residential areas and parks. The primary land use in the basin is residential with some areas of commercial development.

Figure ES-1 | Central Kitsap Basin Map



Data Sources: Kitsap County, WA DNR Base Layer Credits: World Light Gray Canvas Base: County of Kitsap, Bureau of Land Management, Esri, HERE, Garmin, USGS, EPA, NPS
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Central Kitsap General Sewer Plan Update

Central Kitsap Basin Map

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The County has established Urban Growth Area (UGA) boundaries, land use designations, and zoning in accordance with the GMA. Urban level services, including sewer service, are not currently allowed outside of the UGA with limited exceptions. The County owns and maintains the sewer collection system that provides service to Central Kitsap UGA, Silverdale UGA, and a portion of Bremerton East UGA. The system also receives flows from the collection systems owned and operated by the City of Poulsbo, and the Bangor and Keyport United States Naval Bases. The County owned portions of the collection system include approximately 670,000 feet of gravity pipe, 189,000 feet of force main pipe, and 45 pump stations. All sewer flows within the basin are conveyed and treated at the Central Kitsap WWTP.

ES.3 Population, Load, and Flow Projections

Current population and population growth are critical factors when considering required capacity and potential upgrades to the sewer system since sewer flows and population are closely linked.

The current sewered population in the Central Kitsap basin was estimated based on an average of 2.5 people per equivalent residential unit (ERU). An ERU is a system specific unit of measure used to estimate wastewater volumes in the system based on the flow produced by an average single-family household. Sewer permit and ERU data is not available in the Bangor Naval Base, Keyport Naval Base, and City of Poulsbo, so information from Puget Sound Regional Council (PSRC) and the City of Poulsbo was used to estimate the population for these areas.

Growth is presumed to occur within the UGAs and Urban Transition Areas (UTAs) according to the land use designations and zoning in the 2016 KCCP. This Sewer Plan, at the time of writing, is in alignment with the County's Comprehensive Plan and is able to support the growth strategies described therein. Future population growth for the City of Poulsbo is estimated to increase at a rate of 2.5 percent, based on planning data provided by the City from their draft 2024 Comprehensive Plan Update. The growth rate for all other areas within the Central Kitsap basin was provided by PSRC and is estimated at 3.3 percent. The total current and projected populations for the sewered areas in Central Kitsap Basin are summarized in **Table ES-2**. Additionally, the Kitsap County Department of Community Development (DCD) prepared population projections as part of their update to the Comprehensive Plan. These were compared to and are consistent with the projections presented in this Plan.

Table ES-2 | Central Kitsap Basin Current and Projected Sewered Population

Year	Sewered Population
2020	57,939
2028	66,580
2042	89,508
2044	92,783*

Note:
*Extrapolated from 2042 population

Wastewater flows and loadings heavily influence WWTP facility design. Consequently, data related to wastewater characteristics and projected flows and loadings affect the selection of key criteria used to select project alternatives for further consideration. The existing sewer flows and loads at Central Kitsap WWTP were evaluated from January 2016 through June 2020 and correlated to current population to develop per capita values. Then, future flows and loads were estimated based on the anticipated population growth. The existing and projected flows and loads for the Central Kitsap WWTP over the 20-year planning horizon are presented as **Table ES-3** and **Table ES-4**. Consistent with Ecology guidelines, flows are developed for average annual flow (AAF), maximum month wet weather flow (MMWWF), maximum month dry weather flow (MMDWF), peak day flow (PDF), and peak hour flow (PHF). Loads are developed for biochemical oxygen demand (BOD), total suspended solids (TSS), and total Kjeldahl nitrogen (TKN).

Table ES-3 | Central Kitsap WWTP Current and Projected Flows

Flow Event	2020	2028	2042
AAF (MGD)	3.50	4.0	5.4
MMWWF (MGD)	4.93	5.7	7.6
MMDWF (MGD)	4.00	4.6	6.2
PDF (MGD)	8.55	9.9	13.2
PHF (MGD)	14.0	16.2	21.6

Note:
MGD = million gallons per day

Table ES-4 | Central Kitsap WWTP Current and Projected Loads

Parameter	2020			2028			2042		
	AA	MMWW	MMDW	AA	MMWW	MMDW	AA	MMWW	MMDW
BOD (ppd)	8,817	10,116	10,128	10,132	11,624	11,638	13,622	15,627	15,646
TSS (ppd)	7,924	9,924	9,106	9,106	11,404	10,464	12,242	15,331	14,067
TKN (ppd)	1,421	1,635	1,586	1,634	1,879	1,823	2,197	2,526	2,450

Note:
ppd = pounds per day

ES.4 Regulatory Requirements

Collection, conveyance, and treatment facilities operation, design, and construction are regulated through federal, state, County, and local regulations. The regulations are detailed in **Section 4**.

The National Pollutant Discharge Elimination System (NPDES) program, administered by Ecology, is the primary permit for Central Kitsap WWTP, which has been issued NPDES Permit No. WA0030520. The permit went into effect in 2017, was set to expire in 2022, was administratively continued, and remains in effect as of the date of this Plan. The permit includes limits on plant capacity and treated effluent discharge, solids disposal requirements, monitoring requirements, recordkeeping and reporting criteria, and operation and maintenance requirements.

In addition, Ecology recently issued the first Puget Sound Nutrient General Permit (PSNGP), effective as of Jan. 1, 2022. The Central Kitsap WWTP is classified as a moderate total inorganic nitrogen (TIN) load plant and is required to implement nutrient monitoring and reporting, develop a nutrient optimization plan, conduct a nutrient reduction evaluation, and comply with action level exceedance corrective actions if nutrient discharge limits are exceeded. Ensuring compliance with the new PSNGP and developing options for anticipated future nutrient permit requirements is a key focus of the Central Kitsap WWTP condition assessment and alternative analyses.

Central Kitsap WWTP also has coverage under the Statewide General Permit for Biosolids Management as an 'Active Biosolids Management' program and an Industrial Stormwater Discharge General Permit for discharge of stormwater from the WWTP site.

ES.5 Collection and Conveyance Existing Conditions

The Central Kitsap basin collection and conveyance system is comprised of sewer assets owned and operated by the County within the Central Kitsap and Silverdale UGAs, and County facilities serving the City of Poulsbo, and the Bangor and Keyport Naval Bases. The Central Kitsap collection and conveyance system is shown in **Figure ES-2.** A detailed review of the existing collection and conveyance system is provided in **Section 5**.

The Central Kitsap collection and conveyance system is comprised of two service areas defined as the Northern and Southern Service Areas. The Northern Service Area consists of the Keyport Naval Base, Bangor Naval Base, and the City of Poulsbo. The Northern Service Area's flows are routed through PS-17, PS-24, PS-64, and PS-67. Flows from all pump stations combine into a 24-inch diameter force main and discharge at Central Kitsap WWTP.

The Southern Service Area is divided into two primary basins, each defined by the UGA for which they serve. The Silverdale basin includes 14 pump stations encompassed within the Silverdale UGA boundary and the outlying Pump Stations 13, 14, and 68. The Central Kitsap basin is defined by the Central Kitsap UGA boundary and includes 22 pump stations. Flows from all pump stations within the Southern Service Area ultimately combine into a 30-inch diameter pipe that discharges at Central Kitsap WWTP.

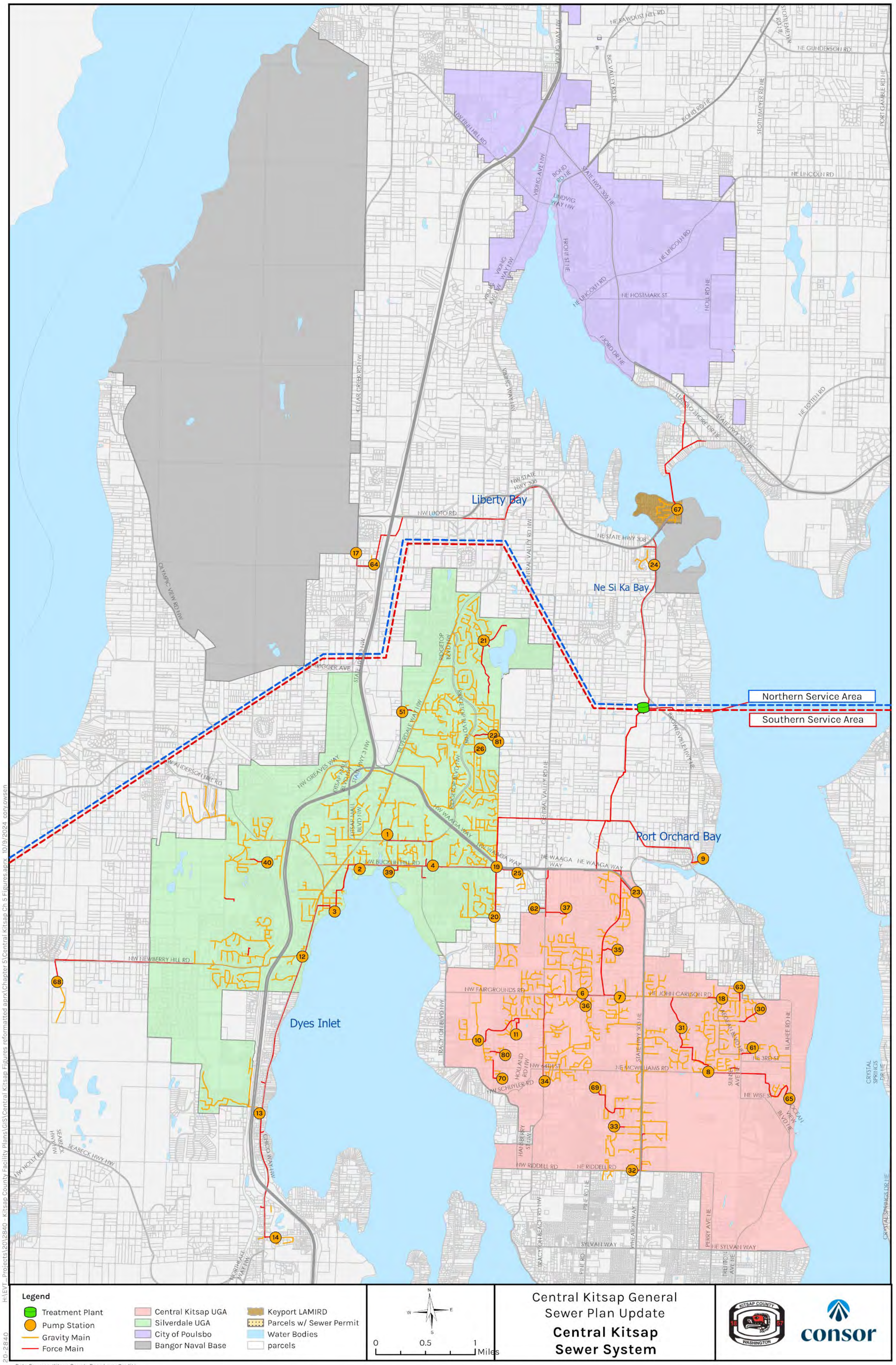
There is approximately 670,000 feet of gravity pipe in the Central Kitsap collection system, not including the upstream systems that are owned and operated by the City of Poulsbo, Bangor Naval Base, or Keyport Naval Base. The County owns most of the pipes, 91 percent of which are 8-inch diameter. Approximately 13,000 feet are owned by private users. There are approximately 189,000 feet of sewer force mains that convey pumped wastewater. The system also includes three inverted siphons.

There were 43 conventional pump stations owned and operated by the County within the Central Kitsap sewer system at the end of 2020 with flow capacity ranging from 40 to 6,400 gallons per minute (gpm). The County classifies their pump stations as Critical, Regional, Relay, or Satellite pump stations based on how many mini-basins (or upstream pump stations) discharge into the pump station. **Table ES-5** shows the classification and number of pump stations in the Central Kitsap basin. Pump station capacity typically increases from about 200 gpm for satellite stations to about 3,000 gpm for the critical pump stations.

Table ES-5 | Pump Station Type Consequence of Failure Definitions

Pump Station Type (from County)	Tributary Pump Stations	Number of Pump Stations in Central Kitsap Basin
Satellite	0	28
Relay	1	4
Regional	2-3	3
Critical	4+	8

Figure ES-2 | Central Kitsap Sewer System



Data Sources: Kitsap County Base Layer Credits:
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A condition evaluation of all of the County owned pump stations was conducted. The evaluations did not include pump stations that are new, upgraded after 2020, or are currently in design or construction. To better inform the County's prioritization of future asset upgrades and replacements, an overall pump station "Asset Health" score was developed that synthesizes each pump station's existing likelihood of failure (condition) and consequence of failure (CoF) (criticality). Each criterion is rated on a 1 to 5 scale where higher numbers indicate worse condition and high criticality, then the scores are multiplied together to get the overall Asset Health score (potential range from 1 to 25). The resulting scores ranged from 3.2 to 15.5, with five pump stations rating higher than 10, 23 pumps stations rated between five and 10, five pump stations rated below five, and 12 pump stations not rated due to recent or current rebuild or replacement activity.

The County has historically conducted pipeline condition assessments through video observation with the ability to examine the entire conveyance system in a 5-year cycle. This process entails inspecting pipes via closed circuit television (CCTV), storing the video in a database, reviewing the video, and assigning an Overall Condition Index (OCI) score based on the observations. The OCI score ranges from 0 to 100 with higher numbers indicating better condition. The criteria that are scored for the OCI score are:

- Obstruction or Intrusion
- Worn Surface
- Belly or Sag in Pipe
- Crack or Fracture
- Break or Failure
- Lining or Repair Failure
- Joint Separation or Offset

The lengths of pipe in each OCI range are summarized in **Table ES-6**. Overall, most of the system is in good condition. There are approximately 12,200 feet of pipe with moderate or severe condition issues.

Table ES-6 | Summary of Pipes OCI Scores

OCI Range	Length (ft)	Percentage of Total
0-20	-	0%
20-40	-	0%
40-60	3,300	<1%
60-80	8,900	1%
80-99	81,800	12%
100	575,700	86%

ES.6 Wastewater Treatment Facilities Existing Conditions

The Central Kitsap WWTP is the sewer utility's flagship facility and it provides treatment of sewer flows for much of the Central Kitsap areas, as well as solids treatment from the Counties' three other WWTPs (Kingston, Suquamish, and Manchester WWTPs), and hauled septage and fats, oils, and grease (FOG) treatment from community members in the region who are not connected to the sewer system. The WWTP began operation in 1979 and portions of the plant were upgraded in 1996, 1999, 2009, and 2016, but many portions of the plant still rely on original equipment that is nearly 50 years old. The plant is a biological nutrient removal (BNR) facility with a rated maximum month flow rate capacity of 6.0 MGD. The Central Kitsap WWTP site plan is shown in **Figure ES-3** with major structures and processes identified. The plant is located on Brownsville Highway NE, between State Route (SR) 303 and SR 308. In addition to the 49-acre lot that the Central Kitsap WWTP is located on, the Sewer Utility Division also owns undeveloped lots to the north and south, although development of the lots is limited by existing wetlands, and unconfirmed seasonal streams, particularly along the western boundary.

The Central Kitsap WWTP's liquid stream processes consist of headworks, primary clarifiers, aeration basins, secondary clarifiers, and ultraviolet (UV) disinfection. Solids, including those hauled from the County's other WWTPs, are thickened and digested anaerobically before dewatering and disposal. The Central Kitsap WWTP also receives a large quantity of hauled FOG from septic tank pumping companies and is the only WWTP in the County that accepts septage. These waste streams are incorporated with the solids treatment processes at the plan for treatment and disposal. The County currently works with the Kitsap Public Health District to provide a local option for treatment of septage at the Central Kitsap WWTP for residents with septic tanks, providing a reasonably accessible disposal option. CKTP is expected to remain a discharge location for the community however, may be re-evaluated during the defined planning period of this General Plan.

The treated effluent from the Central Kitsap WWTP is discharged to Port Orchard Bay in Puget Sound in accordance with the NPDES Permit. Treated solids from the plant are hauled to Natural Selections Farms in Yakima County, where they are land applied in accordance with beneficial reuse regulations.

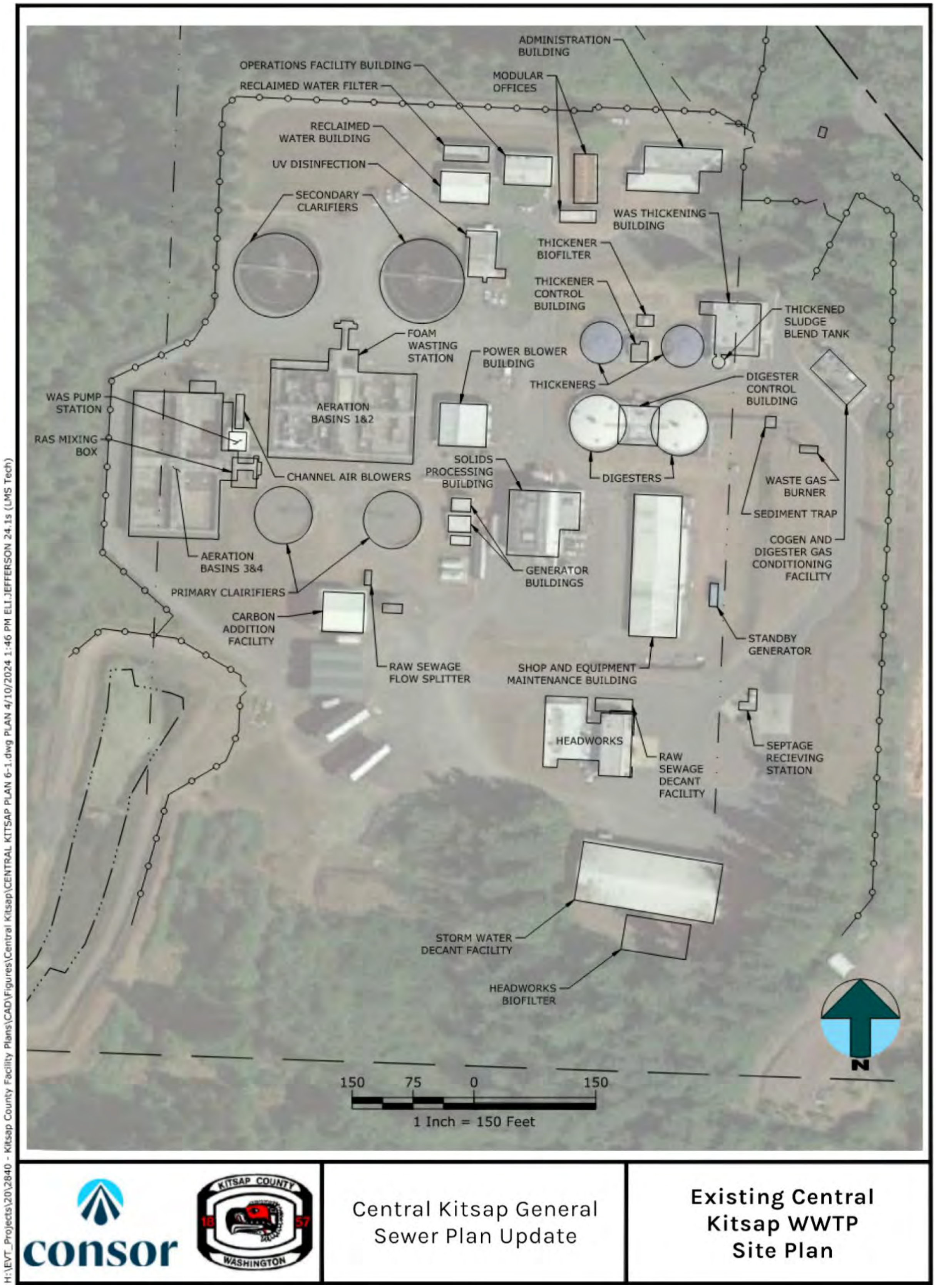
Evaluations of the capacity and condition of the Central Kitsap WWTP were conducted. The process involved a site review of equipment, facilities, processes, discussions with Central Kitsap WWTP staff to understand operational issues, and analysis and modeling.

The condition evaluation led to the development of overall unit process "Asset Health" scores, using the same method as the pump stations, to synthesize the likelihood of failure (condition) and CoF (criticality). Each criterion is rated on a 1 to 5 scale where higher numbers indicate worse condition and high criticality, then the scores are multiplied together to get the overall Asset Health score (potential range from 1 to 25). Primary treatment scores ranged from 2 to 19. Gravity thickening and anaerobic digestion scored higher than a 10, which indicates these systems are generally in poor condition and require upgrades and/or rehabilitation to continue effective and reliable operation. Secondary treatment, septage, dewatering, power distribution, and miscellaneous support systems scored between 5 and 10, indicating moderate upgrades may be necessary. All other processes are in good condition and scored below 5.

A Visual Hydraulics© model was created to determine the hydraulic capacity and a Biowin© biological process model was used to evaluate the biological capacity of the of the existing Central Kitsap WWTP and unit processes. Model results indicated that several unit processes will need significant improvements within the 20-year planning period to alleviate hydraulic or biological limitations and continue proper operation:

- Additional primary clarifier capacity
- Additional secondary clarifier capacity
- Additional septage receiving capacity
- Replacement of gravity thickeners
- Additional anaerobic digester capacity and rehabilitation of existing digesters

Figure ES-3 | Existing Central Kitsap WWTP Site Plan



ES.7 Collection and Conveyance System Analysis

The Central Kitsap collection and conveyance system was previously modeled using the Danish Hydraulic Institute's (DHI's) MIKE URBAN 2019 and documented in the *Silverdale Pump Stations 3, 4, 19 and 31 Upgrades Preliminary Engineering Report* (PER) prepared by BHC Consultants (BHC, 2020) (**Appendix A**). The model was used to analyze the system capacity using a PHF condition of a 25-year, 24-hour storm for the 2017, 2038 and build-out planning horizons. Buildout assumed that all developable properties withing the UGA have developed per zoning and discharge to County sewer and is not assumed to occur within the 20-year planning horizon of 2044.

Manholes, pipes, and pump stations were analyzed for deficiencies using the results of the BHC model. Manholes are considered to have sanitary sewer overflows (SSOs) when the simulated water surface elevation in a manhole exceeds the rim elevation. Pipes are considered surcharged when the simulated water surface elevation in the upstream or downstream manhole connection exceeds the pipe crown. Pump stations are under capacity when the simulated flow to a pump station meets or exceeds the pump station firm capacity which is the station capacity with the largest pump out of service.

The total SSO count and surcharged gravity pipes are included in **Table ES-7**. Detailed maps can be found in **Section 7**. The results indicate that all pump stations have sufficient firm capacity in the 2017 model scenario, four pump stations (PS-4, PS-12, PS-24, and PS-65) have insufficient firm capacity in the 2038 planning horizon, and fourteen pump stations (PS-2, PS-3, PS-4, PS-10, PS-12, PS-21, PS-24, PS-31, PS-32, PS-34, PS-35, PS-36, PS-65, and PS-69) have insufficient firm capacity at build-out.

Table ES-7 | Pipe and Manhole Capacity Criteria

Scenario	Surface Sewer Overflows (SSO)	Number of Pipes Surcharged (Either end)
2017	0	76
2038	1	114
Build-Out	22	279

ES.8 Wastewater Treatment System Analysis

The results from the WWTP Existing Conditions analysis were used to identify processes that require improvement and define feasible alternatives for the 6-year and 20-year planning horizons. The primary alternative analyses of process improvements at Central Kitsap WWTP were completed as part of the Plan and summarized in two technical memoranda (TMs): *Central Kitsap WWTP Solids Handling Improvement Recommendations* (Murraysmith [now Consor], 2022, **Appendix N**) covers all of the solids treatment processes and *Summary of Field Testing of Biological Nutrient Removal Optimization* (HDR, 2022, **Appendix K**) covers the secondary treatment processes. Minor maintenance, repairs, and direct replacements are not subject to a full alternatives analysis due to the relatively simple nature of replacements or expansions.

Preliminary Treatment

The preliminary treatment system was put into service in 2011 and is generally in good condition with adequate capacity. The following improvements are recommended:

- Replacing the manual bar screen.

- Improving the heating, ventilation, and air conditioning (HVAC) system in the headworks facility to provide more ventilation.

Primary Treatment

The primary clarifiers were constructed in 1977, and the flow splitter structure and primary sludge pumps were replaced in 2011. The clarifiers are in fair condition and will require equipment replacement due to age and the need for additional capacity as flows to the plant increase. Installing an additional primary clarifier or replacing the existing clarifiers to provide additional capacity, installing associated primary sludge pump(s), and replacing aging scum pumps is recommended.

Secondary Treatment

The existing secondary treatment process was converted to a BNR process in 2016 but was not optimized for nitrogen removal and continued to operate as a conventional activated sludge process with simple aeration control and no nitrogen monitoring. The system was upgraded, 're-commissioned,' and optimized in 2022 as part of the work completed in support of this Plan to provide better nutrient removal and assess the ability to meet nitrogen removal requirements. This effort is documented in Appendix K. It was concluded that the secondary treatment process can meet current PSNGP requirements when fully optimized; therefore, it is recommended to continue optimization. Additionally, components of the secondary treatment will need to be replaced as equipment ages and/or expanded to provide additional capacity. The following secondary treatment improvements and optimization efforts are recommended:

- Continue BNR operation in warmer months through the next winter and summer to gain additional data and operational experience for refinement of operating protocols and control programming. Continue to test optimal ammonium/nitrate set points to determine optimal operating procedures.
- Construct a centrate flow equalization tank to more evenly meter loads to the aeration basins to provide stability to BNR operation and improve overall average effluent TIN.
- Further test the internal mixed liquor recycle (IMLR) and methanol automated feed methods to further optimize performance.
- Conduct an engineering study of the influent hydraulic box and implement modifications to facilitate adequate mixing of the return activated sludge (RAS) and primary effluent is achieved.
- Implement fully automated flow pacing of the RAS pumping system.
- Add a second methanol storage tank to provide greater flexibility and efficiency of methanol dosing.
- Conduct an engineering study of the aeration distribution system to review flow meters, control valve sizing and locations, and the air distribution network.
- Replace the existing centrifugal blowers with high-speed turbo blowers to provide additional capacity.
- Upgrade wet chemistry analyzers such as the Amtax and Nitratax (manufactured by Hach) to improve low TIN concentration resolution.
- Conduct step-feed field testing to determine if this will provide improved performance.

- Install Aeration Basins 5 and 6 if TIN permit requirements, recycled water use, and plant flows require additional capacity.
- Add sidestream treatment to provide greater TIN removal and improve process efficiency.
- Construct an additional secondary clarifier to provide sufficient capacity. Additionally, replace the existing secondary clarifiers' walkways and drives and RAS pumps at the same time.

Solids Treatment

The existing solid treatment infrastructure and equipment are aging and require replacement or rehabilitation, as reported in **Section 6**. Liquid hauled waste receiving, primary sludge and WAS thickening, anaerobic digestion, and dewatering were further discussed in **Appendix N**, which references two other TMs, the *Liquid Hauled Waste Study* (Murraysmith [now Consor], 2022, **Appendix O**) and the *Class A Biosolids Evaluation* (Murraysmith [now Consor], 2022, **Appendix P**).

As part of **Appendix O**, five alternatives were developed and analyzed for thickening, treatment, and dewatering of both LHW and waste activated sludge (WAS). LHW consists of thickened WAS (TWAS) from the County's Kingston, Manchester, and Suquamish WWTPs, septage, and FOG. Three alternatives were developed and analyzed for solids treatment and disposal as part of **Appendix P**.

Design is currently underway for replacement or expansion of several related components of the solids and LHW treatment processes, based on the approaches recommended in **Appendix O** and **Appendix P**. These improvements are being called the "Solids and Liquid Hauled Waste Upgrades" and include:

- Constructing a new FOG receiving station.
- Constructing a new septage receiving station and replacing the septage pumps.
- Replacing existing septage grit cyclone and classifier.
- Replacing primary sludge and septage thickening with new thickening equipment.
- Constructing new anaerobic digester(s) with approximately 1.3 million gallons (MG) of capacity.
- Replacing existing in-plant pump station.
- Replacing the existing digester hot water system in conjunction with the new digester construction.

The following solids treatment improvements are recommended for future implementation:

- Rehabilitating or replacing the existing anaerobic digesters after the new digesters are in operation.
- Replacing existing scum grinder and pumps.
- Replacing centrifuge sludge feed grinders.
- Restarting the biogas treatment and cogeneration system.
- Replacing centrate pumps.
- Replacing centrifuge feed pumps.
- Replacing digester withdrawal pumps.

Non-Potable Water System and Process Water Systems

Some equipment related to these systems will require in-kind replacement due to age and/or condition.

Odor Control System

The gravity thickener odor control system should be replaced opportunistically in conjunction with other work on the primary sludge and septage thickening processes. The preferred approach for odor control may vary depending on thickening process and should be evaluated during design of the process.

Electrical and Power Distribution System

Transformer repairs, replacement of the main switchgear, a process and load study, and replacement of select electrical panels are needed. Additionally, the County has recently completed a series of Supervisory Control and Data Acquisition (SCADA) Master Plan TMs (HDR, 2022) (**Appendix D**) that include an overview of the existing SCADA system, review of use and needs, selection of preferred technologies, and a project identification, estimate, and CIP.

ES.9 Recycled Water

Recycling treated wastewater can provide numerous benefits, including conservation of limited groundwater resources, reduction of effluent discharge to the Puget Sound, and replenishment of streams and fish habitat. Use of recycled water to replace the use of potable water for nonpotable purposes, such as irrigation, toilet flushing, reduces the stress on area groundwater and supports sustainable management of that limited resource. Over the past decade, recycled water planning activities have been conducted and improvements have been made to the Central Kitsap WWTP that allow the plant to produce recycled water. The distribution system, however, has not been fully developed, therefore no recycled water is currently being produced.

Section 9 discusses and considers the following specific potential uses:

- Silverdale Water District (District) is a primary potential distributor of recycled water produced at the Central Kitsap WWTP. In total, the customers represent approximately 433,000 gallons per day (gpd) of use during the irrigation season. A 20-year forecast of District demands for these uses is approximately 520,000 gpd during peak irrigation season (433,000 gpd with 20 percent increase, assuming half of projected rate of growth in overall water demand). Many recent new construction projects have already installed recycled water infrastructure in anticipation of recycled water supply from the District. The District has plans to further explore a wider range of recycled water uses, including groundwater recharge to sustain the utility's underlying source of water supply.

- A potential year-round application of recycled water is stream augmentation through infiltration. In total, an estimated flow of 0.5 MGD could be used to provide 560 acre-feet per year of streamflow benefit to multiple creeks.

Other recycled water uses are considered, but at a high-level analysis indicated that none are currently feasible.

To support production of recycled water, a re-evaluation of chlorination and UV disinfection options to meet Class A recycled water performance standards was conducted. Based on the analysis, it is recommended that the County consider employing UV disinfection to meet long-term recycled water objectives. End users, e.g. the District, would then provide booster chlorination at distribution system facilities to meet residual chlorine requirements. A phased approach is recommended for implementation, comprised of:

- **Near-term (to meet demands in approximately five years)**. Use of chlorination, with recycled water generated when the Central Kitsap WWTP is operating in BNR mode and potentially only on non-dewatering days to avoid significant increases in ammonia concentration and support a 30-minute chorine contact time. Storage located in the distribution system would be constructed by the District to equalize the recycled water flow to the distribution system during times when recycled water is not being generated. Needed improvements implemented by the County include a short section of new recycled water piping, insertion of a motorized control valve, and an additional chlorine residual meter.

- **Longer-term (to meet demands beyond five years)**. Implementation of UV disinfection to avoid the need for dechlorination and for additional contact time storage beyond that which can be provided by the existing transmission piping. Longer-term items are not recommended until the magnitude and timing of future demands are known.

The County and the District are now coordinating closely to prepare a joint Recycled Water Master Plan to provide the additional analysis needed to finalize the plan for the infrastructure needed by both the County and the District to complete the production and distribution of recycled water. This plan is expected to be completed by 2026.

ES.10 Operations and Maintenance

Section 10 includes a summary of the operations and maintenance (O&M) programs for the collection and conveyance system, and the Central Kitsap WWTP. A review of State and Federal requirements that impact the County's O&M program are also included in **Section 10**.

The County's Sewer Utility Division consists of four main work groups: Utilities O&M (WWTPs and pump stations), Field Operations (collection system piping), Engineering and Administration, and Construction Management. A total of 72 staff work in the Sewer Utility Division and oversee O&M across each of the County's four wastewater systems. O&M activities include regular inspection of pump stations, cleaning and inspection of pipes, preventative maintenance of WWTP equipment, ongoing records management for all components of the system, and review and updates to the WWTPs operation and maintenance manual.

A staffing analysis was conducted for the collection and conveyance system and Central Kitsap WWTP and determined that staffing levels and certifications are appropriate and adequate for current operations. As system flows increase, additional staffing may be needed.

Conclusions and recommendations based on a review of the County O&M practices are:

- Train and certify CCTV operators in National Association of Sewer Service Companies (NASSCO) assessment to improve the consistency of sewer inspecting ratings.

- Review spare parts inventories and assess the need for additional spare parts due to supply chain challenges.

- Institute an annual valve exercising and maintenance program.

- Develop a training program to accelerate employees into Operator Certification Group III and prepare for anticipated Puget Sound nutrient reduction goals and facility upgrades.

- Institute an Arc-Flash Analysis and Protection program and incorporate as capital projects are designed and constructed.

ES.11 Capital Improvement Plan

The CIP projects were developed to remedy existing system deficiencies, address regulatory requirements, and provide adequate capacity for projected flows and loads. CIP projects to address immediate needs are presented in a 6-year planning horizon (from 2023 to 2028) and future CIP projects are included in the 20-year planning horizon (from 2029 to 2042). A planning level cost opinion of CIP project implementation is provided. It is assumed that minor projects will be completed with O&M budget, therefore they are not included in the CIP. CIP projects for the 6-year and 20-year planning horizons are presented in **Table ES-8** through **Table ES-11**. A preliminary implementation timeline of the CIP is provided in **Section 11**.

Table ES-8 | 6-Year Central Kitsap Collection and Conveyance Capital Improvement Plan

CIP No.	Project	Total Project Cost
CIP-CK-CC-CAP-2	Replace PS-4 and Forcemain	$13,200,000
CIP-CK-CC-CAP-3	Upgrade PS-24	$7,300,000
CIP-CK-CC-CAP-8	Lemolo Inverted Siphon Upgrades	$0[1]
CIP-CK-CC-CAP-9	Johnson to Norum Pipeline	$0[1]
	Total	**$20,500,000**

Note:
1. The Lemolo Peninsula Sewer and Inverted Siphon Improvements ($8,100,000 in 2024 dollars) and Johnson to Norum Pipeline projects are funded entirely by the City of Poulsbo and are County owned projects. Therefore, they are not included in CIP.

Table ES-9 | 20-Year Central Kitsap Collection and Conveyance Capital Improvement Plan

CIP No.	Project	Total Project Cost
CIP-CK-CC-CAP-1[1]	Replace PS-3	$7,800,000
CIP-CK-CC-OM-4[1]	Replace PS-36	$1,900,000
CIP-CK-CC-OM-5[1]	Upgrade PS-11	$760,000
CIP-CK-CC-OM-6[1]	Upgrade PS-33	$240,000
CIP-CK-CC-CAP-7[1]	Northern Old Military Road Sewer Upgrades	$12,200,000
CIP-CK-CC-OM-11	Replace PS-13	$3,200,000
CIP-CK-CC-CAP-12	Replace PS-12	$7,600,000
CIP-CK-CC-CAP-13	Replace PS-34	$7,600,000
CIP-CK-CC-OM-14	Upgrade PS-22	$360,000
CIP-CK-CC-OM-15	Replace PS-32	$1,900,000
CIP-CK-CC-OM-16	Replace PS-2	$2,800,000
CIP-CK-CC-OM-17	Replace PS-37	$1,900,000
CIP-CK-CC-OM-18	Upgrade PS-40	$240,000
CIP-CK-CC-OM-19	Upgrade PS-35	$1,200,000
CIP-CK-CC-OM-20	Upgrade PS-9	$260,000
CIP-CK-CC-OM-21	Replace PS-65	$3,000,000
CIP-CK-CC-OM-22	Upgrade PS-26	$250,000
CIP-CK-CC-OM-23	Upgrade PS-30	$1,200,000

CIP No.	Project	Total Project Cost
CIP-CK-CC-OM-24	Upgrade PS-20	$660,000
CIP-CK-CC-OM-25	Upgrade PS-61	$1,090,000
CIP-CK-CC-CAP-26	Replace PS-69	$1,900,000
CIP-CK-CC-DEV-27	Anderson Hill Sewer Upgrades	$5,500,000
CIP-CK-CC-DEV-28	Dickey Road Sewer Upgrades	$3,800,000
CIP-CK-CC-CAP-29	Myhre Road Sewer Upgrades	$3,700,000
CIP-CK-CC-OM-30	Annual Pipe Replacement	$56,000,000
	Total	**$127,060,000**

Note:
1. If funding becomes available, this project should be considered in the 6-year CIP.

Table ES-10 | 6-Year Central Kitsap WWTP Capital Improvement Plan

CIP No.	Project	Total Project Cost
CIP-CK-WWTP-CAP-1[1]	Solids and LHW Upgrades (in design)	$ 140,000,000
CIP-CK-WWTP-REG-2	Construct Third Secondary Clarifier and Replace RAS Pumps	$ 9,900,000
CIP-CK-WWTP-REG-3[1]	Centrate Equalization	$ 0
CIP-CK-WWTP-REG-5[1]	Methanol Storage	$ 0
CIP-CK-WWTP-OB-6[1]	Existing Anaerobic Digester Rehabilitation	$ 0
CIP-CK-WWTP-OB-7[1]	Replace Main Switchgear	$ 0
CIP-CK-WWTP-OB-8[1]	Replace SWGR-2960 ATS-1	$ 0
CIP-CK-WWTP-CAP-19[1]	Conduct Process Load Study and Assess Generator Needs	$ 0
CIP-CK-WWTP-OB-10[1]	Replace Utilidor Panel 1990 and Septage Panel 5012	$ 0
CIP-CK-WWTP-OM-11[2]	Evaluate Headworks Building HVAC	$ 2,200,000
	Total	**$ 152,100,000**

Notes:
1. All costs for several individual projects identified during the planning process were included in the Solids and Liquid Hauled Waste Project currently in design and have been rolled up into CIP-CK-WWTP-CAP-1 and the cost has been updated to reflect the most recent estimate.
2. After the development of the CIP list, the County conducted the described HVAC study and determined improvements would cost approximately $2.2 million dollars. For planning and budgeting purposes, this value will be used.

Table ES-11 | 20-Year Central Kitsap WWTP Capital Improvement Projects

CIP No.	Project	Total Project Cost
CIP-CK-WWTP-REG-4[2]	RAS Distribution Box Hydraulic Study & Improvements	$ 1,000,000
CIP-CK-WWTP-CAP-12	Install New Primary Clarifiers and Primary Sludge Pumps	$ 12,400,000
CIP-CK-WWTP-REG-13	Install a New Effluent Flow Meter	$ 1,000,000
CIP-CK-WWTP-OB-14	Replace Thickened Primary Sludge Grinders	$ 200,000
CIP-CK-WWTP-OB-15	Replace Scum Grinder and Pumps	$ 440,000
CIP-CK-WWTP-OB-16	Replace Centrifuge Sludge Feed Grinders & Pumps	$ 760,000
CIP-CK-WWTP-OB-17	Replace Centrate Pumps	$ 140,000
CIP-CK-WWTP-OB-18	Replace Blower Building Primary Power Switchgear and Transformers	$ 200,000
CIP-CK-WWTP-REG-19[1]	Aeration Basin Air Distribution Study	$ 1,300,000
CIP-CK-WWTP-REG-20[1]	Replace Aeration Blowers 1&2 and Channel Blowers 1&2	$ 1,600,000

CIP No.	Project	Total Project Cost
CIP-CK-WWTP-CAP-21[1]	Construct Aeration Basins 5 & 6	$ 23,900,000
CIP-CK-WWTP-REG-22[2]	Near-term Recycled Water Improvements	$ 600,000
CIP-CK-WWTP-REG-23	Long-term Recycled Water Improvements	$ 4,700,000
	Total	**$ 48,240,000**

Notes:
1. Future nutrient requirements and timing are unknown. Based on the current permit cycle for the PSNGP, it is assumed that effluent TIN restrictions to values below 10 milligrams per liter (mg/L) will not be implemented until 2031 at the earliest.
2. If funding becomes available, this project should be considered in the 6-year CIP.

ES.12 Financial Strategy

Section 12 consists of the financial analysis performed by FCS group to develop a funding plan ("revenue requirement") for the County's sewer utility for the 2024 to 2042 planning horizon. The revenue requirement was identified based on operating and maintenance expenditures, fiscal policies, and the capital funding needs identified in **Section 12**.

The County sewer system has four basins, each with a treatment plant and corresponding collection system: Central Kitsap, Manchester, Suquamish, and Kingston. While a General Sewer Plan has been developed separately for each basin (this focus of this document is the Central Kitsap basin), the County does not separate its sewer utility financial information by basin. As such, the information included in **Section 12** refers to the County sewer utility as a whole, unless explicitly stated otherwise. The result of the analysis indicates that a Countywide rate adjustment of 6.31 percent for 2025 and 6 percent per year through the remaining forecast period would be sufficient to support the capital program.

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SECTION 1

Introduction

1.1 Introduction

The Central Kitsap service area is in Kitsap County (County), Washington on the west side of the Puget Sound. This General Sewer Plan Update (Plan) provides the County with a 20-year plan (2023 to 2042) for the Central Kitsap basin sewer collection, conveyance, and wastewater treatment plant (WWTP) infrastructure. The Kingston, Suquamish, and Manchester basins sewer systems are covered under separate General Sewer Plan Updates.

A Central Kitsap basin vicinity map is shown in **Figure 1-1**. The service area spans approximately 12,662 acres. The primary land use in the basin is residential with some areas of commercial development.

The County owns, operates, and maintains the sewer facilities in the Central Kitsap area. The basin receives and treats flows from the collection systems owned and operated by the City of Poulsbo, the Bangor Naval Base, the Keyport Naval Base. The system consists of approximately 670,000 feet of gravity pipe, 189,000 feet of force main pipe, 45 pump stations and the Central Kitsap WWTP.

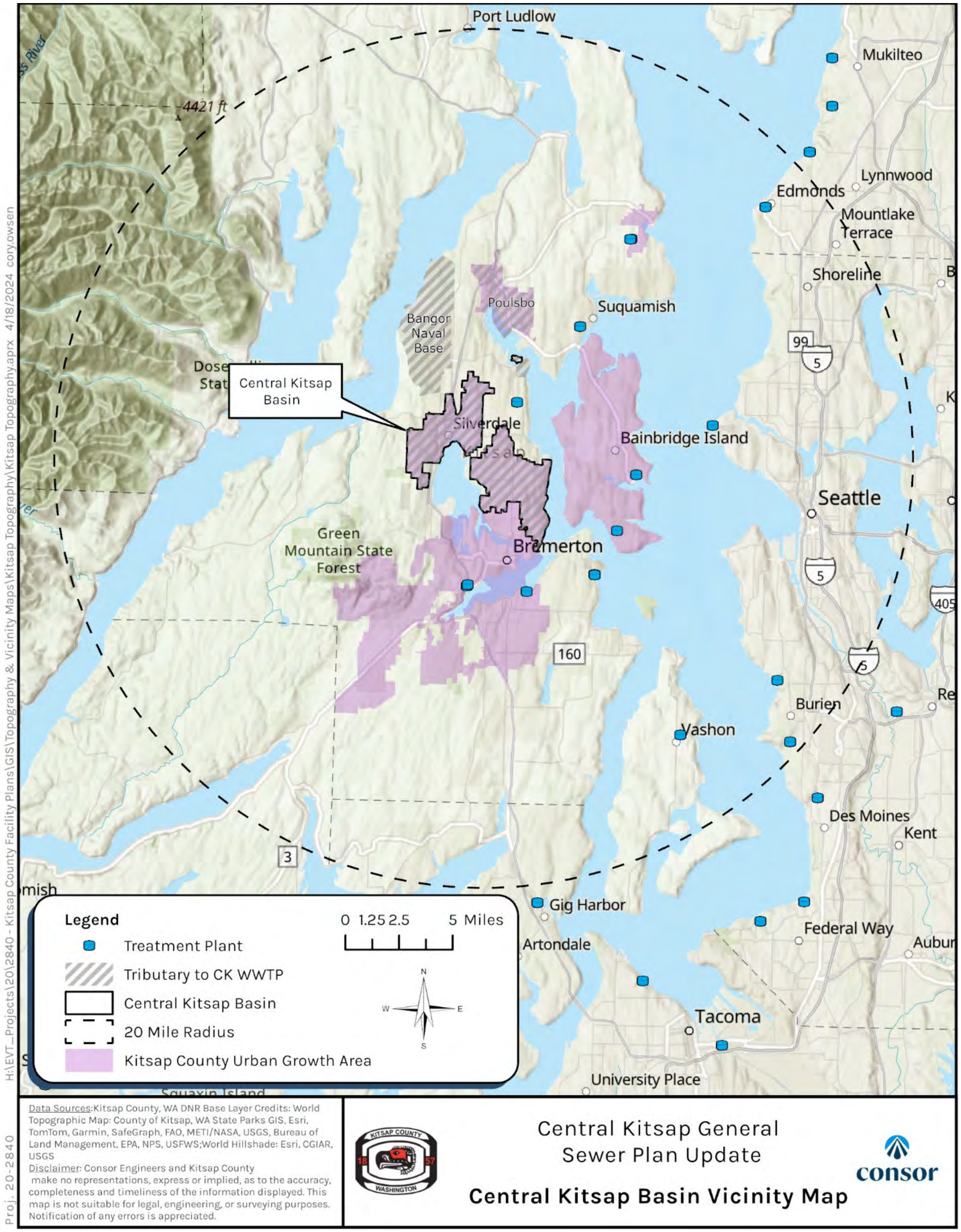
The current sewered population in the basin was estimated by an analysis of sewer permits, indicating there are 16,518 equivalent residential units (ERU) yielding a population of 41,295 people. Sewer permit data is not available in the Bangor Naval Base, the Keyport Naval Base, and the City of Poulsbo. Based on information from Puget Sound Regional Council (PSRC) and the City of Poulsbo, the population for these areas were added to the sewered population, resulting in a current estimated sewered population is 57,939 people. The sewered population is expected to grow to 66,580 in 2028 and 89,508 in 2042.

1.2 Purpose and Scope

This Plan evaluates the expected changes in the Central Kitsap sewer service area, reports the existing condition of the collection system and Central Kitsap WWTP, analyzes potential improvements to the system, and includes recommended and phased capital improvements that will provide service to the growing community over the planning horizon. The Plan was prepared to provide the County, the public, and regulatory agencies with information on the County's plans for maintaining, upgrading, and expanding the system. The Plan provides the roadmap for the County to continue to provide high quality service to its customers while protecting environmental quality. The Plan complies with the Washington State Department of Ecology (Ecology) regulations for general sewer plan (Washington Administrative Code [WAC] 173-240-050).

The Plan is based on planning horizons of a six-year period, 2023 to 2028, and a 20-year period, 2023 to 2042. The plan lays out a strategy to provide wastewater services that accommodate population growth, comply with environmental regulations and permits, assess existing conditions, and maintain collection/conveyance system and treatment plant reliability and longevity. The population projections are in line with those developed by the Kitsap County Department of Community Development (DCD) over the 2044 planning horizon, which corresponds to the County Comprehensive Plan update. The recommendations presented here were made with consideration of the benefits of long-term investments that will continue to serve the community beyond the 20-year planning horizon.

Figure 1-1 | Central Kitsap Basin Vicinity Map



Consor was contracted by the County in April 2020 to prepare the General Sewer Plan and worked with the County to develop the Scope of Work, which provides guidance for decisions regarding the management and improvement of the County's wastewater treatment infrastructure.

1.3 Background

The County owns and operates the Central Kitsap wastewater sewer system that consists of a collection and conveyance system, 45 pump stations, and the Central Kitsap WWTP with an outfall to Port Orchard Bay of the Puget Sound. The oldest portions of the system were installed in the 1950s, with much of the system's growth occurring during the late 1970s and 1980s. The earliest pump stations were packaged pump stations installed in the late 1970s. Since then, the County has gradually added and upgraded its pump stations to meet the demands of growing populations within its service area. Changes to the pump stations since the 2011 Wastewater Facility Plan include:

- Upgrades of PS-1, PS-6, PS-8, and PS-18 to increase firm capacity.
- Diverting PS-5 flows to PS-34 and decommissioning PS-5.
- Upgrade of PS-67, diversion of Lemolo Siphon flows to PS-67, and decommissioning of PS-16.
- Installed new emergency power generators at PS-12 and PS-13.
- Replaced submersible pumps with newer Flygt models.

The system now serves approximately 20 square miles of residential, commercial, and military customers within the Urban Growth Area (UGA) boundaries. The sewer system is separate from the stormwater system and consists of gravity sewers, forcemains, siphons, PS, and individual pump stations (IPS). Some properties within the service area have on-site septic systems that are not connected to the collection system.

The Central Kitsap WWTP was constructed in 1979 as an activated sludge plant with primary clarifiers and anaerobic digesters and upgrades were completed over the past years, including:

- Upgrades of primary treatment, secondary treatment and disinfection in 1996.
- Upgrades of dewatering system in 1999.
- Replacement of headworks, septage receiving station, and primary sludge and plant wastewater sump pumps in 2009. Put into service in 2011.
- Modification of existing aeration basins and construction of new basins allowing operations as biological nutrient removal (BNR) process, solids treatment tanks, a digester gas cogeneration system, and a reclaimed water system in 2016.
- Replacement of ultraviolet (UV) banks in 2019.

The liquids treatment processes in the existing WWTP include headworks with screening and grit removal, two primary clarifiers, four aeration basins, two secondary clarifiers, and UV disinfection. The solids treatment including septage and those hauled from the County's other treatment plants, and other agencies' treatment plants are thickened with gravity thickeners and digested anaerobically before dewatering and disposal.

The County operates the wastewater system under National Pollutant Discharge Elimination System (NPDES) Permit WA-003052-0 that was renewed, effective August 1, 2017, and expired on July 31, 2022. The County has submitted the permit renewal application. The current permit was administratively continued and remains in effect as of this writing. Ecology recently issued the first Puget Sound Nutrient General Permit (PSNGP), effective as of Jan. 1, 2022. The Central Kitsap WWTP is classified as a moderate Total Inorganic Nitrogen (TIN) load plant and is required to implement nutrient monitoring and reporting, develop a nutrient optimization plan, conduct a nutrient reduction evaluation, and comply with action level exceedance corrective actions if nutrient discharge limits are exceeded.

The County has prepared several sewerage planning documents since the 1960s. The last wastewater/sewer facility plan for the Central Kitsap area was prepared in 2011 and a plan addendum was prepared in 2013. Since then, the Central Kitsap planning area, and the County as a whole, has grown substantially. With this growth, the need for a renewed evaluation of sewer service to the entire County became increasingly apparent. This Plan presents the findings and recommendations for the Central Kitsap basin sewer facilities.

1.4 General Sewer Plan Requirements

The Federal Water Pollution Control Act established the requirement for a Water Quality Management Plan. Resultantly, Revised Code of Washington (RCW) 90.71 established the need for a Puget Sound Water Quality Management Plan. The stated objective of this plan is to protect and restore Puget Sound through effective coordination among governments and private interests, and through use of an adaptive management approach.

This Plan is prepared for the County to fulfill the requirements of Chapter 173-240-050 of the WAC, Chapter 90.48 of the RCW, and RCW 36.70A (Growth Management Act). The Plan provides the County with a comprehensive guide for managing and operating the sewer system and coordinating expansions and upgrades to the infrastructure through buildout. The Plan serves as a guide for policy development and decision-making processes for the County. The WAC requirements are outlined in **Table 1-1**.

Table 1-1 | General Sewer Plan Requirements per WAC 173-240-050

WAC Reference Paragraph	Description of Requirement	Location in Document
3a	Purpose and need for proposed plan	Section 1.2
3b	Who owns, operates, and maintains system	Section 1.5
3c	Existing and proposed service boundaries	Figure 2-1
3d	Layout map showing boundaries; existing sewer facilities; proposed sewers; topography and elevations; streams, lakes, and other water bodies; water systems	Figure 2-1, Figure 2-2, Figure 2-4, Figure 2-5 Section 5, Section 6, Section 7, and Section 11
3e	Population trends	Section 3
3f	Existing domestic and/or industrial wastewater facilities within 20 miles	Figure 1-1
3g	Infiltration and inflow problems	Section 3.4.3
3h	Treatment systems and adequacy of such treatment	Section 6
3i	Identify industrial water sources	Section 4
3j	Discussion of public and private wells	Figure 2-5
3k	Discussion of alternatives	Sections 7 and Section 8

WAC Reference Paragraph	Description of Requirement	Location in Document
3l	Define construction cost and O&M costs	Section 10, Section 11, and Section 12
3m	Compliance with water quality management plan	Section 4
3n	State Environmental Policy Act (SEPA) compliance	Section 4

1.5 Ownership and Management

The County owns, operates, and maintains the sewer facilities in Central Kitsap.

The City of Poulsbo contributes flow to the Central Kitsap sewer system via the Lemolo Siphon. The City is responsible for paying for facilities based on the percentage of flow contributions.

The County's Sewer Utility Division (Utility) under the department of Public Works is solely funded through fees from sewer ratepayers. The Utility does not receive funds from County tax revenue and cannot provide any financial assistance to other public works divisions or County departments. These revenues must provide for future capital improvements and cover the maintenance, operation, and replacement of sewer systems.

The operation and maintenance (O&M) of both the sewer collection system and the County's four WWTPs is provided by the Utility. The Utility consists of four main work groups:

- Utilities Operations & Maintenance (Plant and Pump Stations).
- Field Operations (Collection System).
- Engineering and Administration.
- Construction Management.

The Utilities Operations Group is responsible for running the WWTPs and laboratory. The Utilities Maintenance Group is responsible for maintaining the equipment associated with WWTPs and pump stations. The Field Operations Group is responsible to maintain, repair, replace, clean, and inspect the sewer utilities collection systems. The Engineering Group manages the design of capital work. The Administration Group manages the geographic information system (GIS) database and provides review efforts for Developer proposed projects. The Construction Management Group manages the delivery of capital work.

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SECTION 2

Service Area Characterization

2.1 Introduction

The Central Kitsap wastewater system service area characteristics including geography, topography, water resources, general soil conditions, critical areas, endangered species habitats, the water supply system, and zoning designations are described in Section 2.

2.2 Growth Management Act

The State of Washington adopted the Growth Management Act (GMA) with the intent of concentrating most new development and population gains within the urban areas of the more populous and rapidly growing counties. State and local governments are required to define an UGA boundary within which urban services like sewers are provided, and any new parcels created outside that boundary must be at a very low density with sufficient acreage to support on-site sewage disposal systems conforming to Washington State Department of Health (DOH) regulations.

The following exceptions to the prohibitions of sewers outside the UGA are recognized under state law (per RCW 36.70A.110(4), RCW 36.70A.070(5)(d), and WAC 365-196-320(1)(c)):

- Public schools outside the UGA can be served by sewers but are not required to be served.
- Areas of existing development outside the UGA where sufficient on-site sewage disposal systems have failed as to create a "severe public health hazard" can be served by sewers.
- Areas can be defined as a Limited Area of More Intensive Rural Development (LAMIRD), within which the development of necessary public facilities and public services, such as sewer, is allowed.

Sewers provided in these cases can be satellite systems limited to serving just the qualified and defined parcels, or a sewer extension can be 'tight-lined' to convey wastewater from the qualified and defined parcels into the UGA for connection to an existing sewer system.

2.3 Service Area

The Central Kitsap service area, city limits, Urban Transition Area boundary (UTA), LAMIRD, and UGA boundaries are presented in Figure 2-1. The Central Kitsap Basin spans approximately 12,662 acres and is bounded on the east by Port Orchard Bay and on the southwest by Dyes Inlet. The basin is bordered to the north and west by unincorporated rural residential areas and parks. The primary land use in the basin is residential with some areas of commercial development. The basin receives and treats flows from the City of Poulsbo, the Bangor Naval Base, and the Keyport Naval Base.

2.3.1 Topography

The topography of the Central Kitsap Basin is characterized as hilly and sloping generally toward Dyes Inlet to the south of the basin and to Port Orchard Bay to the east.

Figure 2-1 | Central Kitsap Basin Map

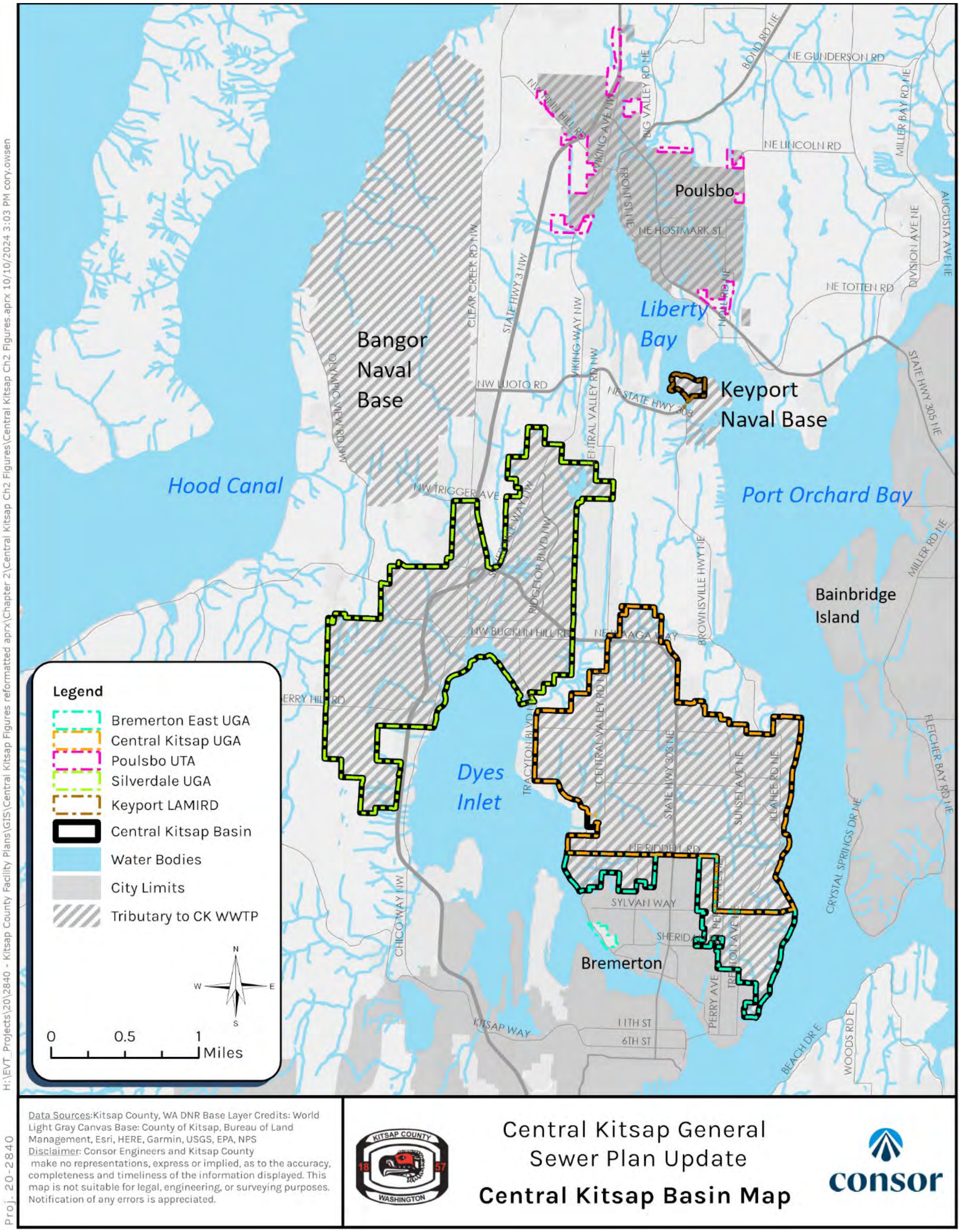
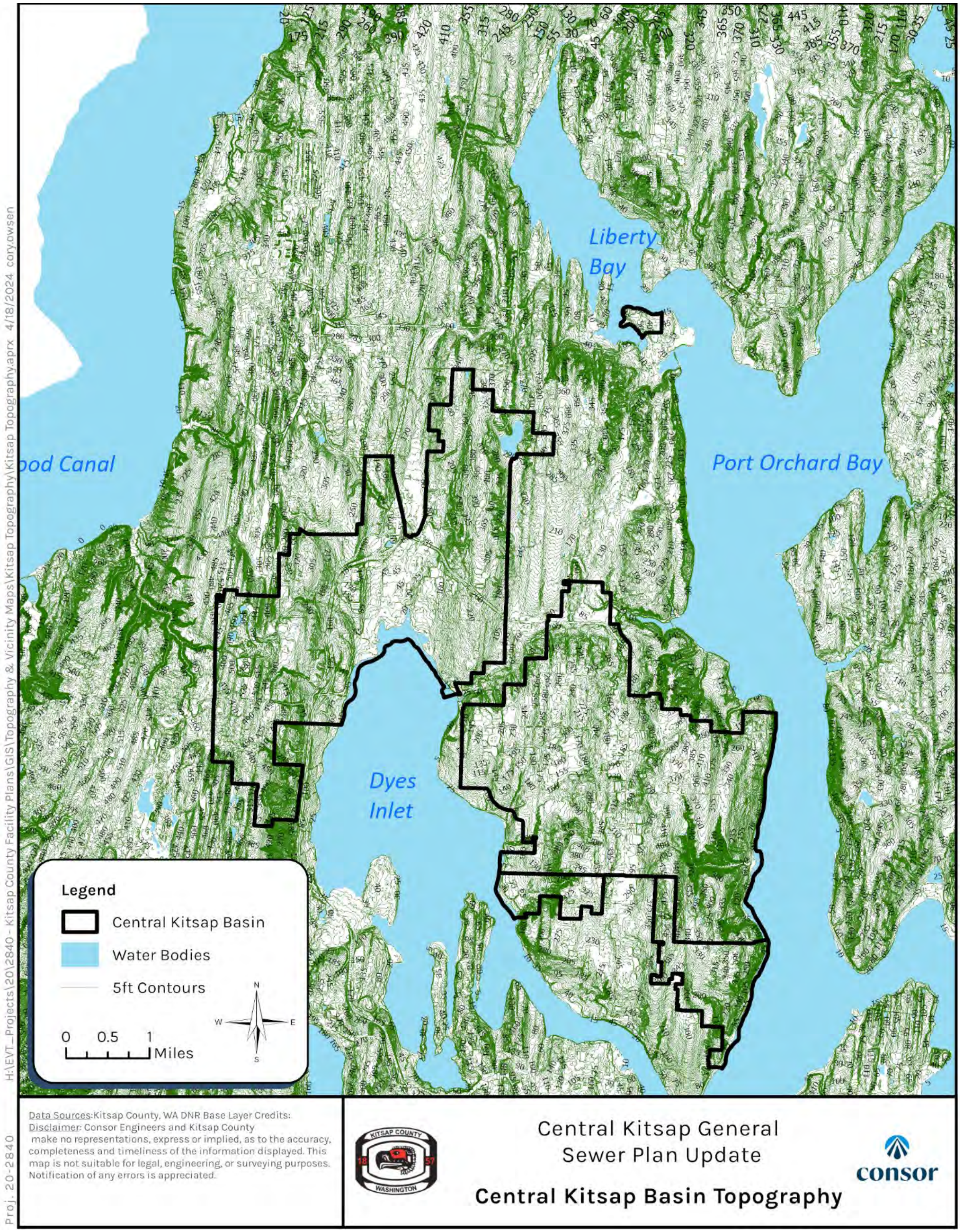


Figure 2-2 | Central Kitsap Basin Topography



2.3.2 Water Resources

The primary water resources in the basin are Mosher Creek, Clear Creek, Island Lake, and groundwater. The basin also contains numerous smaller and unnamed surface water bodies and streams which are shown on the map in **Figure 2-1**.

Clear Creek appears on Ecology's Water Quality Assessment list [303(d)] for impaired water bodies for dissolved oxygen (DO).

2.3.3 Puget Sound Water Quality Management Plan

The Federal Water Pollution Control Act established the requirement for a Water Quality Management Plan. Resultantly, RCW 90.71 established the need of a Puget Sound Water Quality Management Plan. The stated objective of this plan is to protect and restore Puget Sound through effective coordination among governments and private interests, and through used of an adaptive management approach. This Plan is consistent with the intended goals of the Water Quality Management Plan.

2.3.4 Geology

Soils and their distribution in the basin are shown in **Figure 2-3**. The soil descriptions are referenced from the Soil Survey of Kitsap County by the United States Department of Agriculture and the Soil Conservation Service in cooperation with the Washington State Department of Natural Resources (DNR) and the Washington State University Agricultural Research Center. The soil distribution is based on GIS data derived from the Private Forest Land Grading System and the Soil Survey of Kitsap County. Soils were not classified for the Bangor Naval Base or the Keyport Naval Base.

The Alderwood Series is the most prevalent soil type in the basin. The soil is moderately well drained and has a depth to hardpan of 24 to 40 inches. Permeability is moderately rapid in the upper horizons but very slow in the consolidated substratum. These moderately well drained acidic forested soils formed in loamy glacial till and occur on rolling till plains and moraines.

The Poulsbo Series is the second most prevalent soil types in the basin. The soil is moderately well drained and has a depth to hardpan ranging from 20 to 40 inches. Permeability is moderately rapid in the upper stratum and very slow through the hardpan. This soil is found in broad uplands and formed in glacial till.

2.3.5 Critical Areas

Critical areas are located throughout the Central Kitsap basin, as shown on **Figure 2-4**. Development is limited in critical areas. The critical areas consist of wetlands which were identified from the DNR 2000 Hydrology data set, the National Wetlands Inventory data set, and survey delineated wetlands from the County's parcel maps. The Critical Aquifer Recharge Areas (CARA) shown on the map are separated into Category 1 and Category 2 areas. Category 1 is defined as areas where the potential for certain land use activities to adversely affect groundwater is high. Category 2 is defined as areas that provide recharge effects to aquifers that are current or potentially will become potable water supplies and are vulnerable to contamination based on the type of land use activity. Geologic hazard areas are shown on the map and are categorized as areas of high concern and high hazard areas. High hazard areas are defined as areas with slopes greater than 30 percent and mapped by the Coastal Zone Atlas or Quaternary Geology and Stratigraphy of Kitsap County as unstable (U), unstable old landslides (UOS), or unstable recent slides (URS). Areas of concern are classified similar to the high hazard areas but with slopes between 15 percent and 30 percent and also include areas that are classified as highly erodible or potentially highly erodible, and seismic areas subject to liquefaction.

Figure 2-3 | Central Kitsap Soils Distribution

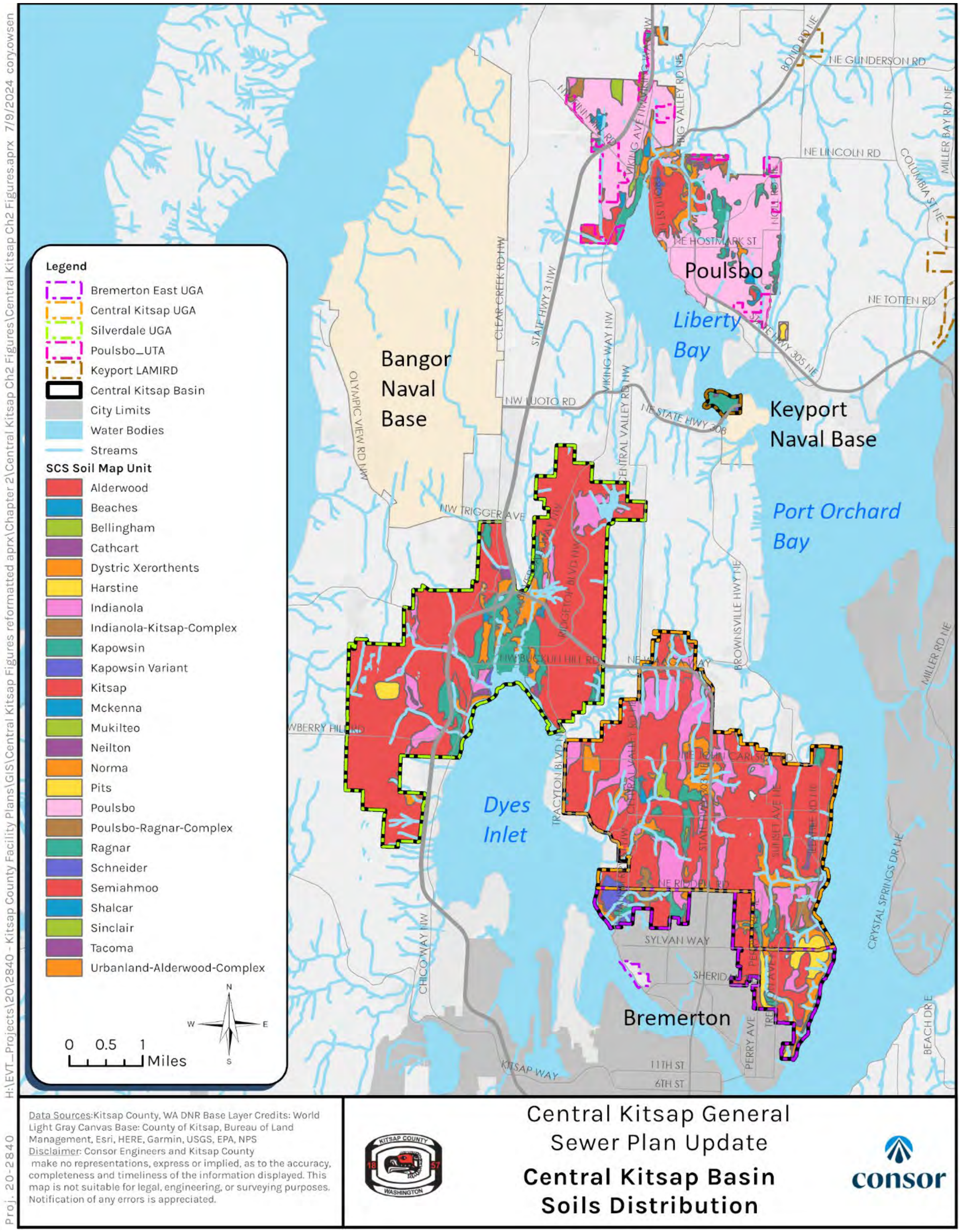
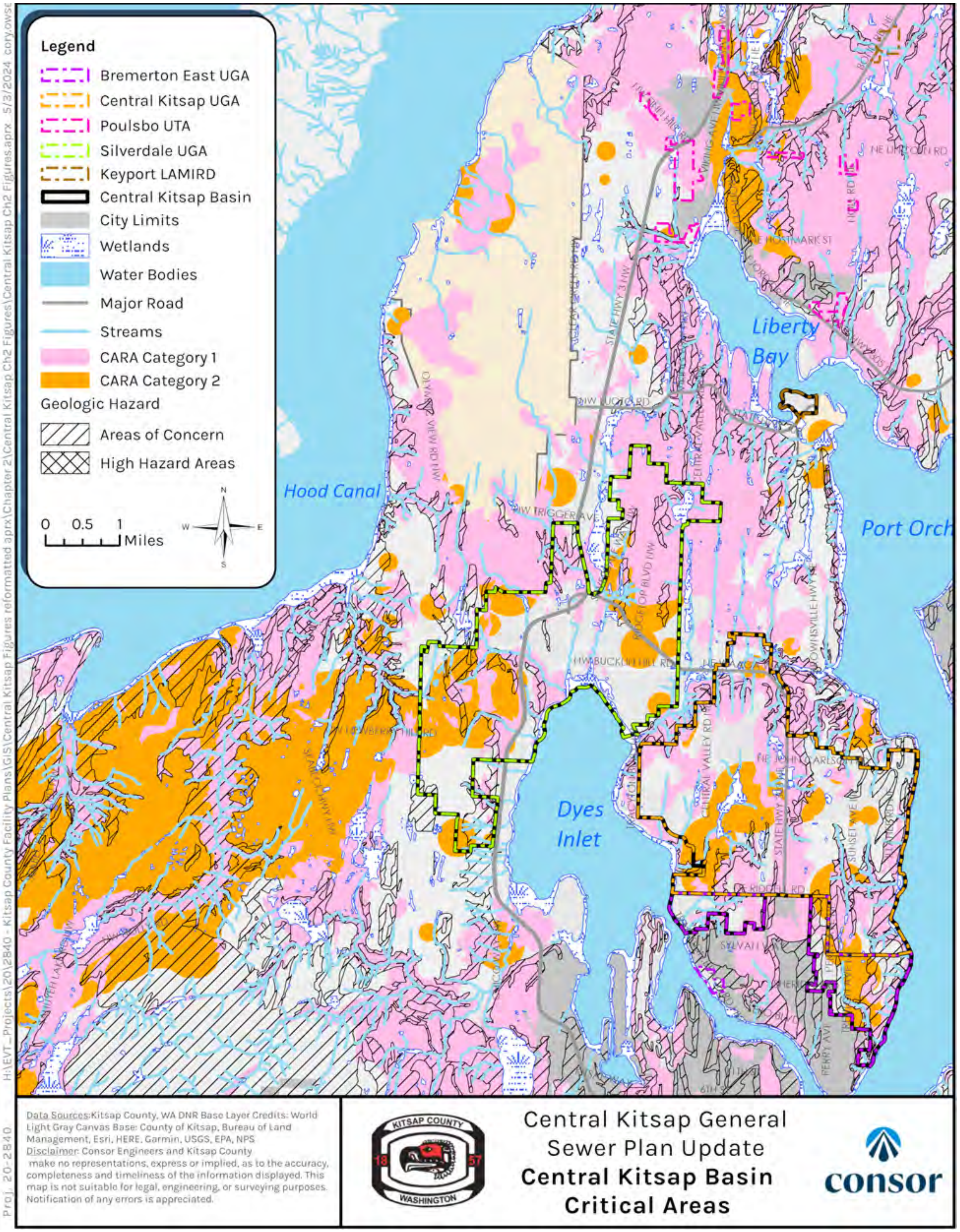


Figure 2-4 | Central Kitsap Critical Areas



2.3.6 Endangered Species Habitat

Several fish species are present in Clear Creek and Mosher Creek. Known species and their endangered species status for these creeks are listed in **Table 2-1**. Additionally, the basin contains numerous freshwater and marine wetlands which provide habitat for many species such as the Mountain Quail, Pileated Woodpecker (Candidate for State Endangered Species status), and Western Pond Turtle (State Endangered Species). Many of the creeks in the basin discharge to Dyes Inlet or Port Orchard Bay which support habitat for numerous species of shellfish, waterfowl, and other fish species not listed in **Table 2-1**.

Table 2-1 | Fish Species Present in Clear Creek and Mosher Creek

Species	Clear Creek	Mosher Creek	State Status	Federal Status
Chinook	Yes	No	Candidate	Threatened
Coho	Yes	Yes	None	Species of Concern
Chum	Yes	No	Candidate	Threatened
Steelhead	Yes	No	None	Threatened

2.4 Water Supply System

Information and GIS data for the water system in the Central Kitsap basin was provided by the Kitsap Public Utilities District (KPUD), City of Bremerton, City of Poulsbo, the North Perry Avenue Water District, and the Silverdale Water District (District).

Most of the water in the County water supply comes from groundwater with the exception of the City of Bremerton which also utilizes surface water from the Union River. The Central Kitsap basin is served by the providers listed in **Table 2-2**. The water supply system is mapped in **Figure 2-5**, which includes private well locations from GIS data.

Table 2-2 | Central Kitsap Basin Water Service Providers

System Name	Owner/Manager
City of Bremerton	City of Bremerton
City of Poulsbo	City of Poulsbo
Eldorado Hills	Kitsap PUD
Island Lake Water Co.	Island Lake Water Co.
Keyport	Kitsap PUD
North Perry Avenue Water District	North Perry Avenue Water District
Silverdale Water District No. 16	Silverdale Water District

2.5 Land Use and Zoning

Land use and zoning within the Bremerton, Central Kitsap, and Silverdale UGAs are currently established in the 2016 Kitsap County Comprehensive Plan (KCCP). Zoning within the Poulsbo UTA are established by the City of Poulsbo. Zoning in the Central Kitsap basin is shown on **Figure 2-6**. Future growth within the Central Kitsap basin is presumed to occur within the UGAs and UTAs according to the land use designations and zoning in the KCCP.

Figure 2-5 | Central Kitsap Water System

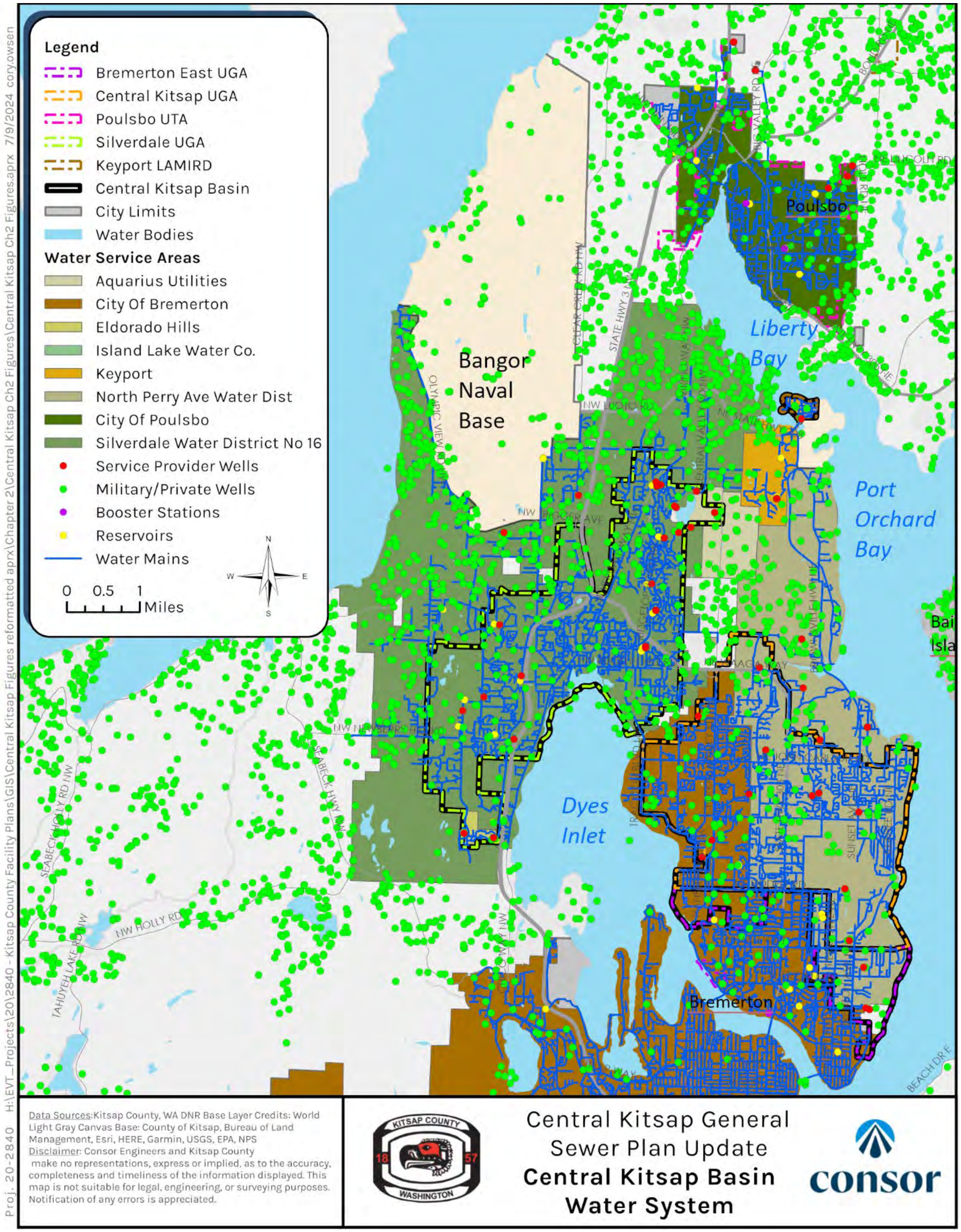
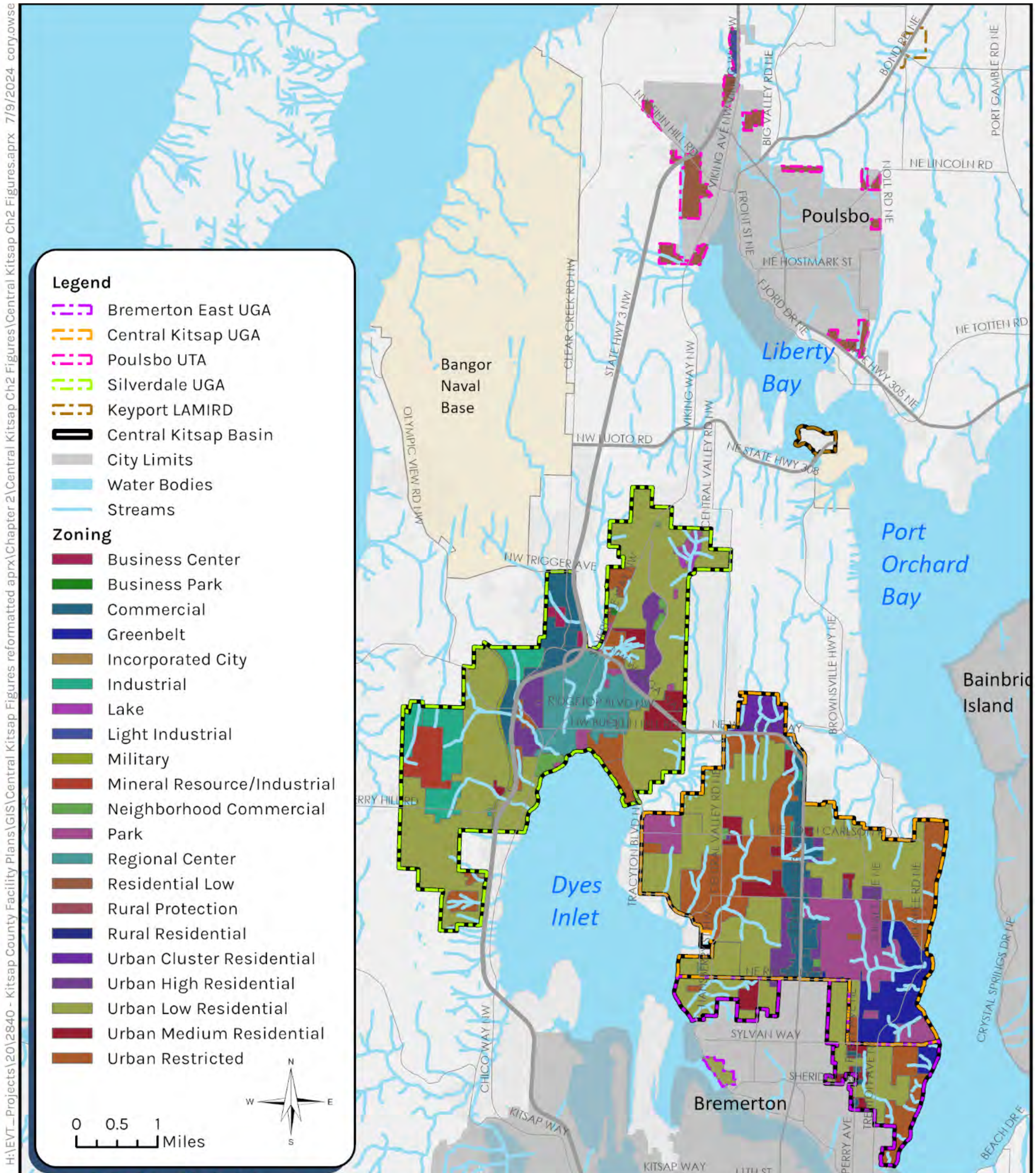


Figure 2-6 | Central Kitsap Zoning



Data Sources: Kitsap County, WA DNR Base Layer Credits: World Light Gray Canvas Base: County of Kitsap, Bureau of Land Management, Esri, HERE, Garmin, USGS, EPA, NPS
Disclaimer: Consor Engineers and Kitsap County make no representations, express or implied, as to the accuracy, completeness and timeliness of the information displayed. This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.

Central Kitsap General Sewer Plan Update

Central Kitsap Basin Zoning

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SECTION 3

Population, Flow, and Load Projections

3.1 Introduction

The existing and projected populations and the methodology of determining the most appropriate sewered population and its growth rate to project future flows and loads for the Central Kitsap WWTP and the collection and conveyance system are described in **Section 3**. The Central Kitsap WWTP Service Area includes several sub-basins including the Central Kitsap UGA, Silverdale UGA, a small portion of Bremerton East UGA, the City of Poulsbo UTA, Bangor Naval Base, and Keyport Naval Base.

The projections consider existing and future customers within the Central Kitsap service area in year 2028 (the 6-year projection) and year 2042 (the 20-year projection). With these population projections, future flows were estimated and compared with flows in the hydraulic model prepared by BHC Consultants to determine sewer system deficiencies and capital improvement projects for the 6-year and 20-year planning horizons to improve and expand Central Kitsap WWTP and the associated collection and conveyance system.

The DCD prepared population projections as part of their update to the Comprehensive Plan. These were compared to and are in line with the projections presented in this Section.

3.2 Definitions

Evaluation Period: The flows and loads analyzed are based on discharge monitoring reports (DMRs) from January 2016 through June 2020.

Wet Weather Season: The wet weather season is November 1 through April 30 of the following year.

Dry Weather Season: The dry weather season is May 1 through October 31.

Average Annual Flow (AAF): The average daily flow for the calendar year.

Maximum Month Wet Weather Flow (MMWWF): The largest volume of flow during a continuous 30-day period in wet weather season, expressed as a daily average.

Maximum Month Dry Weather Flow (MMDWF): The largest volume of flow during a continuous 30-day period in dry weather season, expressed as a daily average.

Peak Day Flow (PDF): The largest volume of flow during a one-day period, expressed as a daily average.

Peak Hour Flow (PHF): The largest flow rate during a one-hour period, over the metered time-period.

3.3 Population Projections

3.3.1 General

The population forecasts for the sewer service areas were provided by the PSRC. The PSRC is a leading source of data and forecasting for regional and local planning in the Puget Sound area and develops policies and coordinates decisions related to regional growth and transportation and economic planning within Kitsap, King, Pierce, and Snohomish Counties.

The PSRC's population projections are based on their Land Use Vision (LUV) forecast. The LUV dataset reflects the VISION 2040 Regional growth strategy, local policies, and each county's adopted growth targets. The LUV dataset projects population growth for the Central Puget Sound region in five-year increments from 2020 through 2040. The PSRC's Regional Macroeconomic Forecast is apportioned to cities and unincorporated areas using the VISION 2040 Regional Growth Strategy and local growth targets to create annual control totals. The PSRC's land use model, UrbanSim, then uses the annual control totals to determine projected growth on developable land. These results can then be reported for varying geographies like UGA, LAMIRD, Census Tracts, or Traffic Analysis Zones (TAZ).

The projections used for this basis of planning are based on projected growth for the portions of TAZs within the Central Kitsap sewer service areas. To determine the rate of growth over the planning horizon, population was estimated for 2019 and projected to 2042. The 2019 estimate of population was developed by the Washington State Office of Financial Management (OFM).

The PSRC projections for residential population are defined by household population and group quarters population. Household population includes both single-family and multi-family units. Group quarters are places where people live or stay in a group living arrangement such as group homes, nursing facilities, federal and state prisons, or military quarters. The population was then extrapolated to 2042 based on the 2040 PSRC projection and the average yearly growth between 2035 and 2040. The detailed projections for each portion of the service area are discussed in the following sections.

Population targets from the 2016 KCCP were compared with population projections received from the PSRC in five-year increments from 2020 to 2040. The targets included in the KCCP are broken down by City or UGA and areas outside of those categories are included in the broad categories of "Unincorporated UGA" and "Rural Non-UGA". The PRSC data was available at a higher resolution which was needed for the General Sewer Plan because the sewer service areas for the four basins do not line up with the UGA boundaries. The overall projections are similar to the KCCP, which gives confidence that the sewer and facility planning efforts will dovetail with the overall County planning efforts described in the KCCP. The PSRC data is somewhat more conservative, which is preferrable for wastewater facility planning.

The DCD prepared population projections as part of their update to the Comprehensive Plan. The DCD projections for 2044 exceed the 2042 PSRC projections by 3.3 percent, or about 3,000 people. DCD's growth rate is approximately 1 percent per year, so 2 percent of that difference can be attributed to the annual growth rate from 2042 to 2044. The DCD and PSRC projections are within approximately 1.3 percent of each other.

3.3.2 Residential

The Central Kitsap projections in **Table 3-1** include the sub-basins for Silverdale UGA, a small northern portion of Bremerton East UGA connected to the Central Kitsap UGA collection system, Central Kitsap UGA, Bangor Naval Base, Keyport Naval Base, and the City of Poulsbo UTA. City of Poulsbo provided planning data which was used to supplement estimates and projections from PSRC and OFM. The City of Poulsbo's projections assume a growth rate of 2.5 percent from 2019 onward.

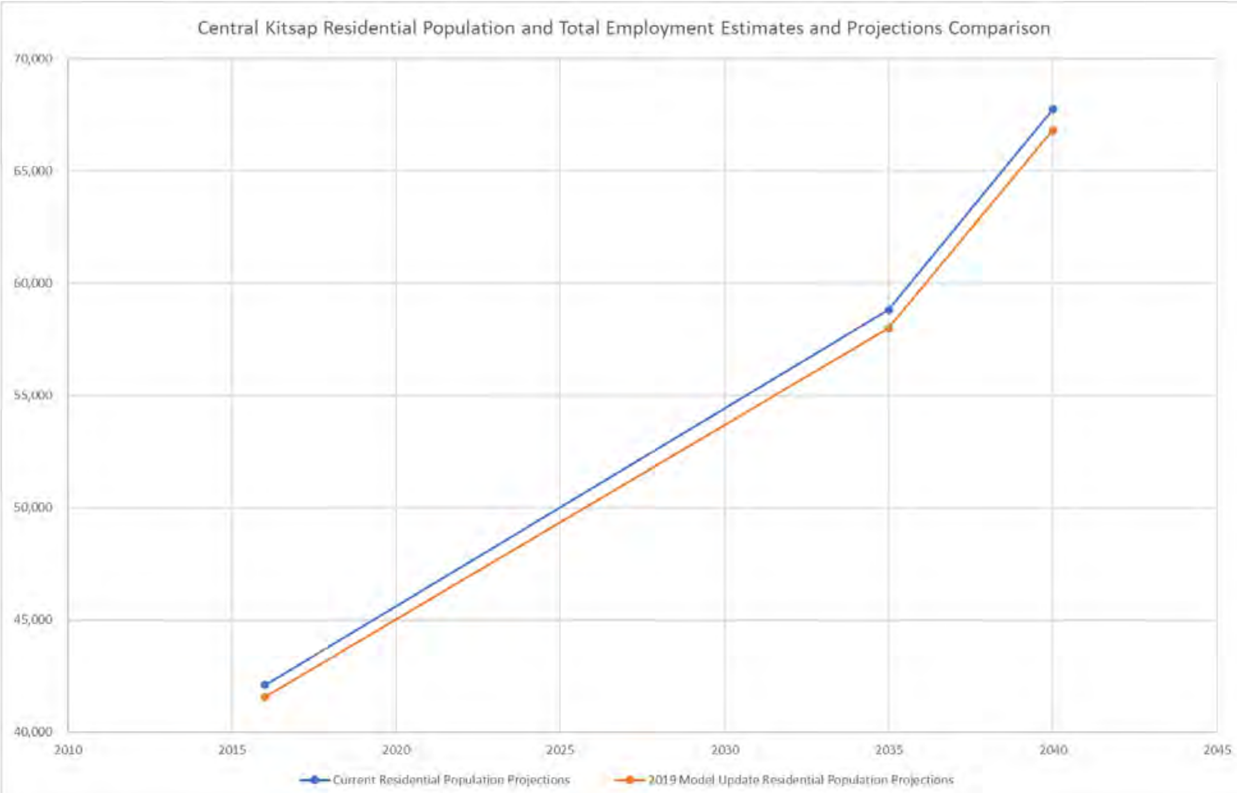
Table 3-1 | Central Kitsap Service Area Population Projections

Year	Residential Population	Group Quarters	City of Poulsbo	Total[5]
2014[1]	43,646	2,727	9,775	56,148
2019[2]	49,205	-----	11,212	60,417
2020[1]	47,454	3,002	11,399	61,855
2025[1]	51,110	3,135	12,897	67,142
2028[3]	53,758	3,210	13,914	70,882
2030[1]	55,523	3,260	14,592	73,375
2035[1]	61,348	3,353	16,510	81,211
2040[1]	70,135	3,449	18,679	92,263
2042[4]	73,650	3,487	19,625	96,762

Notes:
1. PSRC projections and City of Poulsbo projections
2. City of Poulsbo and OFM estimates, group quarters population is not reported separately
3. PSRC Projections, City of Poulsbo projections, interpolated between 2025 and 2030
4. PSRC Projections, City of Poulsbo projections, extrapolated based on yearly growth between 2035 and 2040
5. The total sewered population was computed using a different methodology which is described in the subsequent section

The Central Kitsap hydraulic model was updated (by others) in 2019 based on population projections and estimates for the years 2016, 2035, and 2040 for the Central Kitsap UGA and the Silverdale UGA. A comparison of the total population in the two UGAs were computed using the dataset described above and the 2019 model update projections is shown in **Figure 3-1**. The 2016 total population, using the data described above, was computed based on linear interpolation between the years 2014 and 2020. As shown on **Figure 3-1**, the results of the two population models are similar, therefore the hydraulic model results are still considered valid and valuable for planning purposes.

Figure 3-1 | Central Kitsap Residential Population Projections Comparison



3.3.3 Current Sewered Population

Because the PSRC population includes both sewered and un-sewered population, sewer permit data for the County were used to estimate the existing sewered population in the Central Kitsap service area. The sewered population was estimated by assuming 2.5 people per sewer permit in the year 2020, based on recommendations from County planning staff. The County's sewer permit data indicated there are 16,518 ERUs in the basin yielding a current sewered population of 41,295. The household population for Bangor and Keyport Naval Bases as well as group quarters from PSRC and the estimated population in Poulsbo were added to this to estimate since sewer permit data is not available in those areas. Based on this analysis, the current estimated sewered population is 57,939, less than the 61,855 total basin population from PSRC and the City of Poulsbo. 57,939 will be used as the baseline population. For planning purposes, it is assumed that all parcels will be sewered by the end of the 20-year planning horizon. The Central Kitsap basin sewered area is shown in **Figure 3-2.** It includes some parcels that are sewered but are outside of the UGA. Although not typically allowed by the GMA, some of these are due to allowable exceptions described in **Section 2.2**, such as changes in the UGA boundary, public schools, failed septic systems that create a severe public health hazard, and LAMIRD.

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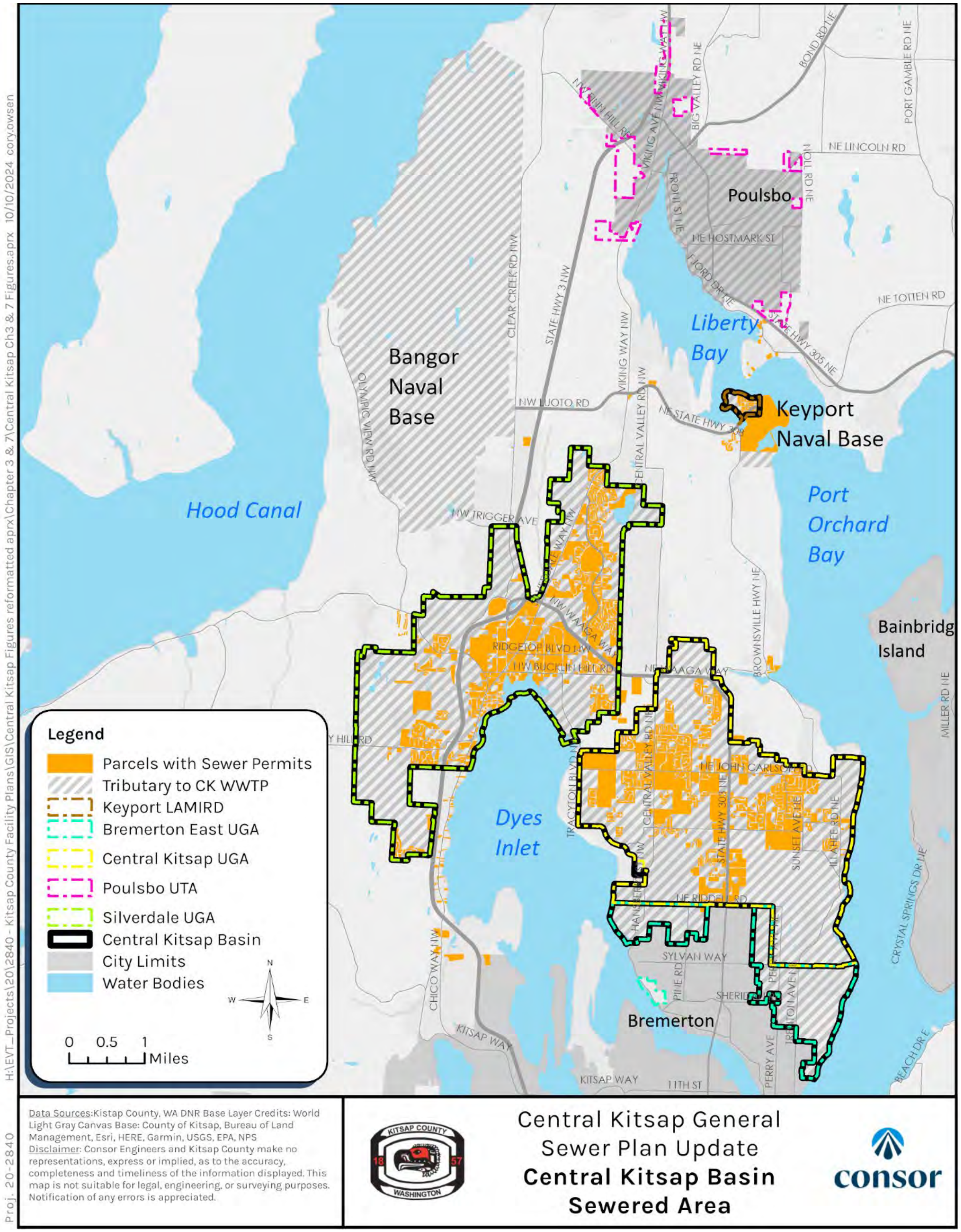
Figure 3-2 | Central Kitsap Basin Sewered Area



3.3.4 Sewered Population Growth Rate and Projections

To project the future sewered populations, the growth rate for all sub-basins except the City of Poulsbo was determined from the estimated growth rate in each sub-basin in the PSRC data. As noted earlier, the growth rate for the City of Poulsbo was assumed to be 2.5 percent. **Table 3-2** presents the projected growth for the sewered population based on the estimated population from the County sewer permits, City of Poulsbo projections, and PSRC projections. This projection shows a 54 percent growth between 2019 and 2042 within the entire Central Kitsap Service Area, which averages out to be an annual growth rate of 2.1 percent.

Table 3-2 | Central Kitsap Service Area Sewered Population Projections

Year	Household	Group Quarters	Poulsbo	Total
2020[1]	44,036	2,504	11,399	57,939
2025[1]	47,543	2,615	12,897	63,055
2028[2]	49,989	2,677	13,914	66,580
2030[1]	51,620	2,718	14,592	68,930
2035[1]	56,768	2,794	16,510	76,072
2040[1]	64,019	2,878	18,679	85,576
2042[3]	66,971	2,912	19,625	89,508

Notes:
1. Kitsap County Sewer permits, City of Poulsbo projections, and PSRC projections.
2. Kitsap County Sewer permits, City of Poulsbo projections, and PSRC projections, interpolated between 2025 and 2030.
3. Kitsap County Sewer permits, City of Poulsbo projections, and PSRC projections, extrapolated from 2035 to 2040 growth rate.

3.4 Wastewater Flows

Influent flow to the Central Kitsap WWTP is primarily made up of domestic wastewater with some commercial and industrial wastewater. Flows increase during the rainy season due to infiltration and inflow (I&I). Inflow is stormwater runoff entering the sewer directly, typically from storm sewer connections, basement sump pumps, roof drains and submerged manholes. Infiltration occurs as groundwater leaks into the sewer system through cracked or broken pipes and manholes, or through loose joints and connections. The flow is conveyed to the WWTP through two force mains from multiple offsite pump stations.

3.4.1 Current Wastewater Treatment Plant Flow

Daily influent flow data were evaluated using DMR reports from January 2016 through June 2020 (the evaluation period) and are shown in **Figure 3-3**. These five-year data indicate very little growth or flow increases since the completion of the previous Facility Plan (Brown and Caldwell, 2011). As expected, peak daily flows occurred during the wet weather winter months. Average daily flows are visibly lower during the dry weather months.

Figure 3-3 | Daily Flowrates

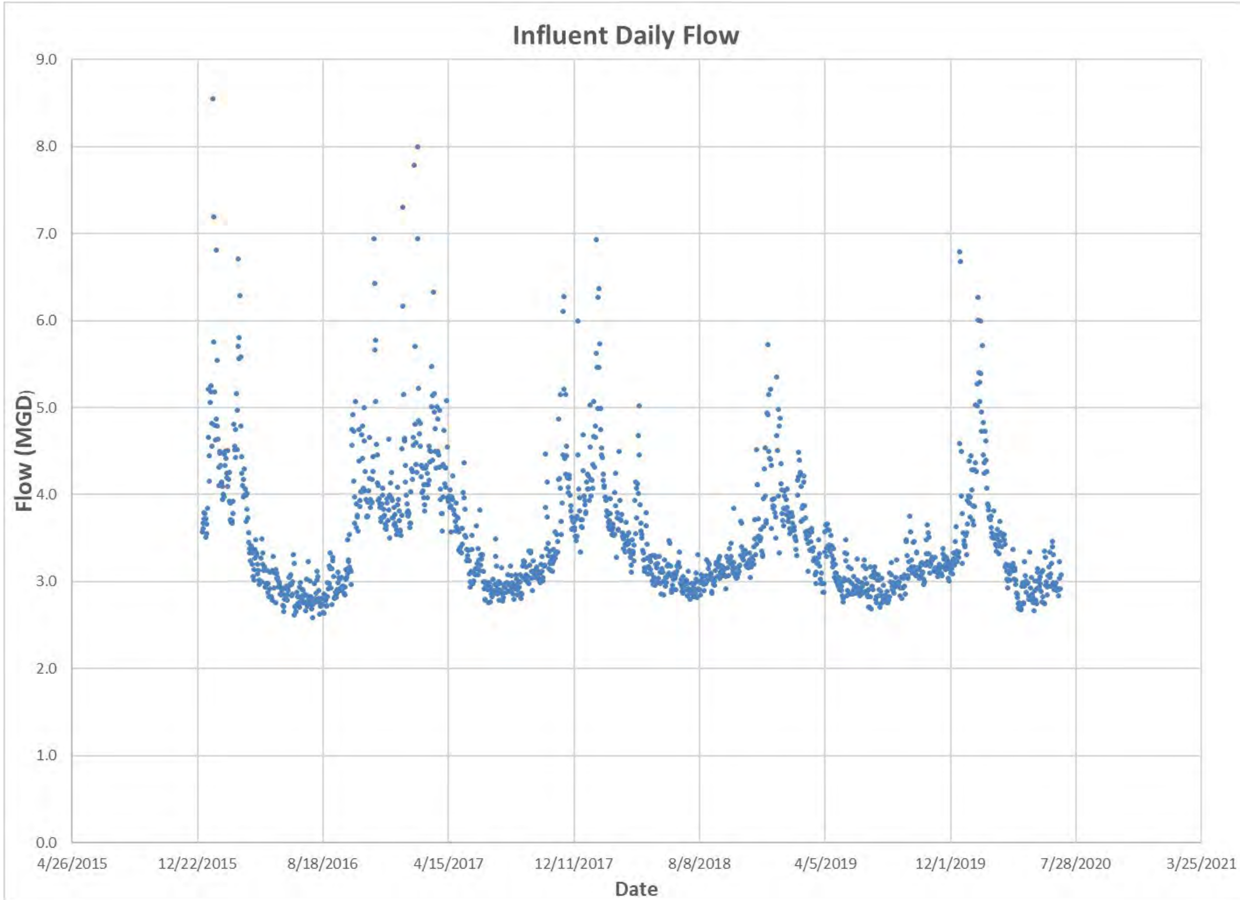


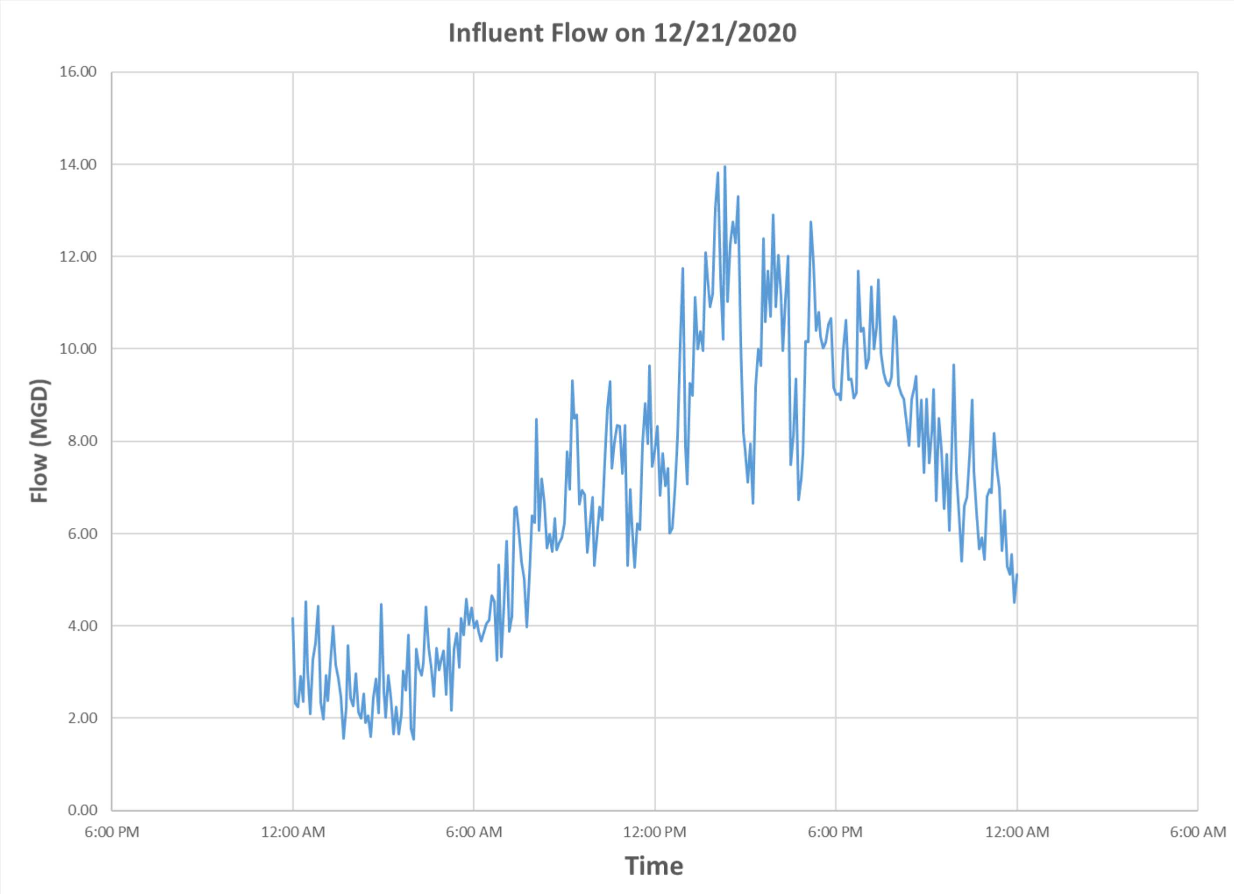
Table 3-3 summarizes the current (2020) AAF, MMWWF, MMDWF, PDF, and PHF from the plant DMR data and corresponding peaking factors and per capita values based on the estimated current sewered population of 57,939. The PHF flow rate was based on the hourly flow data at the Central Kitsap WWTP on December 21, 2020, when the plant experienced the highest influent flow after an extended rain event (**Figure 3-4**). The per capita flow values are in the normal range of most plants.

Table 3-3 | 2020 Influent Flows at Central Kitsap WWTP

Flow Event	Current Flow (MGD)	Peaking Factor	Per Capita Flow (gpcpd)
AAF	3.50	1.00	60.5
MMWWF	4.93	1.41	85.1
MMDWF	4.00	1.14	69.1
PDF	8.55	2.44	147.5
PHF	14.0	4.00	241.6

Notes:
MGD = million gallons per day
gpcpd = gallons per capita per day

Figure 3-4 | Diurnal Influent Flow to Central Kitsap WWTP on 12/21/2020



3.4.2 Wastewater Treatment Plant Flow Projection

Table 3-4 summarizes the projected flows through buildout conditions. Flows for year 2028 (6-year projection) and year 2042 (20-year projection) are based on the current flows and anticipated growth rate. Flows for 2017, 2038, and buildout are output from hydraulic modeling performed as part of the *Silverdale Pump Stations 3, 4, 19, and 31 Upgrades Preliminary Engineering Report (PER)* (BHC, 2020), included as **Appendix A**.

Table 3-4 | Projected Influent Flows at Central Kitsap WWTP

Flow Event	2017[1]	2028	2038[1]	2042	Buildout[1]
Projected Sewered Population	---	66,580	---	89,508	---
AAF (MGD)	---	4.0	---	5.4	---
MMWWF (MGD)	---	5.7	---	7.6	---
MMDWF (MGD)	---	4.6	---	6.2	---
PDF (MGD)	8.5	9.9	13.7	13.2	19.9
PHF (MGD)	13.2	16.2	20.1	21.6	26.2

Note:

1. Simulated results taken as summation of peak flow from North and South services areas to the Central Kitsap WWTP from the *Silverdale Pump Stations 3, 4, 19, and 31 Upgrades Preliminary Engineering Report* (BHC, 2020), included as **Appendix A**.

3.4.3 Infiltration and Inflow

The I&I is the wastewater component consisting of stormwater surface runoff entering the sewer system and infiltration from storm-saturated ground conditions. Inflow is runoff entering the sewer directly, typically from storm sewer connections, basement sump pumps, roof drains and submerged manholes. Infiltration occurs as groundwater leaks into the sewer system through cracked or broken pipes and manholes, or through loose joints and connections.

The I&I is important in determining the PDF and PHF through the system. They can vary significantly due to changes in groundwater tables, intensity of rainfall, duration of rainfall, and when the peak of the rain event occurs during the day.

The EPA publication 'Infiltration/Inflow – I/I Analysis and Project Certification' dated May 1985 was reissued by Ecology as Ecology Publication No. 97-03. This publication established the following thresholds for possibly excessive I&I:

- If average dry weather flow is less than 120 gpcd, infiltration is non-excessive.
- If average wet weather flow is less than 275 gpcd, inflow is non-excessive.

The average dry weather and wet weather flows are summarized in **Table 3-5**. The average dry weather flows indicate that infiltration is non-excessive. The average wet weather flows indicate that inflow is non-excessive.

Table 3-5 | EPA/DOE Excessive I&I Criteria

Parameter	Value
Population	61,855
Average Dry Weather Flow (MGD)	4.51
Average Dry Weather Flow (gpcd)	73
Average Dry Weather Dates[1]	1/14/2021-1/20/2021
Average Wet Weather Flow[2] (MGD)	8.79
Average Wet Weather Flow (gpcd)	142

Notes:

1. Dry weather flows are the average flow on days where no rainfall has occurred during a season of high groundwater.
2. Wet weather flows are the average of the highest flow events per year. Flow from 1/12/2021 was conservatively used for this analysis.

3.5 Wastewater Loads

3.5.1 Current Wastewater Loads

Wastewater loads to a treatment plant are used to evaluate different treatment alternatives and to determine the required treatment capacities. Current biochemical oxygen demand (BOD), total suspended solids (TSS), and Total Kjeldahl Nitrogen (TKN) daily mass loads were derived from January 2016 through June 2020 DMR data as well as monthly influent nitrogen data collected by plant staff. Similar to the influent flows, there appeared to be minimal growth in the loads since the completion of the last Facility Plan in 2011. These daily mass loads were divided by the projected 2020 sewered population of 57,939 to calculate per capita plant loads. The 2020 total and per capita loads for BOD, TSS and TKN during annual average, wet weather and dry weather flows are shown in **Table 3-6**. The load per capita values are typical of WWTPs.

Table 3-6 | 2020 Central Kitsap WWTP Influent BOD, TSS, and TKN Loads

Population	Parameter	Annual Average		Max Month Wet Weather		Max Month Dry Weather	
		Load (ppd)	Load Per Capita (ppcd)	Load (ppd)	Load Per Capita (ppcd)	Load (ppd)	Load Per Capita (ppcd)
57,939	BOD	8,817	0.152	10,116	0.175	10,128	0.175
57,939	TSS	7,924	0.137	9,924	0.171	9,106	0.157
57,939	TKN	1,421	0.025	1,635	0.028	1,586	0.027

Notes:
ppd = pounds per day
ppcd = pounds per capita per day

3.5.2 Influent Wastewater Loads Projection

Per-capita loading factors were multiplied by projected populations in 2028 and 2042 to project future plant BOD, TSS and TKN loading during average, wet weather, and dry weather conditions. Loading projections for 2028 and 2042 are shown in **Table 3-7** and **Table 3-8**.

Table 3-7 | 2028 (6-Year) Central Kitsap WWTP BOD, TSS, and TKN Loading Projections

Population	Parameter	Annual Average		Max Month Wet Weather		Max Month Dry Weather	
		Load (ppd)	Load Per Capita (ppcd)	Load (ppd)	Load Per Capita (ppcd)	Load (ppd)	Load Per Capita (ppcd)
66,580	BOD	10,132	0.152	11,624	0.175	11,638	0.175
66,580	TSS	9,106	0.137	11,404	0.171	10,464	0.157
66,580	TKN	1,634	0.025	1,879	0.028	1,823	0.027

Table 3-8 | 2042 (20-Year) Central Kitsap WWTP BOD, TSS, and TKN Loading Projections

Population	Parameter	Annual Average		Max Month Wet Weather		Max Month Dry Weather	
		Load (ppd)	Load Per Capita (ppcd)	Load (ppd)	Load Per Capita (ppcd)	Load (ppd)	Load Per Capita (ppcd)
89,508	BOD	13,622	0.152	15,627	0.175	15,646	0.175
89,508	TSS	12,242	0.137	15,331	0.171	14,067	0.157
89,508	TKN	2,197	0.025	2,526	0.028	2,450	0.027

SECTION 4

Regulatory Requirements

The operation and construction of wastewater collection and conveyance systems and wastewater facilities are regulated through federal, state, and local regulations. Federal, state, County, and local government regulatory requirements applicable to the Central Kitsap collection and conveyance systems, WWTP, and other wastewater facilities are described in this section.

4.1 Federal Rules and Regulations

4.1.1 Federal Water Pollution Control Act (Clean Water Act)

The Federal Water Pollution Control Act, also known as the Clean Water Act (CWA), is a comprehensive framework for the regulating the discharge of pollutants into waters of the United States. The United States Environmental Protection Agency (EPA) has delegated the administration of the NPDES permit program in Washington State to Ecology. NPDES permitting is discussed in further detail below, as are Pretreatment regulations and Biosolids Management.

4.1.2 U.S. Army Corps of Engineers

The United States Army Corps of Engineers (USACE) has jurisdiction over waterways and wetlands of the United States. Modifications to the treatment plant outfall or development or construction in wetland areas may require a permit from the USACE. Permitting is reviewed by Federal, State, and local agencies as well as Tribal entities. Permits are contingent on certification from Ecology that the project is consistent with the State of Washington Coastal Zone Management Plan.

4.1.3 Endangered Species Act

The National Marine Fisheries Service is directed under Section 4(d) of the Endangered Species Act (ESA) to issue regulations conserving species listed as threatened. The Section 4(d) rules apply to ocean and inland areas as well as any entity subject to U.S. jurisdiction. Species in the basin listed as threatened under Section 4(d) are listed in **Section 2.3.6**.

Section 9 of the ESA prevents “taking” or harm of threatened species and identifies some activities with a high risk of take. These activities include urban development in riparian areas and areas susceptible to erosion destruction or alteration of habitats, and violations of discharge permits.

4.1.4 Capacity Management Operations and Maintenance Programs

Capacity Management Operations and Maintenance (CMOM) is an anticipated regulation from the EPA related to control of sanitary sewer overflows (SSO) from sewer collection and conveyance systems or treatment facilities, which are prohibited under the Federal CWA. The EPA has prepared a draft rule titled “Sanitary Sewer Overflow Control Rule” which is intended to eliminate preventable SSOs through requiring owners and operators of sewer systems to develop and implement CMOM programs.

4.1.5 Puget Sound Water Quality Management Plan

The Federal Water Pollution Control Act established the requirement for a Water Quality Management Plan. Resultantly, the RCW, section 90.71 established the need of a Puget Sound Water Quality Management Plan. The stated objective of this plan is to protect and restore Puget Sound through effective coordination among governments and private interests, and through used of an adaptive management approach.

4.1.6 EPA Plant Reliability Criteria

The Central Kitsap WWTP is required to meet the Reliability Class I standards, as defined in EPA's Technical Bulletin "Design Criteria for Mechanical, Electrical, and Fluid System Component Reliability," EPA 430-99-74-001. A summary of plant reliability criteria and requirements and current deficiencies at Central Kitsap WWTP are discussed in **Section 6** of this Plan.

4.1.7 National Historic Preservation Act

The National Historic Preservation Act (NHPA) established processes to assess, designate, and protect historic and cultural resources. It also established the National Register of Historic Places and the State Historic Preservation Officer (SHPO) to administer state historic preservation program and coordinate with federal agencies on their proposed actions, also known as undertakings. Section 106 of the NHPA requires coordination between federal, state, local, and tribal entities to review the impacts of any undertakings on historical properties listed or eligible for listing on the National Register.

4.2 State Rules and Regulations

4.2.1 Department of Ecology

The approval of this Plan is per Ecology. Requirements for sewer plans are listed in RCW 90.48.110 and WAC 173-240. Ecology administers numerous regulations published in the WAC which are briefly described below.

4.2.1.1 Water Quality Regulations

Ecology's water quality standards for surface waters of the State are published in WAC 173-201A which also contains the anti-degradation policy. The anti-degradation policy has goals which include restoring and maintaining the highest possible quality of the surface waters of Washington and to ensure that all human activities that are like to contribute to a lowering of water quality, at a minimum, apply all known, available, and reasonable methods of prevention, control, and treatment (AKART).

Ecology established water quality criteria for marine environments under WAC 173-210. Under this section, standards are set for "public health and public enjoyment of the waters and the propagation and protection of fish, shellfish, and wildlife." Within this section, water quality criteria are established for aquatic life uses, shellfish harvesting, recreation use, and miscellaneous uses. Under aquatic life uses, target levels for temperature, DO, and bacteria, turbidity, and pH were established with different quality thresholds based on the importance of the environment and the species present. Mixing zone regulations for WWTP outfalls are also specified in WAC 173-201A-400.

4.2.1.2 NPDES Regulations

Ecology has been delegated authority from the EPA to enforce the CWA to regulate the discharge of treated effluent from WWTPs through the NPDES program. Washington's NPDES Permit requirements are included in WAC 173-220, whose purpose is to "establish a state individual permit program, applicable to the discharge of pollutants and other wastes and materials to the surface waters of the state, operating under state law as a part of the NPDES created by Section 402 of the Federal Water Pollution Control Act PCA)." NPDES Permit limits must comply with Washington water quality standards and biosolids management regulations included in WAC 173-201A and WAC 173-308, respectively.

The County's Central Kitsap WWTP NPDES Permit #WA0030520 was renewed on August 1, 2017, allowing the discharge of treated effluent to Port Orchard Bay of the Puget Sound. A copy of the WWTP's NPDES Permit is included in **Appendix B**. The NPDES Permit expired on July 31, 2022. The County submitted the permit renewal application six months before the expiration date per the Permit requirement, so the permit was administratively continued and remains in effect.

4.2.1.3 Pretreatment Regulations & Industrial Users

Central Kitsap WWTP is required in Special Condition S6 of the NPDES permit to enforce the discharge prohibitions, identify and report existing, new, and proposed industrial users, and conduct industrial user survey.

According to 40 Code of Federal Regulations (CFR) Part 403 (General Pretreatment Regulations for Existing and New Sources of Pollution) all "significant industrial users" (SIUs), which are industrial users that discharged an average of 25,000 gpd or more to the Publicly Owned Treatment Works (POTW) or makes up 5 percent or more of the average dry weather hydraulic or organic BOD or TSS capacity of the POTW, are required to be part of the National Pretreatment Program.

The National Pretreatment Program is charged with controlling toxic, conventional, and non-conventional pollutants from non-domestic sources that discharge into sewer systems, as described in CWA Section 307(a). Ecology has been given authority by the EPA to regulate the Pretreatment Program in Washington and is required to comply with the federal provisions of the National Pretreatment Program. The Pretreatment Program requires all large POTW that have a designed treatment capacity of more than 5 million gallons per day (MGD) to establish a Local Pretreatment Program.

Central Kitsap WWTP is required to develop a formal Pretreatment Program in Section S6.C. of the NPDES permit. The County is required to establish a process for authorizing non-domestic wastewater discharge which ensures that all SIUs in all tributary areas have obtained and are meeting applicable state waste discharge permit (SWDP) requirements. Additionally, the County must take continuous and routine measures to identify all existing, new, and proposed SIUs.

The County conducted an Industrial User Survey in 2022. The survey is included in **Appendix C**. There are three SIUs within the Central Kitsap service area, as summarized in **Table 4-1**.

Table 4-1 | Summary of Industrial Discharge Permits

Discharger	State Waste Discharge Permit Number	Wate Quantity	Type of Waste
Poulsbo Village Fuel Groundwater Treatment Project	ST0501328	Up to 3,600 gpd at a flowrate of 20-30 gpm	Wastewater from Fuel Reclamation Process

Discharger	State Waste Discharge Permit Number	Wate Quantity	Type of Waste
US Navy Undersea Warfare Center	ST0007353	Up to 50,000 gpd	Metal Bearing Wastewaters, Hexavalent Chromium-Bearing Wastewaters, and Wastewater from Fuel Reclamation Process
US Navy Submarine Base Bangor	ST0007363	Up to 393,000 gpd, total from several sources. See permit for details.	Metal Bearing Wastewaters, Wastewater from Hydrocarbon Separation Process, TSS, Amalgam Separator Wastewater.

4.2.1.4 Biosolids Management

Central Kitsap WWTP is required in Special Condition S7 of the NPDES permit to store and handle all residual solids in accordance with the requirements of applicable state water quality standards. The final use and disposal of sewage sludge from this facility is regulated by EPA under 40 CFR 503, and by Ecology under RCW chapter 70.95, WAC 173-308, Biosolids Management, and WAC 173-350, Solid Waste Handling Standards. Washington state law requires that biosolids be put to beneficial reuse unless specifically permitted otherwise. The regulations also address the monitoring, record keeping, and reporting requirements.

Ecology regulates biosolids under a General Permit for Biosolids Management, which requires the County to submit a Notice of Intent and Application for Coverage describing the biosolids treatment, handling, and disposal. The general permit requires that permitees conduct testing and submit an annual report to Ecology. Currently, the County hauls Class B biosolids to Natural Selections Farms near Moxee, WA for disposal. As a biosolids handler and beneficial reuse site, Natural Selections Farms has separate coverage under the general permit. If biosolids or other solids residuals are placed in landfills, federal, state, and local solid waste regulations will also apply.

4.2.1.5 Puget Sound Nutrient General Permit

In response to areas of the Puget Sound not meeting the water quality criteria for DO, Ecology initiated the Puget Sound Nutrient Source Reduction Project to investigate the causes and extent of DO deficits. As part of the analysis, Ecology, along with several academic partners, developed a Salish Sea Model and determined the source of these exceedances of the water quality standard was the discharge of excess nutrients, especially nitrogen.

Ecology has implemented the PSNGP for WWTPs to address the largest source of excess nutrients going into Puget Sound. They issued the first PSNGP effective as of January 1, 2022 and expiring on December 31, 2026. This PSNGP applies to the 58 publicly owned domestic WWTPs discharging into Washington waters of the Salish Sea. The WWTPs are categorized as ‘Dominant (D) TIN loads’, ‘Moderate (M) TIN loads’, or ‘Small (S) loads’ based on their percentage of TIN load currently discharged. The dominant or moderate TIN load plants have a facility specific action level and are required to implement nutrient monitoring and reporting, develop a nutrient optimization plan, conduct a nutrient reduction evaluation, and comply with action level exceedance corrective actions if nutrient discharge limits are exceeded. Small TIN load plants do not have a facility specific action level but are also required to implement nutrient monitoring and reporting, develop a nutrient optimization plan, and conduct AKART analysis. Central Kitsap WWTP is classified as a moderate TIN load plant.

Ecology is working collaboratively with Puget Sound stakeholders through the Puget Sound Nutrient Source Reduction Project and Puget Sound Nutrient Forum to find solutions for reducing other human sources of excess nutrients.

4.2.1.5.1 Monitoring and Reporting Requirements

The PSNGP requires nutrient monitoring, recording, and reporting so nutrient loading can be calculated and tracked. The requirements under this permit will supplement the information collected under Central Kitsap WWTP's individual NPDES permit and is limited to analyses necessary to track nutrients in the influent and effluent. The monitoring schedule is based on the classification of the WWTP. The dominant TIN load treatment plants are required to monitor the influent and effluent two times per week, one time per quarter, or one time per month, depending on the parameter. The moderate TIN load treatment plants are required to monitor the influent and effluent nutrient concentrations one time per week, one time per quarter or one time per month, depending on the parameter. The small TIN load treatment plants are required to monitor the influent and effluent nutrients one time per quarter, or once or twice a month depending on the parameter.

The influent and effluent sampling requirements for moderate TIN load plants including Central Kitsap WWTP are shown in **Table 4-2** and **Table 4-3**.

Table 4-2 | Influent Nutrient Sampling Requirement for Central Kitsap WWTP

Parameter	Units	Minimum Sampling Frequency
BOD	mg/L	1/week
Total Ammonia	mg/L as N	1/week
Nitrate plus Nitrite Nitrogen	mg/L as N	1/month
Total Kjeldahl Nitrogen (TKN)	mg/L as N	1/month

Note:
mg/L = milligrams per liter

Table 4-3 | Effluent Nutrient Sampling Requirement for Central Kitsap WWTP

Parameter	Units	Minimum Sampling Frequency
Flow	MGD	1/week
BOD	mg/L	1/week
Total Organic Carbon	mg/L	1/quarter
Total Ammonia	mg/L as N	1/week
Nitrate plus Nitrite Nitrogen	mg/L as N	1/week
TKN	mg/L as N	1/month
TIN	mg/L as N	1/week
TIN	Lbs/day	1/week
Average Monthly TIN	Lbs	1/month
Annual TIN, year to date	Lbs	1/month

Note:
Lbs = pounds

4.2.1.5.2 Nitrogen Optimization Plan

An annual Nitrogen Optimization Plan is a required submittal for all permittees and would be submitted electronically as a permit submittal. The purpose of the Nitrogen Optimization Plan is to provide a framework for developing, implementing, and documenting nitrogen optimization strategies. The permit provided detailed requirements of the Nitrogen Optimization Plan components, which vary slightly depending on the TIN load categories.

4.2.1.5.3 Action Level Exceedance Corrective Actions

If the annual TIN load action level at a dominant or moderate TIN load plant is exceeded, the plant is required to implement corrective actions while continuing optimization. In addition, the dominant TIN load plant is required to submit to Ecology an engineering report or technical memorandum (TM) presenting a proposed approach for reducing the annual TIN load by 10 percent, while the moderate TIN load plant is required to submit a report or memo proposing a reduction below the action level. This proposed approach would be required to be implemented if the load limit is exceeded two years in a row or three years in a permit term.

4.2.1.5.4 Nutrient Reduction Evaluation

In addition to the TIN load limits and action level requirements, the final permit includes planning requirements for all dominant TIN load WWTPs covered by the permit. These plants must conduct a Nutrient Reduction Evaluation during the first permit cycle. The evaluation must include an AKART analysis for treatment technologies capable of reducing TIN and assess other options to reduce effluent TIN to 3 milligrams per liter (mg/L).

The Nutrient Reduction Evaluation is intended to be a treatment feasibility investigation which must include wastewater characterization, treatment technology analysis, economic evaluation, environmental justice review, alternative selection, and implementation timelines.

4.2.1.6 Clean Water Act Section 303(d) List

Ecology conducts the water quality assessment based on Federal laws, state water quality standards, and Water Quality Assessment Policy 1-11 to track water qualities in the rivers, lakes, and marine waters in the state. The water quality assessment compares water data to requirements detailed in Policy 1-11. The assessed waters are placed into categories that describe the status of water quality, before being submitted to the EPA for approval of the category 5 listings, also called the 303(d) list. The water quality assessment divides water bodies into the following impairment categories:

- Category 1: Meets tested standards for clean waters
- Category 2: Waters of concern
- Category 3: Insufficient data
- Category 4: Impaired waters that do not require a Total Maximum Daily Load (TMDL)
- Category 5: Polluted waters that require a water improvement project

4.2.1.7 Infiltration and Inflow

Ecology can require reductions in I&I in situations where diluted influent affect the 85 percent BOD removal and the suspended solids minimum removal limit. State and Federal regulations also require that recipients of loan or grant money demonstrate that their sewer collections systems are not subject to excessive I&I.

4.2.1.8 Engineering Design Criteria

Ecology's "Criteria for Sewage Works Design," (Orange Book), identifies engineering criteria for design, construction, and operation of public sanitary sewer systems and wastewater treatment facilities.

4.2.2 Recycled Water Use

Recycled water is regulated by Ecology and the DOH, according to WAC 173-219. Ecology and DOH are both required to review recycled water proposals to determine if proposed treatment methods and uses will protect public health and the environment while not affecting existing water rights. The regulation also provides criteria to determine the lead agency based on the type of facility recycling the water. Requirements from both the lead and non-lead agency must be met as a condition of permitting. Recycled water from the Central Kitsap WWTP would be regulated with Ecology as the lead agency under WAC 173-219-050 as the source water is effluent from a facility permitted by Ecology.

4.2.3 State Environmental Policy Act

The Washington SEPA is intended to help state and local agencies identify environmental impacts likely to result from a range or projects or decisions. Construction of public facilities such as sewer lines or WWTPs or adopting regulations or policies such as comprehensive plans often trigger a SEPA review.

4.2.4 State Environmental Review Process

The Washington State Environmental Review Process (SERP) is regulated according to WAC 173-98-720 and states all recipients of funding for water pollution control facility projects must comply with the SERP. SERP includes all provisions of SEPA. Mitigation measures identified in documents developed through the SERP become conditions of funding.

4.2.5 Puget Sound Clean Air Agency

The Puget Sound Clean Air Agency (PSCAA) has jurisdiction in the County and is responsible for regulating and permitting air emissions in the Puget Sound Region. Construction projects are often subject to regulation under PSCAA's Notice of Construction (NOC) Program. Projects that fall under the NOC program must not be subject to provisions of the Prevention of Significant Deterioration (PSD) or the New Source Review (NSR) programs, administered by Ecology. Determination of the regulatory pathway is dependent on the potential change in emissions resulting from the project and two categorizations: the source is either characterized as a major or non-major source and emissions from the project categorized as either significant or less than significant. Acceptable Source Impact Levels (ASIL) are defined in WAC 173-460 and regardless of regulatory pathway, toxic air contaminants (TAC) emission increases must be compared to ASILs. Point sources such as waste gas burners, open tanks, and scrubber vents must be evaluated.

4.2.6 Washington State Department of Fish and Wildlife

The Washington State Department of Fish and Wildlife administers the State Hydraulic Code (WAC 220-660) which establishes regulations for the construction of hydraulic projects or work that will impact any salt or fresh waters of the state. It also sets forth procedures for obtaining Hydraulic Project Approval (HPA). Modifications to the Central Kitsap WWTP outfall would likely require HPA.

4.3 Kitsap County and Local Government Requirements

The Central Kitsap sewer basin and Central Kitsap WWTP conveys and treats sewage from the City of Poulsbo and unincorporated Kitsap County, including the Bangor and Keyport Naval Bases.

4.3.1 Kitsap County Codes

Kitsap County Code Chapter 13.12 contains regulations governing public sewer systems, and describes licensing and permitting of sewers, the locations of sewers and connections, and prohibited discharges and disposal of prohibited wastes. Specifications for sewers as well as standards for excavation and trenching are also included in Chapter 13.12.

Kitsap County Code Chapter 18 contains the basic requirements that apply to the SEPA process and describes the sections of the SEPA that have been adopted by the County. Contents of Chapter 18 include, but are not limited to, designation of responsible officials and lead agency, exemptions and threshold determinations, an environmental checklist for applicants, rules for preparing environmental impact statements, rules for commenting on environmental documents under SEPA, rules governing public notices and hearings, and rules describing agency compliance with SEPA.

Kitsap County Code Chapter 19 contains the County's Critical Areas Ordinance which identifies and protects critical areas as required by the GMA. Critical areas include but are not limited to wetlands, fish and wildlife habitat conservation areas, and geologically hazardous areas. Chapter 19 also outlines purposes and objectives for each critical area category and describes development standards, review procedures, and designation statuses.

Kitsap County Code Chapter 22 contains the County's Shoreline Master Program which guides future development of the shorelines in the county consistent with the Shoreline Management Act. Chapter 22 describes shoreline jurisdiction and environment designations, goals and policies for the program, regulations, permit review and enforcement, and shoreline use and modification standards. This chapter also contains a section describing requirements for reports for critical areas including wetlands, habitats, geotechnical, and hydrogeological. This section addresses when reports are required, the qualifications of those preparing the reports, and timelines and schedules for the reports.

4.3.2 City of Poulsbo Codes

Chapter 13.06 of the City of Poulsbo Municipal Code governs water and sewer systems within the City of Poulsbo. This chapter includes regulations describing requirements for sewer connections, regulations pertaining to future development, types of prohibited discharge in the sewer system, side sewer responsibilities, and regulations governing industrial users.

Chapter 16.04 of the City of Poulsbo Municipal Code describes environmental policy guidelines. This chapter lists the sections of the WAC adopted the City. Other sections of this chapter describe the designation of responsible officials and lead agency determination with respect to the adopted sections of SEPA. It also describes exemptions and threshold determinations, an environmental checklist for applicants, rules for preparing environmental impact statements, rules for commenting on environmental documents under SEPA, rules governing public notices and hearings, and rules describing agency compliance with SEPA.

Chapter 16.08 of the City of Poulsbo Municipal Code describes the City's Shoreline Master Program. This chapter describes regulations governing the use, activities, and development withing the City's shoreline jurisdictions and mandates all uses, activities, and developments with the shoreline jurisdiction comply with the Shoreline Management Act. This defines uses, activities, and developments in the shoreline jurisdiction; describes design requirements; describes regulations governing shoreline modifications; and describes, nonconformances, conditional uses and variances, and enforcement.

Chapter 16.20 of the City of Poulsbo Municipal Code describes regulations governing critical areas. Critical areas addressed in this chapter include but are not limited to wetlands, fish and wildlife habitat conservation areas, and geologically hazardous areas. The chapter also outlines purposes and objectives for each critical area category and describes development standards, review procedures, and designation statuses. This chapter also contains a section describing requirements for reports for critical areas including wetlands, habitats, geotechnical, and hydrogeological. This section addresses when reports are required, the qualifications of those preparing the reports, and timelines and schedules for the reports.

4.3.3 Bangor and Keyport Naval Bases

The Bangor and Keyport Naval bases are subject to regulation by the United States Department of Defense (DoD). DoD Instruction (DoDI) 4715.06, updated August 31, 2018, governs environmental compliance for the DoD, including military installations such as the Bangor and Keyport Naval bases which are subject to environmental regulations including, but not limited to, the Clean Air Act, CWA, and the Toxic Substances Control Act. the DoDI establishes the policy that environmental programs in the DoD achieve maintain, and monitor compliance with all applicable environmental requirements. The DoDI calls for minimizing the release of pollutants, achieving compliance through pollution prevention, and implementing environmental management systems to achieve DoD goals.

4.3.4 Growth Management Act

The GMA is a State, County, and City planning requirement which influences City and County plans for future growth. The GMA established a series of 13 goals under RCW 36.70A.020 as well as a 14th goal (RCW 36.70A.480) which adds the goals and policies from the Shoreline Management Act to those of the GMA. The County is subject to the full requirements of the GMA which requires planning for utilities including sewer service. This includes providing a capital facilities element in Comprehensive Land Use Plans as well as forecasting future needs for these facilities, proposed locations and capacities of new or expanded facilities, and plans to fund these facilities into the future. The 2016 KCCP was prepared to satisfy the GMA requirements and describes the planned growth within the sewer service areas as well as plans to maintain and expand services within the sewer service area.

Based on the requirements of the GMA, the County is required to review, and if necessary, revise its Comprehensive Plan by June 30, 2024, and every eight years thereafter. As part of this review and revision, the County plans to revise its population and employment growth projections, which currently are projected to 2036, out to the year 2044. This revision is planned to begin in 2022, thus revised growth projections were not available at the time of this sewer plan update.

4.3.5 Water as a Resource Policy

The County’s Water as a Resource Policy directs the County to treat water as a resource and not a waste stream. The policy focuses on improving water in the County through seven main guiding principles. While the guiding principles largely focus on controlling stormwater, guiding principles concerning conserving groundwater resources impacts the sewer system through use of recycled water or non-potable water for appropriate uses. The policy also contains guiding principles aimed at continual refinement of management tools. In addition to guiding principles, the policy directs the County to consider water as a resource when developing, re-developing, retrofitting, refurbishing, maintaining, and operating public assets. The policy also directs the County to consider water as a resource when developing or revising codes and regulations.

SECTION 5

Collection and Conveyance Existing Conditions

5.1 Introduction

The Central Kitsap basin collection and conveyance system is comprised of the sewer assets owned by the County within the Central Kitsap and Silverdale UGAs, as well as facilities serving the City of Poulsbo, Bangor Naval Base, and Keyport Naval Base. Wastewater within the Central Kitsap system is ultimately conveyed to the Central Kitsap WWTP through two pipes conveying flow from the Northern and Southern Service Areas. The oldest portions of the system were installed in the 1950s, with much of the system's growth occurring during the late 1970s and 1980s. The system now serves approximately 20 square miles of residential, commercial, and military customers within the UGA boundaries. The sewer system is separate from the stormwater system and consists of gravity sewers, pump stations, IPS, force mains, manifold force mains with multiple pump stations, and siphons. Some properties within the service area have on-site septic systems that are not connected to the collection system.

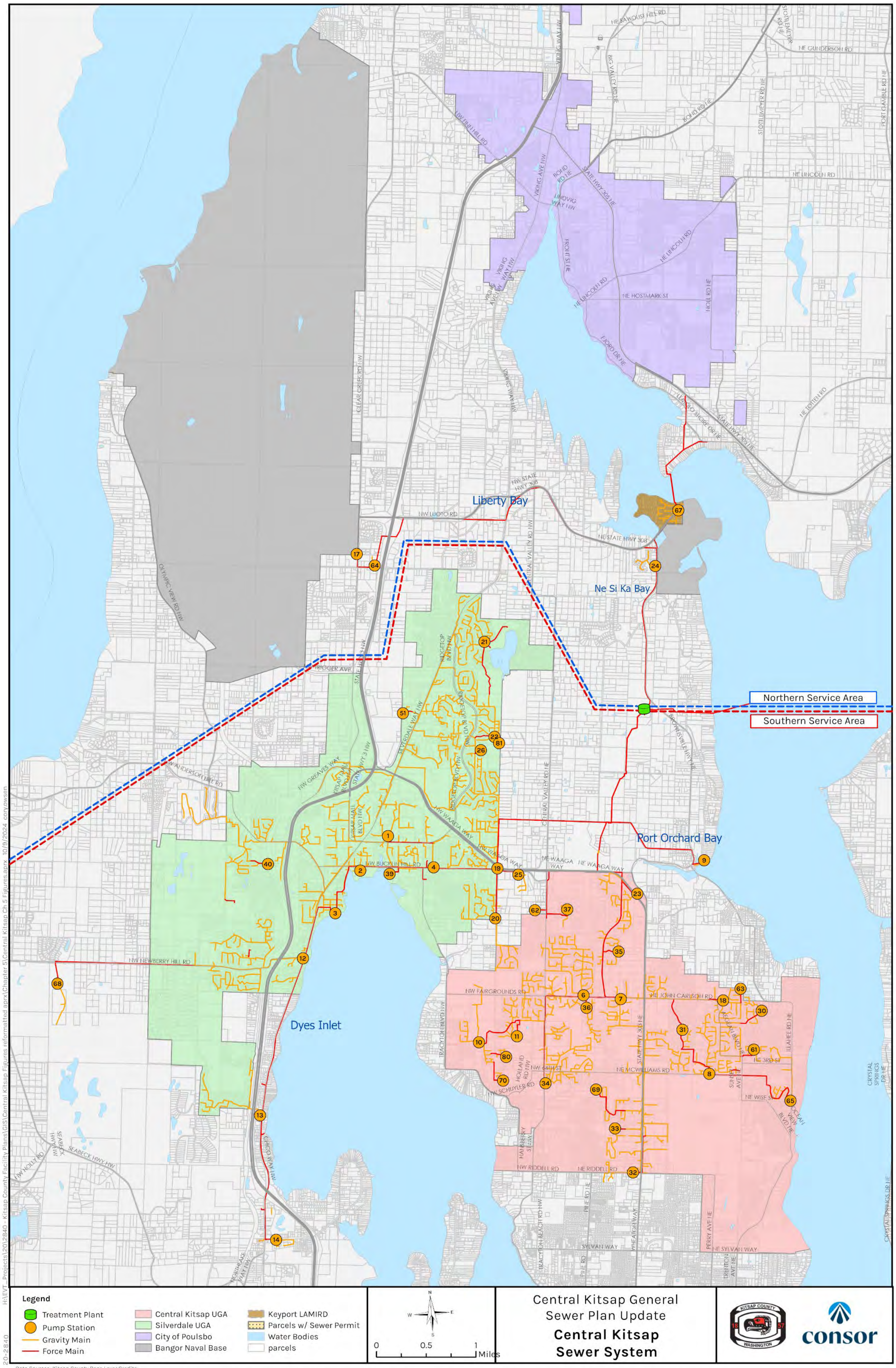
5.2 Service Areas and Sewer Basins

The Central Kitsap collection and conveyance system is comprised of two service areas defined as the Northern and Southern Service Areas. Figure 5-1 presents an overview of the Central Kitsap sewer system.

The Northern Service Area consists of the Keyport Naval Base and Bangor Naval Base, and Poulsbo communities. The Northern Service Area's flows are routed through the following Pump Stations: PS-17, PS-64, PS-67, and PS-24. Flows from all pump stations combine at the intersection of NE Tagholm Road and Brownsville Highway NE into a 24-inch diameter force main that runs south along Brownsville Highway NE and discharges at the influent channel of the Central Kitsap WWTP Headworks. The Navy owns and operates the sewer system upstream of PS-17 within Bangor Naval Base, as well as the sewer system within the boundaries of Keyport Naval Base. The County owns and maintains the sewer system within the residential areas of the Keyport community and performs routine sampling of flows on-site at Keyport Naval Base on a restricted access basis. The City of Poulsbo owns and operates the sewer system upstream of Johnson Way NE and State Highway 305.

The Central Kitsap collection and conveyance system's Southern Service Area is divided into two primary basins, each defined by the UGA for which they serve. The Silverdale basin includes 14 pump stations encompassed within the Silverdale UGA boundary as well as the outlying PS-13, PS-14, and PS-68. The Central Kitsap basin is defined by the Central Kitsap UGA boundary and includes 22 pump stations. Flows from all pump stations within the Southern Service Area ultimately combine at the intersection of NE Paulson Road and Kelly Court NE into a 30-inch diameter pipe running north to the Central Kitsap WWTP.

Figure 5-1 | Central Kitsap Sewer System



Data Sources: Kitsap County Base Layer Credits:
Disclaimer: Consor Engineers & Kitsap County make no representations, express or implied, as to the accuracy, completeness and timeliness of the information displayed. This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.

At the level of single pump stations, service areas are delineated as 'mini-basins', defined as the area from which the collection system drains to a specified discharge point. Delineations of mini-basins are based on existing sewer service and topography. Each portion of the system contributing to a pump station is delineated as a separate mini-basin.

5.2.1 Flow Routing

While all flows within the Central Kitsap basin ultimately arrive at the Central Kitsap WWTP in either one of two large diameter force mains, the complex network of upstream pipes and flow structures in both service areas warrant a full discussion. **Figure 5-2** presents a diagram of the Central Kitsap basin's flow routing and pump station criticalities. Pump station criticality is discussed in **Section 5.3**.

5.2.1.1 Northern Service Area

The Northern Service Area receives and meters flows from the City of Poulsbo at the manhole located to the southwest of the intersection of Johnson Way NE and State Highway 305. The County-owned sewer begins at this manhole and runs to the south, paralleling stretches of Peterson Way NE, Lemolo Shore Drive NE, and Brauer Road NE as it reaches the intersection of Brauer Road NE and Tuk Wil La Road NE. At this intersection, a 3-inch diameter force main carrying flows from the east ties into a 14-inch diameter sewer before it continues to the southwest, eventually reaching the inlet structure of the Lemolo Siphon. Flows conveyed through the Lemolo Siphon run south through two 12-inch diameter barrels underneath Liberty Bay before discharging into the siphon outlet structure at the intersection of NE Grandview Boulevard and Washington Avenue NE, and then flow by gravity to PS-67.

This Central Kitsap sewer system is owned and operated by the County. The City of Poulsbo pays for the infrastructure costs based on the percentage of flow, and therefore pays for 100-percent of the facilities from Highway 305 to the discharge of the Lemolo Siphon. Facilities downstream are paid for by both Poulsbo and Kitsap based on the flow percentage. The County and the City of Poulsbo are currently evaluating a replacement for the Lemolo Siphon, which is aging and reaching capacity.

PS-67 collects flows from the Lemolo Siphon and the surrounding residential customers of the Keyport community and military customers of Keyport Naval Base. The County does not own or perform maintenance on the sewer system located on Keyport Naval Base, however laboratory staff from the Central Kitsap WWTP perform sampling and flow monitoring of the flows on a controlled-access basis.

Flows from PS-67 are pumped southwest along State Route (SR) 308 and Brownsville Highway NE through a 16-inch diameter force main before connecting to the 24-inch diameter manifold force main located at the intersection of Brownsville Highway NE and NE Tagholm Road. The replacement for the 24-inch diameter manifold force main has been constructed at the time of writing. **Figure 5-3** provides details of the County's collection and conveyance system for the Poulsbo and Keyport communities.

Figure 5-2 | Central Kitsap Conveyance System Flow Schematic

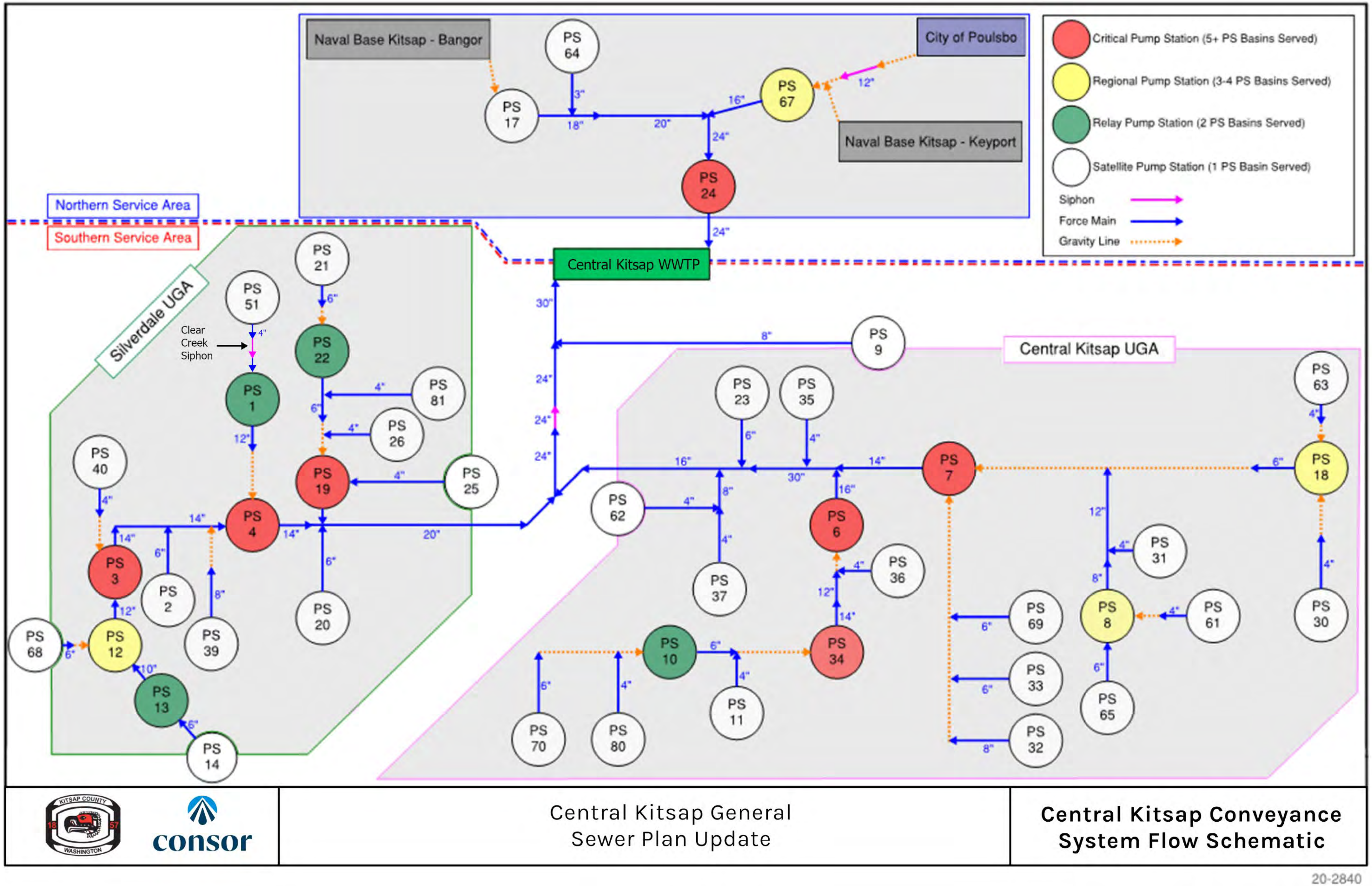
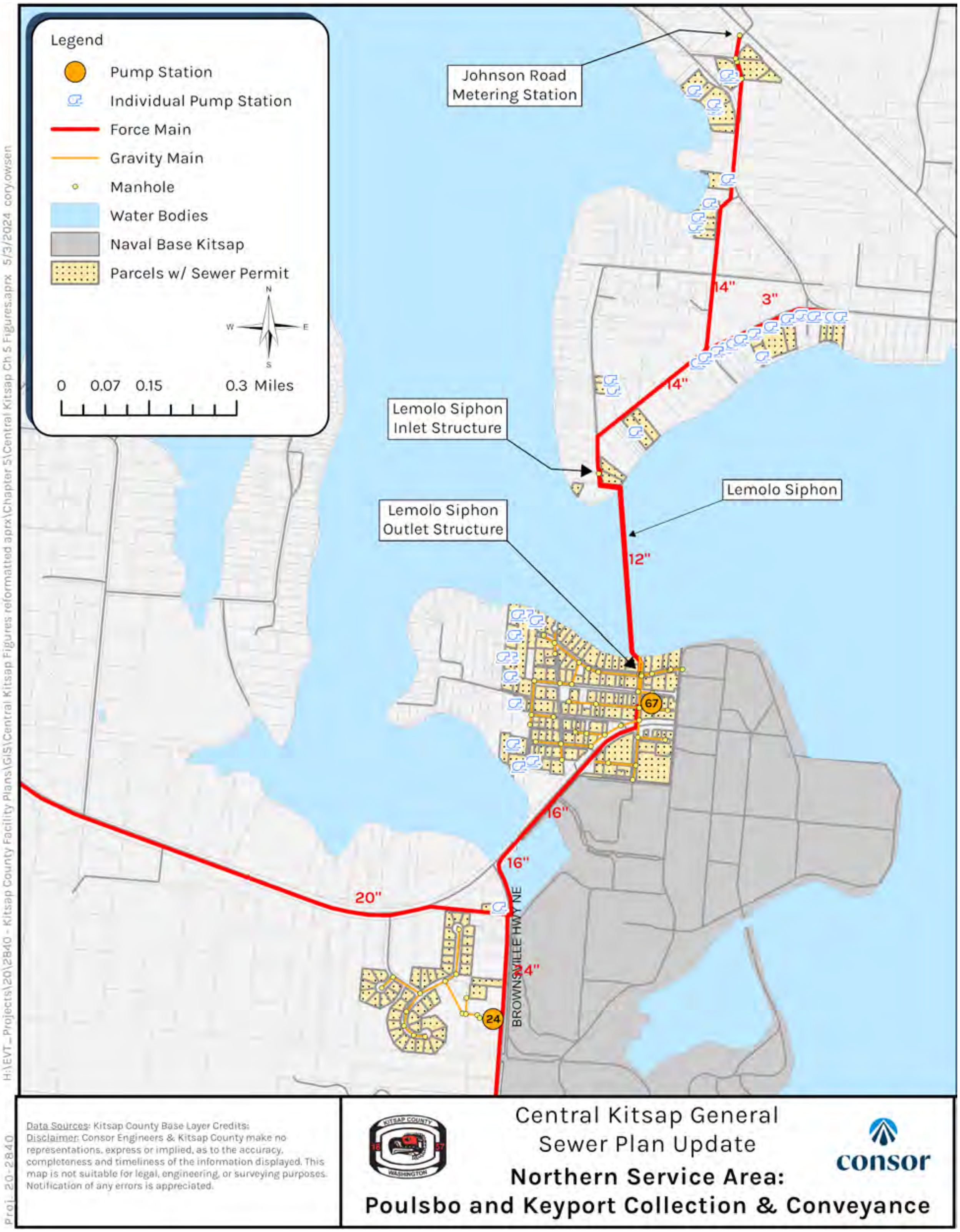


Figure 5-3 | Poulsbo and Keyport Collection & Conveyance



The County receives flows from Bangor Naval Base at PS-17, located on Clear Creek Road NW approximately 530 feet south of Gate 1 of the Naval base. Flows to PS-17 are pumped approximately 4 miles before reaching the 24-inch diameter manifold force main at the intersection of Brownsville Highway NE and NE Tagholm Road. The force main exiting PS-17 runs south along Clear Creek Road NW before turning east and following NW Mountain View Road for approximately 950 feet before turning northeast at the driveway entrance to PS-64. The line continues northeast along the Bonneville Power Administration's (BPA) power corridor for approximately 1,700 feet before turning east to pass beneath SR 3. After crossing under SR 3, the force main parallels the SR 308 off ramp to the northeast before following portions of SR 308, NW Luoto Court, Silverdale Way NW, and NE Tagholm Road on its way to the intersection of Brownsville Highway NE and NE Tagholm Road. **Figure 5-4** displays a closer view of the northern service area force main's route.

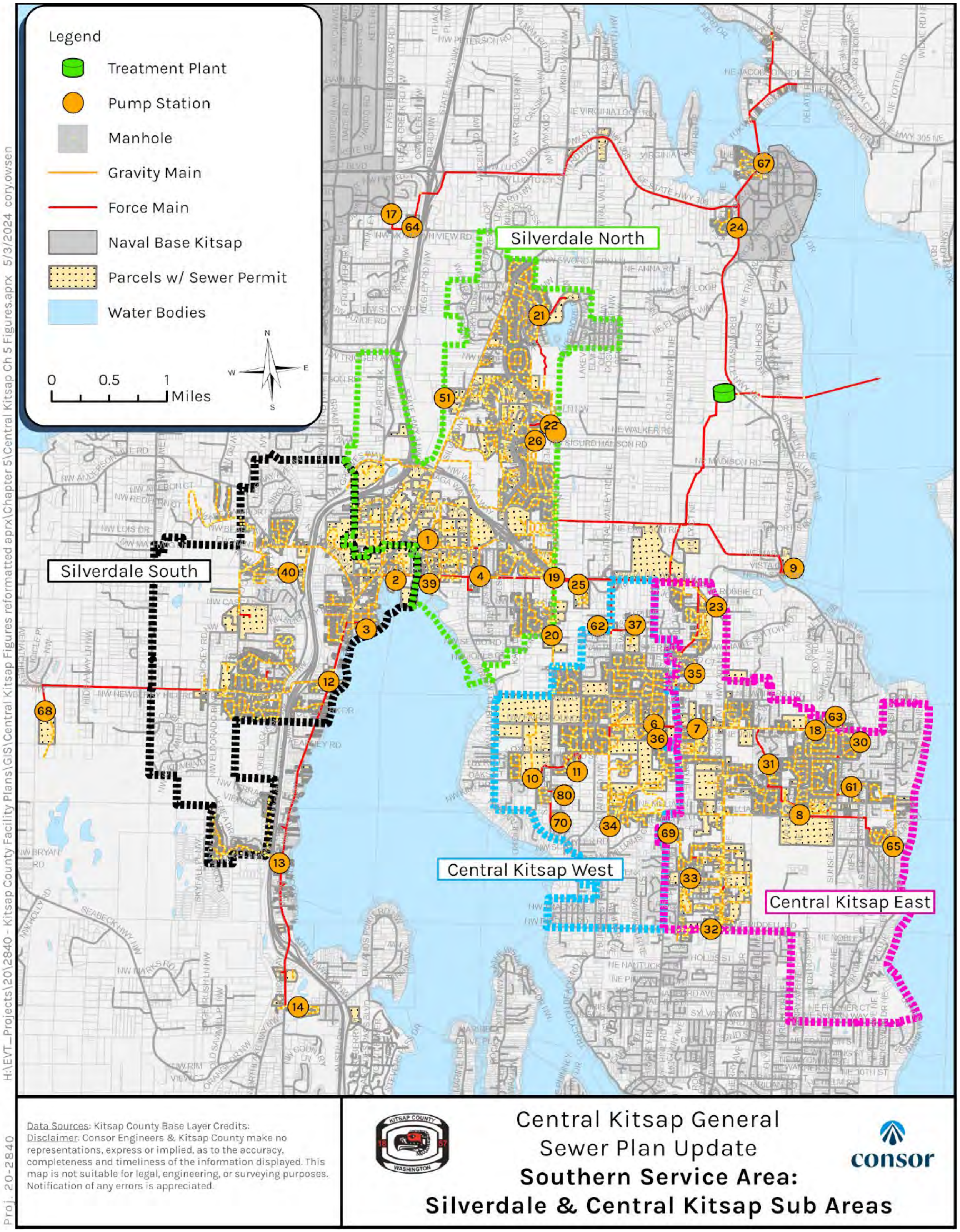
All flows from the Northern Service Area are conveyed to PS-24. From this point, they are pumped through the pump station's 24-inch diameter force main in Brownsville Highway NE to the Central Kitsap WWTP.

5.2.1.2 Southern Service Area

The Southern Service Area contains 41 pump stations. For the purposes of this Plan, the Southern Service Area is divided into four sub-areas: Silverdale South, Silverdale North, Central Kitsap East, and Central Kitsap West. Sub-area delineations are presented in **Figure 5-5**.

Figure 5-4 | Pump Station 17 to Pump Station 24 Collection and Conveyance

Figure 5-5 | Silverdale and Central Kitsap Sub Areas Collection & Conveyance System



5.2.1.2.1 Silverdale South

The Silverdale South sub-area contains four pump stations within the Silverdale UGA and accepts flows from three outlying pump stations. PS-3 is located on the Silverdale waterfront at the southern termination of Washington Avenue NW and is the primary pump station of the Silverdale South sub-area. PS-3 receives flows from PS-12, PS-13, PS-14, PS-40, PS-68, and from customers within its own mini-basin and pumps them through a 14-inch diameter force main to PS-4 located in the Silverdale North sub-area.

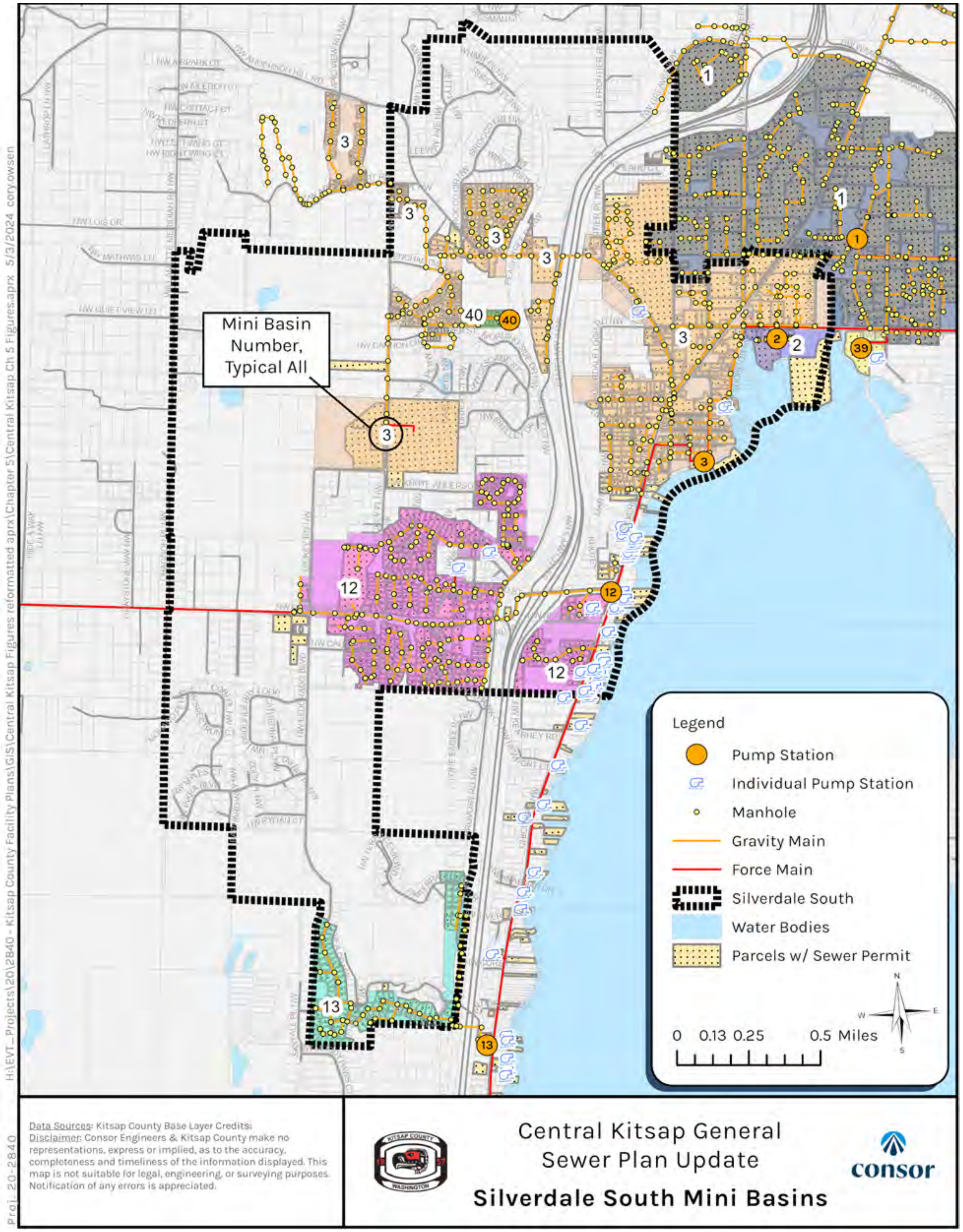
The outlying pump stations in the Silverdale South area include PS-13, PS-14, and PS-68. Key aspects of the sub-area are presented as **Table 5-1**.

Table 5-1 | Silverdale South Summary

Pump Station	Area (ac)	Tributary Mini Basins	Downstream Pump Station	Discharges to	Notes
PS-68	32.1	PS-68	PS-12	➢ 6-inch dia. Force main (FM)	➢ Located outside of UGA ➢ Provides service to Klahowya Secondary School
PS-14	21.5	PS-14	PS-13	➢ 6-inch dia. FM	➢ Located outside of UGA ➢ Was in UGA prior to remand
PS-13	66.8	PS-13, PS-14	PS-12	➢ 10-inch dia. FM	➢ Located outside of UGA ➢ Was in UGA prior to remand
PS-12	220.0	PS-12, PS-13, PS-14, PS-68	PS-3	➢ 12-inch dia. FM	
PS-40	7.64	PS-40	PS-3	➢ 4-inch dia. FM	
PS-3	472	PS-3, PS-12, PS-13, PS-14, PS-68	PS-4	➢ 14-inch dia. FM, 14-inch dia. manifold FM	
PS-2	17.0	PS-2	PS-4	➢ 6-inch dia. FM, 14-inch dia. manifold FM	

Pump stations within the Silverdale South sub-area and their respective mini basins are presented in **Figure 5-6**.

Figure 5-6 | Silverdale South Mini Basins



5.2.1.2.2 Silverdale North

The Silverdale North sub-area contains ten pump stations within the Silverdale UGA. One additional pump station serves an area southwest of the Silverdale UGA, which used to be part of the UGA PS-4 and PS-19 are the sub-area's primary pump stations. PS-19 is located just north of the intersection of NW Bucklin Hill Road and Nels Nelson Road NW and serves most of the north and east portions of the Silverdale North sub-area. PS-4 is located to the northeast of the intersection of Frederickson Road NW and NW Bucklin Hill Road and receives flows from the north and west portions of the Silverdale North sub-area in addition to the entirety of flows from the Silverdale South sub-area.

Chief characteristics of the area's flow routing are summarized in **Table 5-2**.

Table 5-2 | Silverdale North Summary

Pump Station	Area (ac)	Tributary Mini Basins	Downstream Pump Station	Discharges to	Notes
PS-19	245	PS-19, PS-21, PS-22, PS-25, PS-26, PS-81	Central Kitsap WWTP	➢ 16-inch dia. FM to 20-inch dia. manifold	➢ Can pump through 14-inch dia. FM to 30-inch dia. FM
PS-4	51.3	PS-2, PS-3, PS-4, PS-12, PS-13, PS-14, PS-39, PS-68, PS-40	Central Kitsap WWTP	➢ 14-inch dia. FM to 20-inch dia. manifold	
PS-20	139	PS-20	Central Kitsap WWTP	➢ 6-inch dia. FM, 20-inch dia. manifold	
PS-21	120	PS-21	PS-22	➢ 6-inch dia. FM	
PS-22	59.6	PS-21, PS-22	PS-19	➢ 6-inch dia. FM, 6-inch dia. manifold	
PS-25	19.7	PS-25	PS-19	➢ 4-inch dia. FM	➢ Located outside of UGA
PS-26	10.0	PS-26	PS-19	➢ 4-inch dia. FM	
PS-1	787	PS-1, PS-51	PS-4	➢ 12-inch dia. FM	
PS-51	6.41	PS-51	PS-1	➢ 4-inch dia. FM	
PS-39	9.85	PS-39	PS-4	➢ 8-inch dia. FM	

Pump stations within the Silverdale North sub-area and their respective mini basins are presented in **Figure 5-7**.

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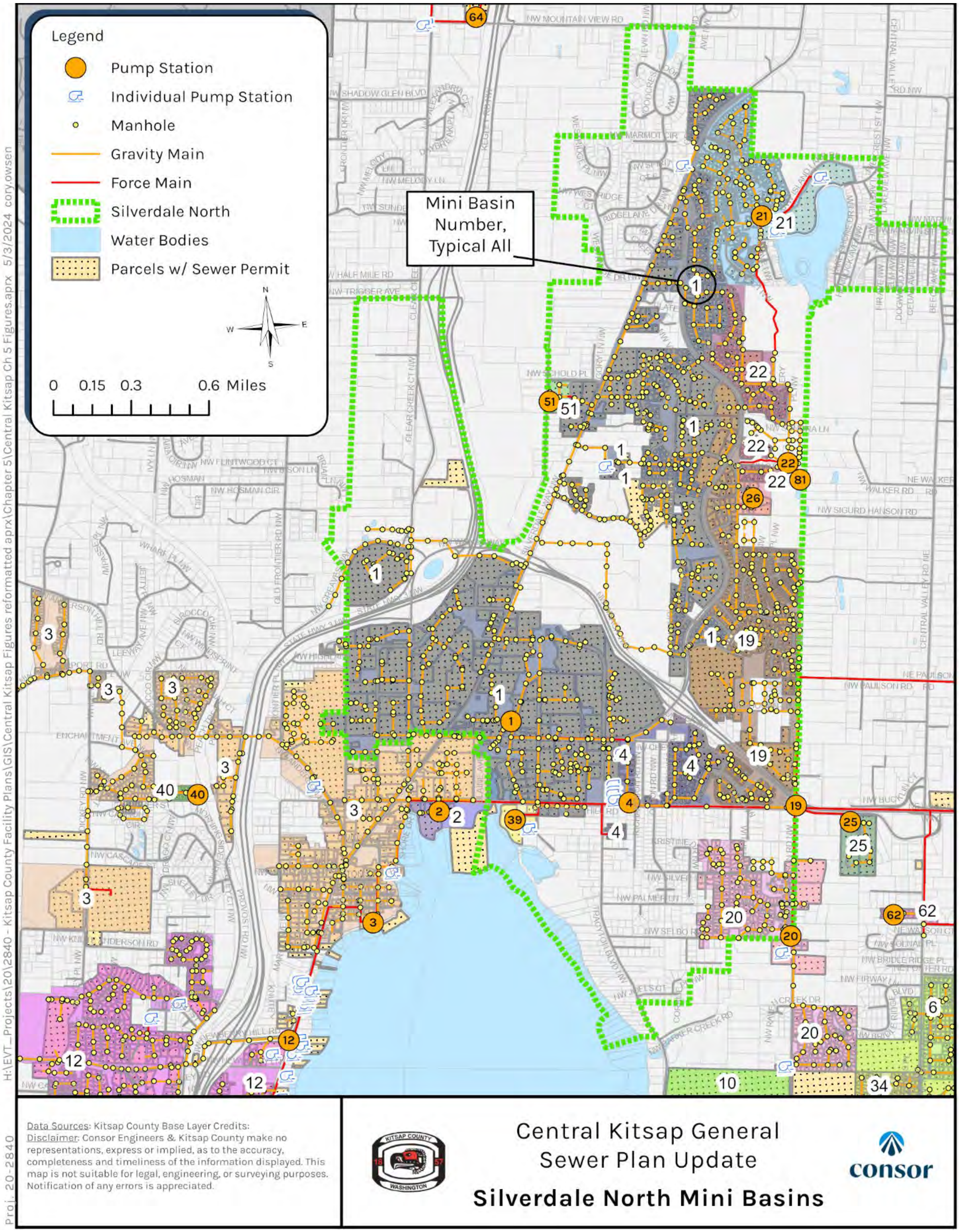
Figure 5-7 | Silverdale North Mini Basins



5.2.1.2.3 Central Kitsap West

The Central Kitsap West sub-area includes eight pump stations within the Central Kitsap UGA limits and one outlying pump station. PS-6 is the area's primary station and is located west of the intersection of Tanbark Drive NE and NE Fairgrounds Road. The pump station receives most of the sub-area flows including those from PS-10, PS-11, PS-34, PS-36, and PS-70, and pumps them to the tie-in point of the 30-inch diameter force main at the intersection of NE Fairgrounds Road and Old Military Road NE.

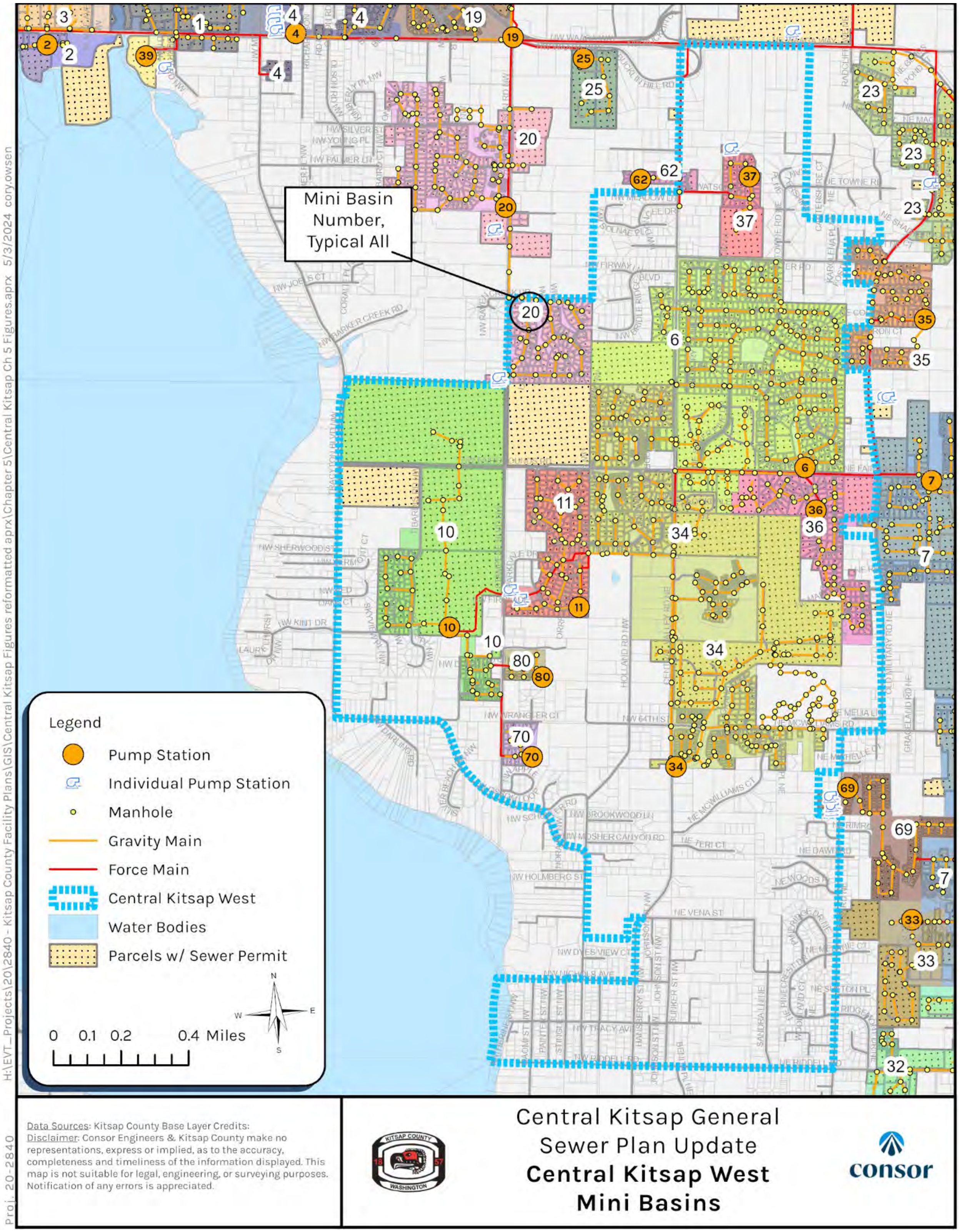
Important characteristics of the sub-area's flow routing are summarized in **Table 5-3**.

Table 5-3 | Central Kitsap West Summary

Pump Station	Area (ac)	Tributary Mini Basins	Downstream Pump Station	Discharges to	Notes
PS-6	226	PS-6, PS-10, PS-11, PS-34, PS-36, PS-70, PS-80	Central Kitsap WWTP	➢ 16-inch dia. FM ➢ 16-inch dia. to 30-inch dia. manifold	
PS-10	176	PS-10, PS-70, PS-80	PS-34	➢ 6-inch dia. FM	
PS-11	50.5	PS-11	PS-34	➢ 4-inch dia. FM	
PS-23	54.1	PS-23	Central Kitsap WWTP	➢ 6-inch dia. FM ➢ 16-inch dia. to 30-inch dia. manifold	
PS-34	274	PS-34, PS-10, PS-11, PS-70, PS-80	PS-6	➢ 12-inch dia. to 14-inch dia. FM	
PS-35	25.0	PS-35	Central Kitsap WWTP	➢ 4-inch dia. FM ➢ 16-inch dia. to 30-inch dia. manifold	
PS-36	62.0	PS-36	PS-6	➢ 4-inch dia. FM	
PS-37	22.5	PS-37	Central Kitsap WWTP	➢ 4-inch dia. FM ➢ 8-inch dia. to 30-inch dia. manifold	
PS-62	5.63	PS-62	Central Kitsap WWTP	➢ 4-inch dia. FM ➢ 8-inch dia. to 30-inch dia. manifold	➢ Located outside of UGA
PS-70	7.45	PS-70	PS-10	➢ 6-inch dia. FM	
PS-80	6.89	PS-80	PS-10	➢ 4-inch dia. FM	

Pump stations within the Central Kitsap West sub-area and their respective mini basins are presented in **Figure 5-8**.

Figure 5-8 | Central Kitsap West Mini Basins



5.2.1.2.4 Central Kitsap East

The Central Kitsap East sub-area includes 13 pump stations within the Central Kitsap UGA. PS-7 is the sub-area's primary pump station and receives all flows from the southern portion of the sub-area including those from PS-8, PS-18, PS-30, PS-31, PS-32, PS-33, PS-63, PS-65, and PS-69. PS-7 pumps into the 30-inch diameter manifold force main at the intersection of NE Fairgrounds Road and Military Road NE.

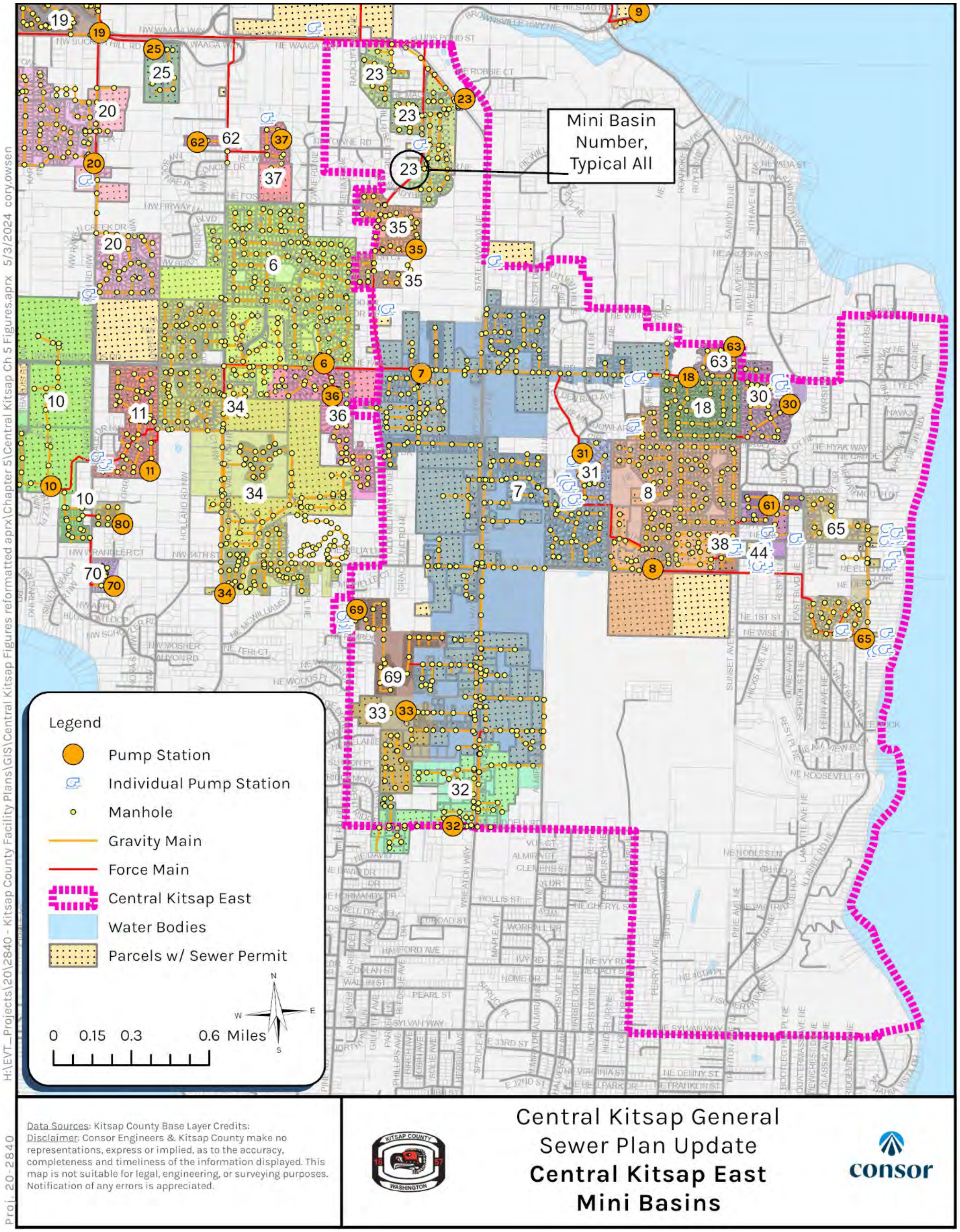
Important features of the sub-area's flow routing are summarized in **Table 5-4**.

Table 5-4 | Central Kitsap East Summary

Pump Station	Area (ac)	Tributary Mini Basins	Downstream Pump Station	Discharges to	Notes
PS-7	619	PS-7, PS-8, PS-18, PS-30, PS-31, PS-32, PS-33, PS-61, PS-63, PS-65, PS-69	Central Kitsap WWTP	➢ 14-inch dia. FM ➢ 16-inch dia. to 30-inch dia. manifold	
PS-8	202	PS-8, PS-61, PS-65	PS-7	➢ 8-inch dia. FM ➢ 12-inch dia. manifold	
PS-9	3.39	PS-9	Central Kitsap WWTP	➢ 8-inch dia. FM ➢ 30-inch dia. Manifold	
PS-18	49.2	PS-18, PS-30, PS-63	PS-7	➢ 6-inch dia. FM	
PS-30	34.3	PS-30	PS-18	➢ 4-inch dia. FM	
PS-31	23.9	PS-31	PS-7	➢ 4-inch dia. FM ➢ 12-inch dia. Manifold	
PS-32	80.2	PS-32	PS-7	➢ 8-inch dia. FM	➢ Has a gravity overflow to City of Bremerton's collections system
PS-33	47.2	PS-33	PS-7	➢ 6-inch dia. FM	
PS-61	15.0	PS-61	PS-8	➢ 4-inch dia. FM	
PS-63	13.1	PS-63	PS-18	➢ 4-inch dia. FM	
PS-65	66.8	PS-65	PS-8	➢ 6-inch dia. FM	
PS-69	42.2	PS-69	PS-7	➢ 6-inch dia. FM	

Pump stations within the Central Kitsap East sub-area and their respective mini basins are presented in **Figure 5-9**.

Figure 5-9 | Central Kitsap East Mini Basins



5.2.2 Gravity Sewer

There are approximately 670,000 feet of gravity sewer pipes in the Central Kitsap collection system ranging in size from 6-inches to 30-inches in diameter. The County owns most of the gravity pipe in the Central Kitsap collection system, 91 percent of which is 8-inch diameter.

The sewer pipe inventory is summarized in **Table 5-5**; pipe lengths are approximated from GIS data provided by the County in October 2023. An updated total length was also provided by the County's sewer asset count in March 2024.

Table 5-5 | Gravity Sewer Pipe Inventory

Pipe Diameter (in)	Total Length (ft)
6	9,041
8	585,104
10	9,877
12	20,256
15	14,969
16	5,114
18	1,815
24	413
30	246
Total Gravity (2023 GIS)	**647,216**
Total Gravity Including Private (2024 Sewer Asset Count)	**669718**

In addition to the County owned gravity sewer pipes, there are also privately owned gravity pipes within the Central Kitsap system. These do not include the upstream systems owned and operated by the City of Poulsbo, Bangor Naval Base, or Keyport Naval Base. Private gravity sewer pipes are summarized in **Table 5-6**.

Table 5-6 | Private Gravity Pipe Inventory

Pipe Diameter (in)	Total Length (ft)
6	2,823
8	13,220
10	81
12	350
Total Private Gravity (2023 GIS)	**16,474**

5.2.3 Force Mains

The County owns approximately 189,000 feet of sewer force mains for conveying wastewater to Central Kitsap WWTP or to downstream gravity conveyance piping. The Central Kitsap conveyance system is unique in that it contains a high number of manifold force mains, or force mains that are common to multiple pump stations. For this reason, it is important to differentiate between individual and manifold force mains when describing pipe lengths. For pump stations whose force mains connect to manifold force mains, individual force main lengths are measured between the pump station and the point of connection to the manifold force main. Pipe lengths are approximated from GIS data provided by the County in May 2023 and are summarized in **Table 5-7** below. An updated total length was also provided by the County's sewer asset count in March 2024.

Table 5-7 | Force Main Summary

Pipe Diameter (in)	Individual Length (ft)	Manifold Length (ft)	Total Length (ft)
3	1,419	-	1,419
4	12,515	-	12,515
6	39,007	-	39,007
8	17,465	-	17,465
10	7,075	-	7,075
12	11,845	-	11,845
14	23,804	3,846	27,650
16	4,097	4,852	9,001
18	1,809	1,589	3,696
20	1,808	23,039	24,847
24	8,358	4,091	12,449
30	-	8,507	8,779
Total Force Main Length (2023 GIS)			**175,751**
Total Force Main Length Including Private (2024 Sewer Asset Count)			**188,760**

There are also privately owned force mains associated with IPS located in the Central Kitsap sewer system. These do not include the force mains owned and operated by the City of Poulsbo, Bangor Naval Base, or Keyport Naval Base. The privately owned force mains are summarized in **Table 5-8**.

Table 5-8 | Private Force Main Inventory

Pipe Diameter (in)	Total Length (ft)
1.25	485
2	3,104
4	1,726

5.2.4 Individual Pump Stations

The Central Kitsap basin has approximately 155 customers served by IPS systems. Although the IPSs are owned and maintained by the individual homeowner, they were designed and constructed to meet County standards and inspected by the County. Additionally, a maintenance covenant is recorded on the property. These systems consist of a relatively small pump basin where the customer's waste stream is ground to a slurry and pumped through small diameter force mains to the gravity system. These systems are best used in gravity basins where individual or small groups of customers are unable to discharge directly to the gravity system because of the local topography. The IPS systems do not tend to develop significant odor problems due to the reduced residence time of the waste stream, if force main lengths are relatively short and properly sized. However, the deposition of solids is a concern if scouring velocities are not reached on a regular basis.

5.2.5 Odor Control

Odor control facilities are present at several pump stations throughout the system and are summarized in **Table 5-9**.

Table 5-9 | Odor Control Inventory

Facility	Odor Control System	Operational Status
PS-3	Sodium Hypochlorite Addition	Not in use
PS-6	Sodium Hypochlorite Addition	Currently in use
PS-8	Sodium Hypochlorite Addition	Currently in use
PS-12	Sodium Hypochlorite Addition	Not in use
PS-13	Bioxide Addition	Currently in use
PS-14	Bioxide Addition	Currently in use
PS-17	Sodium Hypochlorite Addition Bioxide Addition	Not in use Planned future use
PS-24	Sodium Hypochlorite Addition Activated Carbon Odorous Air Treatment	Not in use Currently in use
PS-65	Bioxide Addition	Currently in use
PS-67	Activated Carbon Odorous Air Treatment Bioxide Addition	Currently in use Planned future use
PS-68	Sodium Hypochlorite Addition	Not in use
BPA Manhole[1]	Biofilter Odor Control	Currently in use

Note:
1. BPA manhole (structure I.D. K21-3005) is the manhole located directly west of State Highway 3 and within the BPA's power corridor.

5.2.6 Siphons

The Central Kitsap collection system contains three inverted siphons, the Lemolo Siphon, the Royal Valley Siphon, and the Clear Creek Siphon.

The Lemolo Siphon conveys flows from the City of Poulsbo to PS-67 and stretches approximately 1,600 feet as it crosses beneath Liberty Bay. The siphon's inlet structure is located on the south end of Norum Road NE on the Lemolo Peninsula and its outlet structure is located on the Keyport Peninsula at the intersection of Washington Avenue NE and NE Grandview Boulevard. The siphon consists of two 12-inch barrels and was installed in the mid-1970s, originally discharging to the then-operational PS-16. Since the decommissioning of PS-16 in 2016, the siphon now discharges to a 30-inch gravity sewer installed in 2016 that carries flows from the siphon outlet structure PS-67.

The Royal Valley Siphon runs along Royal Valley Road NE, conveying flows from the Central Kitsap and Silverdale UGA's beneath Crouch Creek to the 30-inch diameter force main located at the intersection of NE Paulson Road and Kelly Court NE. The siphon consists of two barrels having diameters of 18 and 24 inches.

A third, shorter siphon containing two six-inch diameter barrels is located immediately west of PS-1 and crosses beneath Clear Creek before discharging to the PS-1 wet well. Siphons are summarized in **Table 5-10**.

Table 5-10 | Siphon Summary

Siphon	No. of Barrels	Barrel Diameter (in.)	Barrel Length (ft)	Material
Lemolo	2	12	1,846	DI
		12	1,850	DI
Royal Valley	2	18	217	DI
		24	246	DI
Clear Creek	2	6	107	DI

Note:
DI = Ductile Iron

5.2.7 Pump Stations

There were 45 conventional pump stations within the Central Kitsap sewer system at the end of 2020. Central Kitsap's hilly terrain necessitates a high density of pump stations, as long stretches of gravity-driven flow are not frequently available in the Silverdale and Central Kitsap areas. The earliest pump stations were packaged pump stations installed in the late 1970s. Since then, the County has gradually added and upgraded its pump stations to meet the demands of growing populations within its service area.

Since the 2011 Kitsap County Facility Plan was completed, capital improvements projects have taken place that have resulted in the alteration of multiple pump stations. Changes to the Central Kitsap pump stations since 2011 include:

- Upgrades of PS-1, PS-6, PS-8, and PS-18 to increase firm capacity.
- Diverting PS-5 flows to PS-34 and decommissioning PS-5.
- Upgrade of PS-67, diversion of Lemolo Siphon flows to PS-67, and decommissioning of PS-16.
- Installed new emergency power generators at PS-12 and PS-13.

Additional upgrades to the County's pump stations include the replacement of submersible pumps with newer Flygt models. County staff expressed the desire to standardize the Sewer Utility's inventory of submersible pumps and plan to install only submersible pumps manufactured by Flygt to simplify and standardize pump installation, maintenance, and operational procedures over time.

The existing pump station information is summarized in **Table 5-11.** The information was obtained from County records including pump station inventories, GIS data, vendor O&M records, and draw down test records. Pump station force main lengths are presented in **Table 5-11** for stretches of pipe that are specific to each pump station (individual) and for those lengths that are shared among multiple stations (manifold). Firm capacities in **Table 5-11** are the pumping capacities when the largest pump is out of service.

On-site emergency generators have been installed at all but 13 of the pump stations. Of the remaining 13 pump stations that do not have on-site emergency generators, nine are provided with "pig tails" to attach portable generators. PS-26 and PS-31 do not have standby generators or pigtail connections, but they have a 2,700 gallon and 1,000 gallon storage tank, respectively.

All pump stations are connected to the County's Supervisory Control and Data Acquisition (SCADA) system and are equipped with radio telemetry units to relay process signals to the Central Kitsap WWTP. These signals include at a minimum power failure, low and high wetwell levels, and intrusion alarms. The County has completed a SCADA Master Plan which will improve reliability and increase the information available via SCADA. See **Appendix D** for the details.

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Table 5-11 | Pump Station Summary[1]

Pump Station	Location	Year Built/ Upgraded	VFD	Firm Capacity (gpm)	Static Head (ft)	Total Dynamic Head (ft)	No. of Pumps	Pump HP	Individual Force Main		Manifold Force Main		Mini basins Served	Generator
									Diameter (in)	Length (ft)	Diameter (in)	Length (ft)		
PS-1	10015 Levin Rd NW, Silverdale WA	1986/1995 /2016	Y	2,800	140	199	3	160	12	2,745	N/A	N/A	1	Cummins 450 DFEJ (450 kW)
PS-2	3073 NW Bucklin Hill Rd, Silverdale, WA	1980	N	320	125	138	2	40	6	238	14	3,846	2	Onan/Allis-Chalmers 2900 MK1 (60 kW)
PS-3	8801 Washington Ave NW, Silverdale, WA 98383	1980/2005	N	1,800	135	150	3	100	14	3,476	14	3,846	3	Kohler 175ROZ71 (175 kW)
PS-4	9607 Fredrickson Rd NW, Bremerton, WA 98311	1980/2005	Y	3,000	100	121.9	3	100	14 20	1,585 1,808	20 24	5,297 922	4	Kohler 175ROZ71 (175 kW)
PS-6	393 NE Fairgrounds Rd, Bremerton, WA 98311	1980/2004 /2016	Y	2,990	65	74	3	60	16	1,176	16 24 30	4,825 922 1,966	6	Cummins 150 DSGAC (150 kW)
PS-7	1314 NE Fairgrounds Rd, Bremerton, WA 98311	1977/2006	N	4,200	72	147	3	50	14	941	16 24 30	4,825 922 1,966	7	Cummins DQDAC (300 kW)
PS-8	2862 NE McWilliams Rd, Bremerton, WA 98311	1980/2016	Y	1,200	40	122	3	60	8 12	3,089 1,002	12	1,885	8	Cummins 150 DSGAC (150 kW)
PS-9	9816 Ogle Rd NE, Bremerton, WA 98311	1980	N	400	89	107	4	25	8	6,461	30	6,612	9	Kohler 60ROZ71 (60 kW)
PS-10	7070 Stampede Blvd NW, Bremerton, WA 98311	1980	N	270	90	110	2	25	6	3,074	N/A	N/A	10	Kohler 45RZ71 (45 kW)
PS-11	735-799 Firglade Ct NW, Bremerton, WA 98311	1979/1985	N	230	60	65	2	15	4	975	N/A	N/A	11	None; Pigtail Connection Available
PS-12	8172 Chico Way NW, Bremerton, WA 98312	1980	N	545	15	23	2	10	12	4,107	N/A	N/A	12	Cummins C30D6 (30 kW)
PS-13	4600 NW Eldorado Blvd, Bremerton, WA 98312	1980	N	400	20	41	2	10	8 10	1,694 7,075	N/A	N/A	13	Cummins C30D6 (30 kW)
PS-14	3353 Shadden Ln NW, Bremerton, WA 98312	1981	N	300	25	59	2	7.5	6	7,400	N/A	N/A	14	Onan Series DDA (30 kW)
PS-17	14698 Clear Creek Rd NW, Silverdale, WA 98383	1980	Y	3,000	40	76	3	50	18	1,777	18 20 24	1,589 17,549 1,000	17	Kohler 175ROZ71 (175 kW)
PS-18	2705 NE John Carlson Rd, Bremerton, WA 98311	1977/2016	N	300	35	56	2	11	6	800	N/A	N/A	18	Cummins C50D6 (50 kW)
PS-19	9598 Nels Nelson Rd NW, Bremerton, WA 98311	1986/1999	Y	3,000	70	162	3	75	16	50	20 24	5,297 922	19	Onan (200 kW)
PS-20	9000 Nels Nelson Rd NW, Bremerton, WA 98311	1981	N	426	110	138	2	40	6	2,623	20 24	5,297 922	20	ILI Generator Systems (50 kW)
PS-21	950 NW Island Lake Rd, Poulsbo, WA 98370	1986	N	220	90	-[1]	2	23	6	3,011	N/A	N/A	21	Onan Model 100.DYC-15r\26682J (100KW)
PS-22	11503 Quail Run Dr NW, Silverdale, WA, 98383	1986	N	450	120	130	2	50	6	1,057	N/A	N/A	22	Onan/Chalmers (100 kW)
PS-23	1376 WA-303, Bremerton, WA 98311	1985	N	600	105	167	2	50	6	1,275	16 24	1,824 922	23	Onan (115 kW)
PS-24	14487 Brownsville Hwy NE, Poulsbo, WA 98370	2000	Y	6,400	160	180	3	250	24	8,678	N/A	N/A	24	Cummins 7500DFHA (750 kW)
PS-25	524 Northwest Silver Meadow Lane, Bremerton, WA 98311	1989	N	150	30	51	2	5	4	1,387	N/A	N/A	25	None
PS-26	1187 NW Gooseberry Ct, Silverdale, WA 98383	1990	N	70	30	46	2	7.5	4	450	N/A	N/A	26	None

Pump Station	Location	Year Built/ Upgraded	VFD	Firm Capacity (gpm)	Static Head (ft)	Total Dynamic Head (ft)	No. of Pumps	Pump HP	Individual Force Main		Manifold Force Main		Mini basins Served	Generator
									Diameter (in)	Length (ft)	Diameter (in)	Length (ft)		
PS-30	7278 Sunset Ave NE, Bremerton, WA 98311	1993	N	160	145	160	2	40	4	1,409	N/A	N/A	30	None; Pigtail Connection Available
PS-31	7199 NE Clover Blossom Ln, Bremerton, WA 98311	1975	N	40	35	40	2	3	4	1,284	12	1,887	31	None
PS-32	1550 NE Riddell Rd, Bremerton, WA 98311	1983	N	165	30	44	2	10	8	2,541	N/A	N/A	32	None; Pigtail Connection Available
PS-33	1199 NE Franklin Ave, Bremerton, WA 98311	1983	N	220	50	54	2	10	6	560	N/A	N/A	33	None; Pigtail Connection Available
PS-34	6252 Central Valley Rd NE, Bremerton, WA 98311	1989	N	900	130	155	2	60	14	6,671	N/A	N/A	34	ILI Model 95D348 (100 kW)
PS-35	1099 NE Coco Ct, Bremerton, WA 98311	1983	N	112	85	102	2	15	4	900	16	4,852	35	None; Pigtail Connection Available
											24	922		
											30	2,626		
PS-36	7252 Blackbird Dr NE, Bremerton, WA 98311	1979/1999	N	150	30	74	2	14	4	680	N/A	N/A	36	Waukesha Model VRD232U (30 kW)
PS-37	289 NE Watson Ct, Bremerton, WA 98311	1983	N	150	25	98	2	15	4	1,485	8	2,157	37	None; Pigtail Connection Available
									8	204	20	2,564		
											24	922		
PS-39	1600 NW Crista Shores Ln, Silverdale, WA 98383	1994	N	110	25	31	2	5	8	730	N/A	N/A	39	None; Pigtail Connection Available
PS-40	4900 NW Discovery Ridge Ct, Silverdale, WA 98383	1993	N	70	80	85	2	15	4	950	N/A	N/A	40	None; Pigtail Connection Available
PS-51	12120 Schold Rd NW, Silverdale, WA	1995	N	100	40	49	2	7.5	4	572	N/A	N/A	51	Kohler; kW Unknown
PS-61	3488 Ocasta St NE, Bremerton, WA 98311	2009	N	-[1]	77	-[1]	2	25	4	1,049	N/A	N/A	61	Cummins 60DGCB (60 kW)
PS-62	122 NW Glade Ct, Bremerton, WA 98311	2008	N	50	42	-[1]	2	-[1]	4	624	8	2,157	62	None; Pigtail Connection Available
											20	2,564		
											24	922		
PS-63	7658 Trica Ave NE, Bremerton, WA 98311	2006	N	129	35	45	2	7.5	4	750	N/A	N/A	63	Katolight D40F*J4T2 (40 kW)
PS-64	2873 NW Mountain View Rd, Silverdale, WA 98383	2003	N	70	40	46	2	5	3	30	20	17,549	64	None; Pigtail Connection Available
											24	1,000		
PS-65	6001 Illahee Road NE, Bremerton, WA 98311	1994	N	313	275	320	4	30	6	6,420	N/A	N/A	65	Kohler 200ROZD (200 kW)
PS-67	15378 Washington Ave NE, Keyport, WA 98345	1999/2016	Y	4,500	40	43	3	70	16	2,922	24	1,000	67	Cummins/Onan 300DGCB (300 kW)
PS-68	7607 NW Newberry Hill Rd, Silverdale, WA 98383	1998	N	310	50	106	2	20	6	8,488	N/A	N/A	68	Cummins/Onan 50 DCGA (50 kW)
PS-69	882 NE Beaumont Ln, Bremerton, WA 98311	1998	N	141	65	87	2	11	6	2,739	N/A	N/A	69	Cummins/Onan 40DGCB (40 kW)
PS-70	708 NW Ashford Loop, Bremerton, WA 98311	2016	N	300	62	68	2	11	6	1,278	N/A	N/A	70	Cummins C40D6 (40 kW)
PS-80	Foxtail Pl NW, Bremerton, WA 98311	2019	N	132	41	62	2	4	4	1,032	N/A	N/A	80	Cummins C100D6C (100 kW)
PS-81	NW Sigurd Hanson Rd, Silverdale, WA, 98383	2021	N	-[2]	-[2]	-[2]	2	11	4	-[2]	N/A	N/A	81	Cummins natural gas (45 kW)

Notes:
VFD = Variable frequency drive
kW = kilowatt
1. The table should be cross-checked against working knowledge of the system, and all pump station characteristics should be confirmed with the County before proceeding with the design.
2. Information is not available.

5.3 Pump Station Condition Assessments

In September 2020 Murraysmith (now Consor) staff visited most of the pump stations in the Central Kitsap basin and conducted condition assessments. Pump stations that were rebuilt within the past two years, and stations that are currently under design or construction, were not visited. During the site visits, Murraysmith [now Consor] staff documented through visual observation and interviews with County staff each pump station's current components and systems, and their condition. Industrial Systems Inc. (ISI) documented electrical equipment conditions and potential code violations. An assessment form was filled out for each pump station visited and is included as **Appendix E**.

5.3.1 Condition Summary Tables

To better organize the assessment results, the equipment and systems at the pump stations were arranged in several categories presented in **Table 5-12**. While no two pump stations are identical, they are anatomically similar and can be characterized by a standardized set of component groupings. These component groupings are consistent with County Asset Functional Class Levels.

Table 5-12 | Component Group Definitions

Component Grouping	Constituent Systems and Components
Civil	Site, roadways, sidewalks, fencing
Structural	Buildings, tanks, vaults, wetwells, equipment pads, Parshall flumes
Pumping Systems	Pumps, suction, and discharge valves, check valves
Motors	Motors associated with pumps or rotating machinery
Piping Systems	Suction piping, discharge headers, drain lines, backflushing lines, water lines, chemical dosing lines, segments of on-site force main
Valve Systems or Assemblies	Odor control system valves, washdown water valves
Support Systems	Compressed air systems, potable water, fire suppression, Heating, ventilation, and air conditioning (HVAC)
Instrumentation	Level indicators, flow meters, pressure gauges, water quality analyzers, SCADA systems, network hardware, panel views
Electrical and Power Distribution	Electrical systems between MCC and main power disconnect, standby generators, transfer switches, lighting

5.3.2 Pump Station Asset Health Score

A pump station 'Asset Health Score' was developed that synthesizes each pump station's existing likelihood of failure (condition) and consequence of failure (CoF). The score was developed to better inform the County's prioritization of future asset upgrades and replacements.

For structural components, e.g., buildings and wetwells, individual condition ratings generally apply to the physical integrity of these assets in the face of material degradation due to environmental forces such as corrosion, weathering, settling, and flooding. Individual condition scores for mechanical, electrical, and instrumentation systems consider each's physical integrity and their current ability to perform as designed. General observations and historical accounts from County Operations and Maintenance (O&M) staff were also used to inform the condition ratings for all pump station components to incorporate information not observed by Murraysmith (now Consor) staff. Examples of historical information from O&M staff include high frequency check valve failures, power outages, pump ragging, and pump seal failures. Individual condition ratings range from 1 to 5, with a score of 1 representing the best condition and a score of 5 representing the worst. It is important to note that condition scores are not simply reflections of age as dissimilar environmental and operational factors among the County's pump stations necessitate differing rates of condition degradation. Although age/obsolescence is not accounted for in the condition assessment, it is a consideration for development of the 20-year Capital improvement Plan (CIP) so that replacement of aging infrastructure is accounted for. **Table 5-13** presents the definition of the component condition scores.

Table 5-13 | Component Condition Scores Definitions

Condition Rating	Definition
1	Very Good, well maintained, expected to remain reliable for more than 90 percent of the expected life.
2	Good, some degradation but performance and reliability are not significantly affected. Performance and reliability expected to remain satisfactory for 50-90 percent of the expected life.
3	Fair, performance and reliability are still acceptable, but some rehabilitation or replacement will be needed in the 50 percent +/- of the expected life.
4	Poor, performance and/or reliability has significantly decreased, maintenance rehabilitation or replacement needed to restore performance or reliability to acceptable levels. Failure (no longer functions) is likely in 10-50 percent of the expected life if not rehabilitated or replaced.
5	Very poor, performance and/or reliability has significantly decreased, and failure is probable within 10 percent of the expected life if rehabilitation or replacement is not performed.

Individual CoF ratings for pump station components are based on a consideration of the effects of failure of each component within the context of the local pump station. The CoF ratings range from 1 to 5, with a score of 1 representing the lowest consequence and 5 representing the highest. **Table 5-14** presents the definition of the CoF scores.

Table 5-14 | Component Consequence of Failure Definitions

Consequence of Failure Rating	Definition
1	Not Managed. Failure would not affect the pump station operation
2	Not Critical. Could marginally reduce the pump station capacity or performance
3	Important (critical but redundant). The pump station performance is significantly impacted without a currently installed redundant component
4	Critical. The pump station performance is significantly impacted upon failure.
5	Highly Critical. Failure will cause an immediate loss of hydraulic throughput.

To fully develop an overall pump station score, the individual condition and CoF scores of each pump station's systems and components were considered within the larger context of the Central Kitsap basin. To accomplish this, an overall pump station CoF score (from a system-wide perspective) is applied to an overall condition score for each station. This pump station CoF score is based on County conventions for pump station CoF rankings (Sheridan, Chris M. "FKC205-20 Pump Station Criticality Map 02272019", Message to Erika Schuyler. September 10, 2020. E-mail), in which a station's CoF is defined by the number of pump stations tributary to it. **Table 5-15** presents the overall CoF scores and ranking conventions.

Table 5-15 | Pump Station Type Consequence of Failure Definitions

Pump Station Type (from County)	Station CoF Score	Tributary Pump Stations	Total Pump Station Flows Handled
Satellite	2	0	1
Relay	3	1	2
Regional	4	2-3	3-4
Critical	5	4+	5+

Overall condition scores for each pump station are weighted by component CoF and are defined as the quotient of the sum of the products of individual component condition and CoF scores and the sum of individual component CoF scores. This scoring is represented symbolically as follows:

$$Overall\ Condition\ Score \equiv \frac{\sum_{Components}(Condition\ Score \times CoF\ Score)}{\sum Individual\ CoF\ \ Scores}$$

This overall condition score is then scaled by the station CoF score to obtain the Asset Health Score:

$$Asset\ Health\ Score \equiv Overall\ Condition\ Score \times Station\ CoF\ Score$$

The results of the analysis described in the preceding paragraphs are summarized in **Table 5-16** and detailed in **Table 5-17**. Note that condition and CoF scores (columns 4 and 5, rows 2 through 10) are for individual components; overall condition and station CoF scores are presented in row 1 of columns 4 and 5, respectively. The Asset Health Score will be used to rank the projects in the CIP.

Table 5-16 | Station Asset Health Summary

Pump Station	Consequence of Failure	Condition	Asset Health Score
24	5	3.1	15.5
34	5	2.9	14.5
12	4	3.6	14.4
7	5	2.8	14.0
13	3	3.7	11.1
10	3	3.3	9.9
22	3	2.7	8.1
36	2	3.7	7.4
11	2	3.5	7.0
33	2	3.5	7.0
25	2	3.4	6.8
32	2	3.4	6.8
2	2	3.3	6.6
37	2	3.3	6.6
35	2	3.2	6.4
40	2	3.2	6.4
9	2	3.1	6.2
65	2	3.1	6.2
51	2	3.1	6.2
67	5	1.2	6.0
26	2	3.0	6.0
30	2	3.0	6.0
14	2	3.0	6.0

Pump Station	Consequence of Failure	Condition	Asset Health Score
20	2	2.9	5.8
23	2	2.9	5.8
17	2	2.8	5.6
64	2	2.8	5.6
39	2	2.7	5.4
68	2	2.3	4.6
69	2	2.0	4.0
62	2	1.9	3.8
63	2	1.9	3.8
61	2	1.6	3.2
3	5	-	-
4	5	-	-
6	5	-	-
8	4	-	-
18	4	-	-
19	5	-	-
21	1	-	-
31	1	-	-
70	2	-	-
80	2	-	-
81	2	-	-
1	3	-	-

Table 5-17 | Pump Station Condition Assessments

Pump Station	Asset Health Score	Station Component	Condition	CoF	Year Installed/ Upgraded	Notes	Recommendations
1	N/A	Assessment Not Performed	-	-	1986/1995/2016	➢ Station recently constructed; Assessment not necessary	
2	6.6	Overall	3.3	2.0	1980	➢ Station is a Smith & Loveless style dry can configuration.	➢ Adequate condition but should be scheduled for replacement due to age nearing the end of the useful design life. ➢ O&M staff want to replace bubbler system.
		Civil	2.0	2.0	1980		
		Structural	2.0	5.0	1980		
		Pumping Systems	3.5	5.0	1980		
		Motors[1]	3.0	3.0	1980		
		Piping Systems	3.0	5.0	1980		
		Valve Systems or Assemblies	3.0	2.0	1980		
		Support Systems	3.5	1.0	1980		
		Instrumentation	3.5	5.0	1980/2012		
		Electrical and Power Distribution	5.0	5.0	1980/2006		
3	N/A	Assessment Not Performed	-	-	1980/2005	➢ Station scheduled for upgrade; Assessment not necessary	
4	N/A	Assessment Not Performed	-	-	1980/2005	➢ Station scheduled for upgrade; Assessment not necessary	
6	N/A	Assessment Not Performed	-	-	1980/2004/2016	➢ Station recently upgraded; Assessment not necessary	
7	14.0	Overall	2.8	5.0	1976/2006	➢ Rags and grease accumulate on and near level floats, causing interference with floats. ➢ Air release/vacuum/relief valves are isolated as they reportedly leak during pumping. ➢ Three pumps present; Pump 2 is a jockey pump. ➢ Generator is new. ➢ Controls were replaced in 2009. ➢ Original pump impellers were designed for clean water and have been replaced after performing poorly.	
		Civil	3.5	2.0	1976		
		Structural	3.0	5.0	1976		
		Pumping Systems	3.0	3.0	2006		
		Motors	2.0	3.0	2006		
		Piping Systems	2.0	5.0	1976		
		Valve Systems or Assemblies	3.0	2.0	1976		
		Support Systems	3.0	1.0	1976		
		Instrumentation	3.0	5.0	2009		
		Electrical and Power Distribution	3.0	5.0	2006		
8	N/A	Assessment Not Performed	-	-	1980/2016	➢ Station recently upgraded; Assessment not necessary	
9	6.2	Overall	3.1	2.0	1980	➢ Four pumps total; two sets of two pumps in series due to high head. ➢ Surge tank located in pump station building. ➢ Some switches have been observed to get stuck; County is planning to fix. ➢ Check valve keeper pin has dislodged multiple times. ➢ Station is a USEMCO dry can configuration.	➢ New generator is needed per O&M staff.
		Civil	2.0	2.0	1980		
		Structural	3.0	5.0	1980		
		Pumping Systems	3.3	5.0	1980		
		Motors	2.0	3.0	1980		
		Piping Systems	2.0	5.0	1980		
		Valve Systems or Assemblies	3.0	2.0	1980		
		Support Systems	3.0	1.0	1980		
		Instrumentation	3.5	5.0	1980		
		Electrical and Power Distribution	5.0	5.0	1980		
10	9.9	Overall	3.3	3.0	1980	➢ The existing propane generator is planned for replacement. ➢ Surface water has been observed to run into the station building. O&M staff plan to address this. ➢ Metal roof is damaged/deformed along the northwest corner of the building. ➢ Pumps get air bound if level in wet well gets too low. ➢ Station is a Smith & Loveless style dry can configuration. ➢ National Electrical Manufacturers Association (NEMA) 4X junction box proximity to wet well is National Fire Protection Association (NFPA) 820 4.2.2 and NFPA 70 (National Electrical Code (NEC)) article 500 violation. ➢ Dry pit exhaust fan is NFPA 70 (NEC) article 500 code violation.	➢ Relocate junction boxes outside of the wet well's Class 1 Division 2 hazardous area classification boundary in compliance with current NFPA 70 (NEC) and NFPA 820 standards.
		Civil	2.0	2.0	1980		
		Structural	3.4	5.0	1980		
		Pumping Systems	3.0	5.0	1980		
		Motors	3.0	3.0	1980		
		Piping Systems	3.0	5.0	1980		
		Valve Systems or Assemblies	3.0	2.0	1980		
		Support Systems	3.0	1.0	1980		
		Instrumentation	3.0	5.0	1980		
		Electrical and Power Distribution	5.0	5.0	1980		

[1]For motors <25 HP, condition scores are considered identical to Pumping Systems condition score.

Pump Station	Asset Health Score	Station Component	Condition	CoF	Year Installed/ Upgraded	Notes	Recommendations
11	7.0	Overall	3.5	2.0	1979/1985	➢ Historical power outages noted by O&M staff. There is typically enough time for O&M staff to bring a portable generator on site. ➢ Station is a Smith & Loveless style dry can configuration. ➢ Dry can is in poor condition. ➢ NEMA 4X junction box proximity to wet well is NFPA 820 4.2.2 and NFPA 70 (NEC) article 500 violation.	➢ Relocate junction boxes outside of the wet well's Class 1 Division 2 hazardous area classification boundary in compliance with current NFPA 70 (NEC) and NFPA 820 standards.
		Civil	4.0	2.0	1979/1985		
		Structural	4.0	5.0	1979/1985		
		Pumping Systems	3.0	5.0	1979/1985		
		Motors	3.0	3.0	1979/1985		
		Piping Systems	3.0	5.0	1979/1985		
		Valve Systems or Assemblies	3.0	2.0	1979/1985		
		Support Systems	3.0	1.0	1979/1985		
		Instrumentation	3.0	5.0	1979/1985		
		Electrical and Power Distribution	5.0	5.0	1979/1985		
12	14.4	Overall	3.6	4.0	1980	➢ Pump are observed to experience regular issues. ➢ Grease accumulation on Multitrode level probe causes level setting errors. ➢ Station is a Smith & Loveless style dry can configuration. ➢ Generator is new. ➢ Wet well coating is peeling off. ➢ NEMA 4X junction box proximity to wet well is NFPA 820 4.2.2 and NFPA 70 (NEC) article 500 violation.	➢ Replace pump station.
		Civil	2.0	2.0	1980		
		Structural	3.3	5.0	1980		
		Pumping Systems	3.5	5.0	1980		
		Motors	3.5	3.0	1980		
		Piping Systems	3.0	5.0	1980		
		Valve Systems or Assemblies	3.0	2.0	1980		
		Support Systems	3.0	1.0	1980		
		Instrumentation	4.0	5.0	1980		
		Electrical and Power Distribution	5.0	5.0	1980/2020		
13	11.1	Overall	3.7	3.0	1980	➢ Wetwell is experiencing heavy corrosion – exposed aggregate visible, high H_2S levels reported. ➢ Wetwell hatch is badly corroded. ➢ Unknown fibers present in influent; suspected source is IPS connecting to upstream PS-14 force main. ➢ Check valves are reportedly worn out. ➢ Station is a Smith & Loveless style dry can configuration. ➢ Stiffness observed in isolation valve actuation. ➢ Pumps are noted as being 'OK', however they are aging and occasionally clog due to unknown fibers. ➢ NEMA 4X junction box proximity to wet well is NFPA 820 4.2.2 and NFPA 70 (NEC) article 500 violation.	➢ Replace pump station.
		Civil	3.5	2.0	1980		
		Structural	3.7	5.0	1980		
		Pumping Systems	3.3	5.0	1980		
		Motors	3.3	3.0	1980		
		Piping Systems	4.0	5.0	1980		
		Valve Systems or Assemblies	3.0	2.0	1980		
		Support Systems	3.0	1.0	1980		
		Instrumentation	3.0	5.0	1980		
		Electrical and Power Distribution	5.0	5.0	1980/2020		
14	6.0	Overall	3.0	2.0	1981	➢ A rag collector is present at influent pipe. ➢ Force main experiences excessive grease, rags, and fiber and is pigged frequently (2 weeks maximum between piggings). The fibers are suspected of originating from IPS connected to the PS-14 force main. These fibers cause downstream issues at PS-13 and PS-12. ➢ An overflow tank is on site. The isolation drain valve to overflow tank does not work. The connection to the tank has been plugged so the pumps would run more often which has helped with the fiber issue. ➢ Force main from station crosses the bridge along Erlands Point Rd NW. ➢ Two new Flygt pumps installed in 2020. County suspects installing a larger impeller may help with the fiber issue.	➢ Upgrade pumps with largest possible impellor for the motor size
		Civil	3.5	2.0	1981		
		Structural	3.0	5.0	1981		
		Pumping Systems	2.3	3.0	1981/2020		
		Motors	2.3	3.0	1981		
		Piping Systems	3.0	5.0	1981		
		Valve Systems or Assemblies	2.0	2.0	1981		
		Support Systems	3.0	1.0	1981		
		Instrumentation	4.0	5.0	1981		
		Electrical and Power Distribution	3.0	5.0	1981		

Pump Station	Asset Health Score	Station Component	Condition	CoF	Year Installed/ Upgraded	Notes	Recommendations
17	5.6	Overall	2.8	2.0	1980	➢ Corrosion observed on pump casing exteriors. ➢ Roof leaks have been observed in the generator room. ➢ Chlorine tank and injection is on site but is not used. ➢ The station only serves the Bangor Naval Base. ➢ Bangor Naval Base is in the process of installing a Bioxide® odor control system. ➢ The County is considering installing Bioxide® on site. ➢ A Muffin Monster is located on the open influent channel located outside. ➢ The force main is badly corroded and is in the process of being replaced	➢ Recoat pump casings ➢ Fix roof leak
		Civil	2.5	2.0	1980		
		Structural	3.5	5.0	1980		
		Pumping Systems	3.2	3.0	1980/2004		
		Motors	3.0	3.0	1980		
		Piping Systems	3.0	5.0	1980		
		Valve Systems or Assemblies	4.0	2.0	1980		
		Support Systems	4.0	1.0	1980		
		Instrumentation	3.0	5.0	1980		
		Electrical and Power Distribution	1.0	5.0	1980/2017		
18	N/A	Assessment Not Performed	-	-	1977/2016	➢ Station recently constructed; Assessment not necessary	
19	N/A	Assessment Not Performed	-	-	1986/1999	➢ Station scheduled for upgrades; Assessment not necessary	➢ Replace pump station
20	5.8	Overall	2.9	2.0	1981	➢ Valves are noted as performing 'OK', however they are noted as being old. ➢ Pumps do not sound good but still operate. ➢ Station is a Smith & Loveless style dry can configuration. ➢ Electrical conduit and conduit fitting locations near wet well do not comply with NFPA 820 4.2.2 Design and Construction and NFPA 70 (NEC) article 500.	➢ Station building is in poor condition; replacement of roof and siding are likely required. ➢ Bubbler has had maintenance issues and should be replaced. ➢ O&M staff have expressed desire to see station converted to submersible configuration. ➢ Provide seal offs per NEC article 500.
		Civil	2.0	2.0	1981		
		Structural	2.7	5.0	1981		
		Pumping Systems	3.3	5.0	1981		
		Motors	3.5	3.0	1981		
		Piping Systems	3.0	5.0	1981		
		Valve Systems or Assemblies	3.0	2.0	1981		
		Support Systems	3.0	1.0	1981		
		Instrumentation	3.5	5.0	1981		
		Electrical and Power Distribution	2.0	5.0	1981		
21	N/A	Assessment Not Performed	-	-	1986	➢ Station scheduled for upgrades; Assessment not necessary	
22	8.1	Overall	2.7	3.0	1986	➢ One new Flygt pump installed; One original pump from 1981 is still present. The Flygt pump has higher capacity. ➢ NEMA 4X junction box proximity to wet well is NFPA 820 4.2.2 and NFPA 70 (NEC) article 500 violation. ➢ Not all electrical conduits or the electrical receptacle comply with NFPA 820 4.2.2 Design and Construction and NFPA 70 (NEC).	➢ Existing generator is aging and would benefit from replacement. ➢ CIP should include a budgetary allowance for a second Flygt pump. ➢ Relocate junction boxes outside of the wet well's Class 1 Division 2 hazardous area classification boundary in compliance with current NFPA 70 (NEC) and NFPA 820 standards.
		Civil	2.0	2.0	1986		
		Structural	2.0	5.0	1986		
		Pumping Systems	3.5	3.0	1986/2019		
		Motors	3.5	3.0	1986		
		Piping Systems	3.0	5.0	1986		
		Valve Systems or Assemblies	3.0	2.0	1986		
		Support Systems	2.0	1.0	1986		
		Instrumentation	3.0	5.0	1986		
		Electrical and Power Distribution	2.0	5.0	1986		
23	5.8	Overall	2.9	2.0	1985	➢ Frequent power outages have been observed. The generator has functioned well during outages. ➢ Station is a Smith & Loveless style dry can configuration.	➢ Gutter needs replacing.
		Civil	3.5	2.0	1985		
		Structural	2.5	5.0	1985		
		Pumping Systems	2.3	5.0	1985		
		Motors	2.0	3.0	1985		
		Piping Systems	2.0	5.0	1985		
		Valve Systems or Assemblies	3.0	2.0	1985		
		Support Systems	2.0	1.0	1985		
		Instrumentation	3.0	5.0	1985		
		Electrical and Power Distribution	5.0	5.0	1985		

Pump Station	Asset Health Score	Station Component	Condition	CoF	Year Installed/ Upgraded	Notes	Recommendations
24	15.5	Overall	3.1	5.0	2000	➢ Wetwell is experiencing severe corrosion due to H_2S. Future epoxy recoating is planned as part of the Bangor-Keyport Forcemain Replacement project. ➢ The Bangor-Keyport Forcemain Replacement project will replace the existing 24-inch DI force main with 30-inch High-Density Polyethylene (HDPE) force main. ➢ Air entrainment issues during high flows were rectified by raising float control levels. ➢ Replacement of the magnetic flowmeter is planned as part of the Bangor-Keyport Forcemain Replacement project. ➢ Station has room for a fourth pump. ➢ The City of Poulsbo may install Bioxide in their collection system which would reduce corrosion in County facilities. ➢ On-site sodium hypochlorite odor control system is not currently in use.	➢ Replace pumps and electrical equipment to increase capacity and due to age of equipment
		Civil	2.0	2.0	2000		
		Structural	3.7	5.0	2000		
		Pumping Systems	2.7	3.0	2000		
		Motors	3.0	3.0	2000		
		Piping Systems	3.0	5.0	2000		
		Valve Systems or Assemblies	3.5	2.0	2000		
		Support Systems	2.0	1.0	2000		
		Instrumentation	3.5	5.0	2000		
		Electrical and Power Distribution	3.0	5.0	2000		
25	6.8	Overall	3.4	2.0	1989	➢ Isolation valves are reportedly hard to turn. ➢ Overflow tank lid is covered by arborvitaes growing along border of site. ➢ NEMA 12 rated double door enclosure location is violation of NFPA 820 4.2.2 Design and Construction and NFPA 70 (NEC) article 500.	➢ Relocate the enclosure and all the electrical equipment away from the Class 1 Division 2 hazardous area. ➢ Construct canopy over electrical equipment
		Civil	4.0	2.0	1989		
		Structural	3.0	5.0	1989		
		Pumping Systems	4.3	3.0	1989		
		Motors	4.3	3.0	1989		
		Piping Systems	4.0	5.0	1989		
		Valve Systems or Assemblies	4.0	2.0	1989		
		Support Systems	3.0	1.0	1989		
		Instrumentation	3.0	5.0	1989		
		Electrical and Power Distribution	2.0	5.0	1989		
26	6.0	Overall	3.0	2.0	1990	➢ Wetwell and valve vault hatches perform poorly; Hinge located in valve vault is broken. ➢ Wetwell hatch is enveloped by dirt. ➢ No pig tail connection present.	➢ O&M staff have expressed the desire to install an on-site generator.
		Civil	4.0	2.0	1990		
		Structural	3.0	5.0	1990		
		Pumping Systems	2.7	3.0	1990		
		Motors	2.7	3.0	1990		
		Piping Systems	4.0	5.0	1990		
		Valve Systems or Assemblies	3.0	2.0	1990		
		Support Systems	3.0	1.0	1990		
		Instrumentation	3.0	5.0	1990		
		Electrical and Power Distribution	2.0	5.0	1990		
30	6.0	Overall	3.0	2.0	1993	➢ Fairly frequent power outages have been reported. ➢ Corrosion observed on discharge piping. ➢ Open conduits located in classified area. ➢ The control panel and electrical conduits currently do not comply with proper installation in a hazardous classified area according to NFPA 820 4.2.2 Design and Construction and NFPA 70 (NEC) article 500.	➢ Pumps are old and need replacing. ➢ O&M staff have expressed the desire to install an on-site generator to avoid the difficulties of generator mobilization. ➢ Control panel should be moved further back from the wet well opening.
		Civil	3.5	2.0	1993		
		Structural	2.5	5.0	1993		
		Pumping Systems	3.3	3.0	1993		
		Motors	3.0	3.0	1993		
		Piping Systems	4.0	5.0	1993		
		Valve Systems or Assemblies	3.0	2.0	1993		
		Support Systems	3.0	1.0	1993		
		Instrumentation	3.0	5.0	1993		
		Electrical and Power Distribution	2.0	5.0	1993		
31	N/A	Assessment Not Performed	-	-	1975	➢ Station scheduled for replacement; Assessment not necessary	

Pump Station	Asset Health Score	Station Component	Condition	CoF	Year Installed/ Upgraded	Notes	Recommendations
32	6.8	Overall	3.4	2.0	1983	➢ Pumps are reportedly old and worn. ➢ Valves are aging and becoming stiffer. ➢ Bubbler system is antiquated. ➢ Station is an Ideal Pump and Equipment dry can configuration.	➢ Station overflows to the City of Bremerton's collection system. This station should be replaced or removed and replaced with a gravity connection to Bremerton's sewer.
		Civil	2.0	2.0	1983		
		Structural	3.0	5.0	1983		
		Pumping Systems	3.7	5.0	1983		
		Motors	3.7	3.0	1983		
		Piping Systems	3.0	5.0	1983		
		Valve Systems or Assemblies	3.0	2.0	1983		
		Support Systems	3.0	1.0	1983		
		Instrumentation	3.0	5.0	1983		
		Electrical and Power Distribution	5.0	5.0	1983		
33	7.0	Overall	3.5	2.0	1983	➢ Frequent power outages reported. ➢ The NEMA 4X junction box and some nearby electrical conduits currently do not comply with proper installation in a hazardous classified area according to NFPA 820 4.2.2 Design and Construction and NFPA 70 (NEC) article 500.	➢ Relocate junction boxes outside of the wet well's Class 1 Division 2 hazardous area classification boundary in compliance with current NFPA 70 (NEC) and NFPA 820 standards. ➢ Install generator
		Civil	3.5	2.0	1983		
		Structural	3.0	5.0	1983		
		Pumping Systems	4.0	3.0	1983/1993		
		Motors	4.0	3.0	1983		
		Piping Systems	4.0	5.0	1983		
		Valve Systems or Assemblies	3.0	2.0	1983		
		Support Systems	3.0	1.0	1983		
		Instrumentation	3.5	5.0	1983		
		Electrical and Power Distribution	3.0	5.0	1983		
34	14.5	Overall	2.9	5.0	1989	➢ Isolation valves are difficult to actuate due to stiffness. ➢ Larger surges have been observed while surge tank is on. ➢ A Bioxide® system is located on-site. ➢ New Flygt pumps were installed in 2019. ➢ A more recent installation of a wet well level transmitter has flexible conduit and fittings that according to NFPA 820 falls within the Wet Wells Class 1 Div 2 hazardous area classification boundary envelope.	➢ The control systems are old and in need of replacing. The level control is new and should remain in service. ➢ Relocate junction boxes outside of the wet well's Class 1 Division 2 hazardous area classification boundary in compliance with current NFPA 70 (NEC) and NFPA 820 standards.
		Civil	4.0	2.0	1989		
		Structural	3.0	5.0	1989		
		Pumping Systems	2.3	3.0	1989/2019		
		Motors	3.0	3.0	1989		
		Piping Systems	2.0	5.0	1989		
		Valve Systems or Assemblies	3.5	2.0	1989/2011		
		Support Systems	4.0	1.0	1989		
		Instrumentation	4.0	5.0	1989		
		Electrical and Power Distribution	2.0	5.0	1989		
35	6.4	Overall	3.2	2.0	1983	➢ No generator present on-site. ➢ Two new Flygt pumps installed within the last 1-2 years. ➢ Soft starts have had historical issues but were corrected and have not resurfaced. ➢ The NEMA 4X junction box and some nearby electrical conduits currently do not comply with proper installation in a hazardous classified area according to NFPA 820 4.2.2 Design and Construction and NFPA 70 (NEC) article 500.	➢ Electrical systems are aging and should be replaced. ➢ VFDs would benefit station.
		Civil	4.0	2.0	1983		
		Structural	3.0	5.0	1983		
		Pumping Systems	3.0	3.0	1983		
		Motors	3.0	3.0	1983		
		Piping Systems	4.0	5.0	1983		
		Valve Systems or Assemblies	3.0	2.0	1983		
		Support Systems	3.0	1.0	1983		
		Instrumentation	3.0	5.0	1983		
		Electrical and Power Distribution	3.0	5.0	1983		

Pump Station	Asset Health Score	Station Component	Condition	CoF	Year Installed/ Upgraded	Notes	Recommendations
36	7.4	Overall	3.7	2.0	1979/1999	➢ Steel wetwell is experiencing high levels of corrosion. ➢ Pump gasket sticks out between discharge claw and foot. ➢ General station conditions are poor. ➢ Generator set is obsolete. ➢ Corrosion observed on piping and valves. ➢ The NEMA 4X junction box and some nearby electrical conduits currently do not comply with proper installation in a hazardous classified area according to NFPA 820 4.2.2 Design and Construction and NFPA 70 (NEC) article 500.	➢ Replace pump station ➢ Relocate junction boxes outside of the wet well's Class 1 Division 2 hazardous area classification boundary in compliance with current NFPA 70 (NEC) and NFPA 820 standards.
		Civil	3.5	2.0	1979		
		Structural	4.1	5.0	1979		
		Pumping Systems	3.8	3.0	1979		
		Motors	3.8	3.0	1979		
		Piping Systems	4.0	5.0	1979		
		Valve Systems or Assemblies	3.0	2.0	1979		
		Support Systems	3.5	1.0	1979		
		Instrumentation	4.0	5.0	1979		
		Electrical and Power Distribution	3.0	5.0	1979		
37	6.6	Overall	3.3	2.0	1983	➢ Steel wet well is experiencing moderate corrosion. ➢ The NEMA 4X junction box and some nearby electrical conduits currently do not comply with proper installation in a hazardous classified area according to NFPA 820 4.2.2 Design and Construction and NFPA 70 (NEC) article 500.	➢ Replace pump station ➢ Relocate junction boxes outside of the wet well's Class 1 Division 2 hazardous area classification boundary in compliance with current NFPA 70 (NEC) and NFPA 820 standards.
		Civil	3.5	2.0	1983		
		Structural	3.8	5.0	1983		
		Pumping Systems	2.7	3.0	1983		
		Motors	2.7	3.0	1983		
		Piping Systems	3.0	5.0	1983		
		Valve Systems or Assemblies	3.0	2.0	1983		
		Support Systems	3.0	1.0	1983		
		Instrumentation	4.0	5.0	1983		
		Electrical and Power Distribution	3.0	5.0	1983		
39	5.4	Overall	2.7	2.0	1994	➢ Station runs off of Crista Shores generator and power. ➢ NEMA 12 rated Junction Boxes, some conduits and conduit fittings in ISI's assessment are situated within the Class 1 Div2 hazardous area classification boundary envelope of 36" horizontally and 18" vertically from the Wet Well. Violation of NFPA 820 4.2.2 Design and Construction and NFPA 70 (NEC) article 500.	➢ Relocate junction boxes outside of the wet well's Class 1 Division 2 hazardous area classification boundary in compliance with current NFPA 70 (NEC) and NFPA 820 standards.
		Civil	4.0	2.0	1994		
		Structural	2.5	5.0	1994		
		Pumping Systems	3.3	3.0	1994		
		Motors	3.3	3.0	1994		
		Piping Systems	3.0	5.0	1994		
		Valve Systems or Assemblies	3.0	2.0	1994		
		Support Systems	3.0	1.0	1994		
		Instrumentation	3.0	5.0	1994		
		Electrical and Power Distribution	1.0	5.0	1994		
40	6.4	Overall	3.2	2.0	1993	➢ Corrosion observed on discharge piping. ➢ Cracks observed in steel wetwell coating. ➢ Fair amount of power outages recorded in the past. ➢ The NEMA 4X junction box and some nearby electrical conduits currently do not comply with proper installation in a hazardous classified area according to NFPA 820 4.2.2 Design and Construction and NFPA 70 (NEC) article 500.	➢ O&M staff have expressed desire to install on-site generator. ➢ Relocate junction boxes outside of the wet well's Class 1 Division 2 hazardous area classification boundary in compliance with current NFPA 70 (NEC) and NFPA 820 standards.
		Civil	2.0	2.0	1993		
		Structural	3.5	5.0	1993		
		Pumping Systems	3.3	3.0	1993		
		Motors	3.3	3.0	1993		
		Piping Systems	4.0	5.0	1993		
		Valve Systems or Assemblies	3.0	2.0	1993		
		Support Systems	3.0	1.0	1993		
		Instrumentation	3.0	5.0	1993		
		Electrical and Power Distribution	3.0	5.0	1993		

Pump Station	Asset Health Score	Station Component	Condition	CoF	Year Installed/ Upgraded	Notes	Recommendations
51	6.2	Overall	3.1	2.0	1995	➢ Generator set is owned by Country Meadows assisted living facility. ➢ Slight corrosion observed on discharge piping and valves. ➢ Wetwell coating observed to be worn.	
		Civil	4.0	2.0	1995		
		Structural	3.5	5.0	1995		
		Pumping Systems	2.8	3.0	1995		
		Motors	2.8	3.0	1995		
		Piping Systems	4.0	5.0	1995		
		Valve Systems or Assemblies	3.0	2.0	1995		
		Support Systems	3.0	1.0	1995		
		Instrumentation	3.0	5.0	1995		
		Electrical and Power Distribution	2.0	5.0	1995		
61	3.2	Overall	1.6	2.0	2009	➢ Occasional ragging issues reported. ➢ Station is described as 'mostly reliable'.	➢ O&M staff have expressed the desire to budget for replacement pumps in 20-year CIP.
		Civil	2.0	2.0	2009		
		Structural	1.7	5.0	2009		
		Pumping Systems	1.3	3.0	2009		
		Motors	2.0	3.0	2009		
		Piping Systems	1.0	5.0	2009		
		Valve Systems or Assemblies	2.0	2.0	2009		
		Support Systems	2.0	1.0	2009		
		Instrumentation	2.0	5.0	2009		
		Electrical and Power Distribution	1.0	5.0	2009		
62	3.8	Overall	1.9	2.0	2008	➢ Slight corrosion observed on discharge piping. ➢ Has an overflow tank.	
		Civil	1.0	2.0	2008		
		Structural	1.7	5.0	2008		
		Pumping Systems	2.0	3.0	2008		
		Motors	2.0	3.0	2008		
		Piping Systems	3.0	5.0	2008		
		Valve Systems or Assemblies	2.0	2.0	2008		
		Support Systems	2.0	1.0	2008		
		Instrumentation	2.0	5.0	2008		
		Electrical and Power Distribution	1.0	5.0	2008		
63	3.8	Overall	1.9	2.0	2006	➢ Historical grease issues have subsided in recent years. ➢ Wetwell coating observed to be peeling. ➢ The NEMA 4X junction box and some nearby electrical conduits currently do not comply with proper installation in a hazardous classified area according to NFPA 820 4.2.2 Design and Construction and NFPA 70 (NEC) article 500.	➢ Relocate junction boxes outside of the wet well's Class 1 Division 2 hazardous area classification boundary in compliance with current NFPA 70 (NEC) and NFPA 820 standards.
		Civil	2.0	2.0	2006		
		Structural	2.3	5.0	2006		
		Pumping Systems	2.0	3.0	2006		
		Motors	2.0	3.0	2006		
		Piping Systems	2.0	5.0	2006		
		Valve Systems or Assemblies	2.0	2.0	2006		
		Support Systems	2.0	1.0	2006		
		Instrumentation	2.0	5.0	2006		
		Electrical and Power Distribution	1.0	5.0	2006		
64	5.6	Overall	2.8	2.0	2003	➢ Wetwell coating observed to be worn. ➢ Control cabinet handle broken. ➢ Has an overflow tank.	
		Civil	2.0	2.0	2003		
		Structural	3.0	5.0	2003		
		Pumping Systems	3.3	3.0	2003		
		Motors	3.3	3.0	2003		
		Piping Systems	3.0	5.0	2003		
		Valve Systems or Assemblies	3.0	2.0	2003		
		Support Systems	3.0	1.0	2003		

Pump Station	Asset Health Score	Station Component	Condition	CoF	Year Installed/ Upgraded	Notes	Recommendations
		Instrumentation	3.0	5.0	2003		
		Electrical and Power Distribution	2.0	5.0	2003		
65	6.2	Overall	3.1	2.0	1994	➢ Two sets of two pumps in series arrangement. ➢ Check valves are approximately 10 years old. ➢ Generator engine is a two stroke. ➢ Bioxide® is injected into the wet well ➢ Has a bubbler ➢ Station is a Dakota Pump dry can configuration.	
		Civil	3.0	2.0	1994		
		Structural	3.0	5.0	1994		
		Pumping Systems	2.3	5.0	1994		
		Motors	3.0	3.0	1994		
		Piping Systems	2.0	5.0	1994		
		Valve Systems or Assemblies	2.5	2.0	1994/2010		
		Support Systems	3.0	1.0	1994		
		Instrumentation	3.5	5.0	1994		
		Electrical and Power Distribution	5.0	5.0	1994		
67	6.0	Overall	1.2	5.0	1999/2016	➢ Station was upgraded/expanded in 2016. ➢ Station collects and pumps flows from Poulsbo. ➢ Existing odor control fan is undersized; County plans to replace soon	
		Civil	2.0	2.0	1999/2016		
		Structural	1.0	5.0	1999/2016		
		Pumping Systems	1.3	3.0	1999/2016		
		Motors	1.0	3.0	1999/2016		
		Piping Systems	1.0	5.0	1999/2016		
		Valve Systems or Assemblies	2.0	2.0	1999/2016		
		Support Systems	3.5	1.0	1999/2016		
		Instrumentation	1.0	5.0	1999/2016		
		Electrical and Power Distribution	1.0	5.0	1999/2016		
68	4.6	Overall	2.3	2.0	1998	➢ Overflow storage tank valves located in the take and are submerged in groundwater. ➢ Pumps experience occasional clogging. ➢ Corrosion observed on discharge piping. ➢ Power blips will cause pumps to fail if running. ➢ Panel's proximity to wetwell introduces falling hazard. ➢ Chlorine injection is no longer in use.	
		Civil	1.0	2.0	1998		
		Structural	2.0	5.0	1998		
		Pumping Systems	3.0	3.0	1998		
		Motors	3.0	3.0	1998		
		Piping Systems	4.0	5.0	1998		
		Valve Systems or Assemblies	2.0	2.0	1998		
		Support Systems	2.0	1.0	1998		
		Instrumentation	2.0	5.0	1998		
		Electrical and Power Distribution	1.0	5.0	1998		
69	4.0	Overall	2.0	2.0	1998	➢ New Flygt pumps installed in 2015/2016. ➢ Station influent contains high volume of grease, but this does not cause a problem with the new Flygt pumps.	
		Civil	1.0	2.0	1998		
		Structural	1.7	5.0	1998		
		Pumping Systems	2.7	3.0	1998/2015		
		Motors	2.7	3.0	1998/2015		
		Piping Systems	3.0	5.0	1998		
		Valve Systems or Assemblies	2.0	2.0	1998		
		Support Systems	2.0	1.0	1998		
		Instrumentation	2.0	5.0	1998		
		Electrical and Power Distribution	1.0	5.0	1998		
70	N/A	Assessment Not Performed	-	-	2016	➢ Station recently replaced; Assessment not necessary	
80	N/A	Assessment Not Performed	-	-	2019	➢ Station recently constructed; Assessment not necessary	
81	N/A	Assessment Not Performed	-	-	In Design	➢ Station under design; Assessment not necessary	

5.4 Pipeline Conditions Assessments

The County has historically conducted pipeline condition assessments through video observation. The County process consists of inspecting pipe via closed circuit television (CCTV), storing the video in a database, reviewing the video, and assigning an Overall Condition Index (OCI) score based on the observations. The results of these assessments have been stored in their asset management database software Cartegraph since 2017. They are on a five-year inspection cycle with approximately 20 percent of the pipes inspected each year and completed first round of inspection of the entire system at the end of 2022.

The County uses consistent scoring when reviewing pipeline inspection videos with several criteria, which are summarized in **Table 5-18.** Each criterion has a defined score corresponding to the severity of an observed issue. Lower scores indicate more severe issues. Note that "Roots" and "I&I" have a weighting of zero which excludes these criteria from the OCI. The County captures information so that it can be filtered and viewed in Cartegraph but other categories describe the actual pipe conditions. For example, a pipe with roots present would also be scored under the obstruction or intrusion category. The OCI is calculated by this equation:

$$OCI = \frac{\sum_{pipe}(Category\ Value\ x\ Calculation\ Weight)}{\sum_{pipe} Calculation\ Weight}$$

Table 5-18 | OCI Criteria and Weighting

Category	Value	Description	Calculation Weight
Roots	0	Blockage	0
	30	Heavy	
	50	Medium	
	80	Light	
	100	None	
I & I	40	Gushing or Spurting	0
	60	Running or Trickling	
	80	Weeping or Dripping	
	90	Stain, Possible I&I	
	100	None	
Obstruction or Intrusion	0	Severe or Impassable	1
	60	Moderate	
	80	Minor	
	100	None	
Worn Surface	40	Severe	1
	60	Moderate	
	80	Minor	
	100	None	
Belly or Sag	40	Severe (>30 percent)	1
	60	Moderate (10 to 30 percent)	
	80	Minor (<10 percent)	
	100	None	
Cracks or Fractures	40	Severe Cracking	3
	60	Moderate Cracking	
	80	Minor Cracking	
	100	None	

Category	Value	Description	Calculation Weight
Break or Failure	0	Collapse	5
	15	Hole Void Visible	
	30	Hole Soil Visible	
	100	None	
Lining or Repair Failure	40	Severe	1
	60	Moderate	
	80	Minor	
	100	None	
Joint Separation or Offset	40	Severe (> 1.5 Pipe Thickness)	2
	60	Moderate (1 to 1.5 Pipe Thickness)	
	80	Minor (< Pipe Wall Thickness)	
	100	None	

The County provided OCI scores for 161,302 feet of pipe where issues were found and noted in Cartegraph. This data is included as **Appendix F**. Because only pipes with noted deficiencies were input into Cartegraph, it is assumed that all inspected but unscored pipes have an OCI of 100. The lengths of pipe in a given OCI range have been extrapolated and are summarized in **Table 5-19**. The rankings of all County-owned pipelines in the Central Kitsap basin will be used to develop CIP prioritizations and to project annual costs for pipeline replacement.

Table 5-19 | Percentage of Pipes in OCI Condition Ranges

OCI Range	Length (ft)	Percentage of Total
0-20	-	0%
20-40	-	0%
40-60	3,300	0.5%
60-80	8,900	1%
80-99	81,800	12%
100	575,700	86%

The CIP will include an Annual Pipe Replacement Program to replace or rehabilitate all pipes with the 6-year and 20-year CIP. Pipes with the lowest OCI ratings will have the highest priority for replacement. The pipes with an OCI under 60 are summarized in **Table 5-20**.

Table 5-20 | Pipes with OCI Under 60

Pipe Name	OCI	Diameter (in)	Length (ft)	Location
H16-3078-H16-3063	47	8	131	NE Tronson Circle
K18-3016-K18-3106	48	8	275	
L17-1023-L17-1022	50	8	322	NW Lowell Street
H16-3064-H16-3063	50	8	119	NE Tronson Circle
G16-3016-G16-3015	53	8	176	NE Bently Drive
H17-3037-H17-3030	54	8	397	
H16-2022-H16-2021	54	8	346	
K18-3106-K18-3021	55	8	272	
L18-4011-L18-4010	57	12	183	
G16-3075-G16-3074	58	8	187	St Charles Lane NE
K18-1032-K18-1025	59	8	121	

SECTION 6

Wastewater Treatment Facilities Existing Conditions

6.1 Introduction

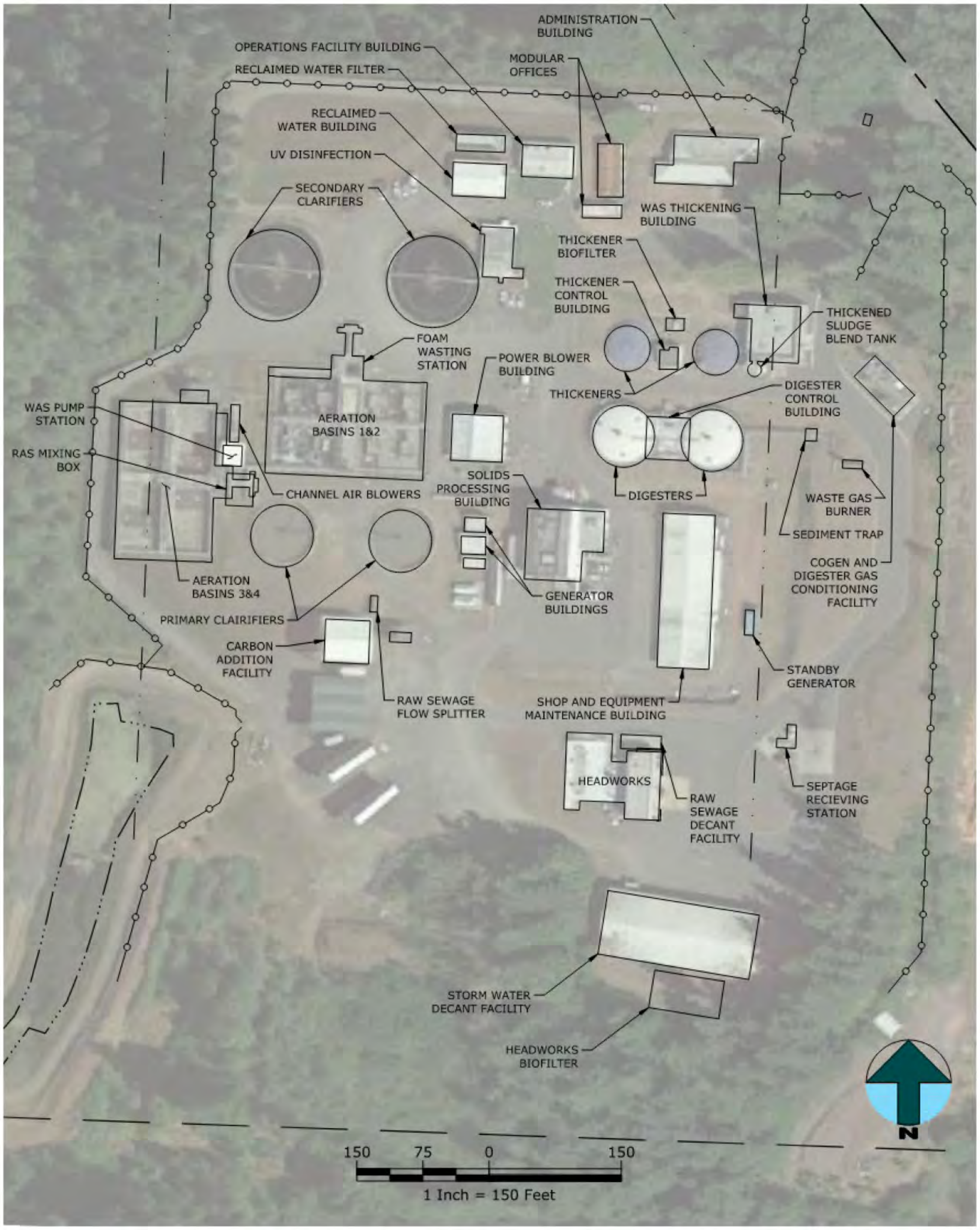
A description of the existing Central Kitsap WWTP field evaluation and condition assessment, the capacity analysis of the plant facilities and processes, and an evaluation of each process to identify any deficiencies is presented in **Section 6**. Recommendations are provided to address challenges impacting facility operations along with maintenance upgrades necessary to continue meeting NPDES Permit requirements.

6.2 Existing Wastewater Treatment Plant Description

Central Kitsap WWTP provides wastewater treatment for much of the central Kitsap Peninsula and is located on Brownsville Highway NE, between SR 303 and SR 308. The existing plant consists of headworks, primary clarifiers, aeration basins, secondary clarifiers, and UV disinfection. Solids, including those hauled from the County's other treatment plants, are thickened and digested anaerobically before dewatering and disposal. The plant is rated for maximum month flow rate of 6.0 MGD as listed in the NPDES Permit. The treated effluent is discharged to Port Orchard Bay of the Puget Sound in accordance with the NPDES Permit.

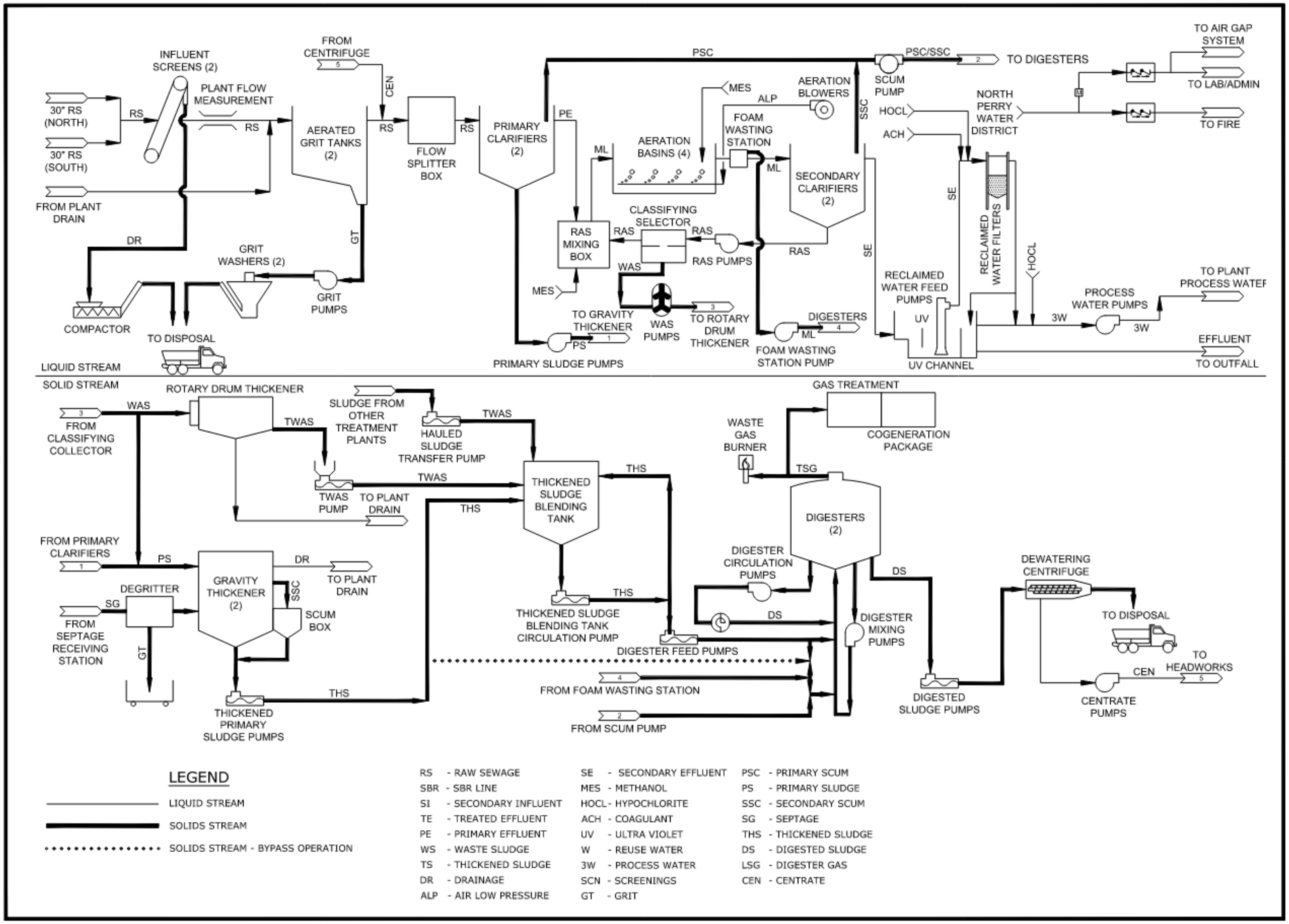
The original Central Kitsap WWTP began operation in 1979 as an activated sludge plant with primary clarifiers and anaerobic digesters. It was designed with an average daily flow of 4.8 MGD and a peak flow of 12.0 MGD. In 1996, the 'Contract I Improvements' project modified the aeration basins, added a new aeration blower building, upgraded the secondary clarifiers, replaced the chlorine disinfection with an UV system, replaced the Waste Activated Sludge (WAS) pumps, and added primary sludge pumps. Shortly thereafter, in 1999, the 'Contract IIC Expansion' project upgraded the dewatering system. The next major improvement project was installed in 2009 and put into service in 2011, when the headworks and septage receiving station were entirely replaced and the primary sludge and plant wastewater sump pumps were replaced. In 2016 the "Resource Recovery Project" made numerous changes. The existing aeration basins were modified and new basins were constructed, a WAS thickening building and thickened sludge blending tank were built, a digester gas cogeneration system was installed, and a reclaimed water filter structure and building were constructed. Most recently, in 2019, the UV banks were replaced. The existing Central Kitsap WWTP site plan is shown in **Figure 6-1**, and **Figure 6-2** shows the process schematic. The permitted maximum month flow is 6.0 MGD. The design peak hour flow of the plant is 22.7 MGD, as documented in the process design data of the 2016 Resource Recovery Project.

Figure 6-1 | Existing Central Kitsap WWTP Site Plan



consor / Kitsap County Washington	Central Kitsap General Sewer Plan Update	**Existing Central Kitsap WWTP Site Plan**

Figure 6-2 | Existing Central Kitsap WWTP Schematic



6.3 Wastewater Treatment Plant Condition Assessment

The Murraysmith (now Consor) team visited the Central Kitsap WWTP on September 15th, 16th, and 17th, 2020 to observe and document existing plant conditions and to have discussions with plant staff regarding operational and plant performance challenges. The group investigated facilities and unit processes for the liquid streams and solids streams by walking through each process to ascertain equipment condition and manufacturing information. WWTP electrical equipment and structures were observed. Plant staff provided information on the daily operations of the plant, as well as past and current operational challenges. The information gathered from the assessment was used to develop a list of recommendations for maintaining plant operations and performance. The major equipment information, photos and field notes are summarized in **Appendix G**, Central Kitsap WWTP Condition Assessment Form.

6.3.1 Condition Summary Tables

To better organize the results of the assessments at the Central Kitsap WWTP, major processes were grouped as presented in **Table 6-1**.

Table 6-1 | WWTP Process Group Definitions

Process	Components
Civil	Site, site security, roadways, sidewalks, fencing
Preliminary Treatment	Screens and grit removal and associated equipment and piping
Primary Treatment	Primary clarifiers, flow splitter and associated pumps and piping
Secondary Treatment	Aeration basins and associated equipment and piping
Disinfection and Effluent	UV system and associated equipment and piping
Septage	Septage receiving station, cyclone and classifier and associated equipment and piping
Gravity Thickening	Gravity thickeners and associated pumps and piping
WAS Thickening	Rotary drum thickener, thickened sludge blending tank and associated pumps, mixers, and piping
Anaerobic Digestion and Digester Gas Handling	Anaerobic digesters, boilers, heat exchangers, burners and associated equipment and piping
Digester Gas Treatment and Cogeneration	H_2S removal vessels, siloxane vessels, cogeneration structure and associated equipment and piping
Sludge Dewatering	Centrifuges, feed pumps, centrate sump and pumps
Support Systems	Odor control and plant water systems
Power Distribution	Electrical services, transfer switches, standby generator, motor control centers and control panels

These processes were further broken down into several categories when appropriate. While no two processes are identical, the processes are anatomically similar and can be characterized by a standardized set of component groupings. These component groupings are consistent with County Asset Functional Class Level and are presented in **Table 6-2** along with definitions. Note that the Asset Functional Class Level has nine groups: Civil, Structural, Piping Systems, Pump Systems, Valve System or Assemblies, Equipment, Support Systems, Instrumentation, and Power Distribution. However, for the WWTP conditions assessments, the components are shortened to four groups, which are more directly applicable to the wastewater treatment processes. Civil, Power Distribution and Support Systems are treated as processes; Piping and Valves are grouped together; Pumps are grouped with Equipment.

Table 6-2 | Component Group Definitions

Component Grouping	Definitions
Equipment	Mechanical equipment such as screens, pumps, and blowers. Equipment and motors are treated as one asset unless the motor is 25 HP or larger.
Instrumentation	Electrical and measuring devices such as flowmeters, transmitters, and indicators.
Structural	Concrete structures such as buildings, basins, and tanks.
Piping	A system of pipes and valves used to convey fluids such as influent, effluent, chemical, air and sludge.

Note:
HP = Horsepower

6.3.2 Treatment Plant Process Asset Health Score

To better inform the County's prioritization of future asset upgrades and replacements, an overall treatment plant process "Asset Health" score was developed with County input that synthesizes each process's existing likelihood of failure (condition) and CoF.

Individual condition scores for equipment, instrumentation, and piping systems consider each system's physical integrity and their current ability to perform as designed. For structural components, individual condition ratings generally apply to the physical integrity of these assets in the face of material degradation due to environmental forces such as corrosion, weathering, settling, and flooding. General observations and historical accounts from County Operation & Maintenance (O&M) staff were also used to inform the condition ratings for all treatment plant process components to incorporate phenomena not observed by Murraysmith [now Consor] staff during the site visits. Examples of this historical information from O&M staff include, but are not limited to, challenges associated with equipment operation, lack of redundancy and lack of automation. Individual condition ratings range from 1 to 5, with a score of 1 representing the best condition and a score of 5 representing the worst. **Table 6-3** presents the definition of the condition scores. It is important to note that condition scores are not simply reflections of age as dissimilar environmental and operational factors among the Central Kitsap WWTP necessitate differing rates of condition degradation. Although age/obsolescence is not accounted for in the condition assessment, it will be a consideration for development of the 20-year CIP so that replacement of aging infrastructure is accounted for and can be budgeted.

Table 6-3 | Component Condition Scores Definitions

Condition Rating	Definition
1	Very Good, well maintained, expected to remain reliable for more than 90 percent of the expected life.
2	Good, some degradation but performance and reliability are not significantly affected. Performance and reliability expected to remain satisfactory for 50-90 percent of the expected life.
3	Fair, performance and reliability are still acceptable, but some rehabilitation or replacement will be needed in the 50 percent +/- of the expected life.
4	Poor, performance and/or reliability has significantly decreased, maintenance rehabilitation or replacement needed to restore performance or reliability to acceptable levels. Failure (no longer functions) is likely in 10-50 percent of the expected life if not rehabilitated or replaced.
5	Very poor, performance and/or reliability has significantly decreased, and failure is probable within 10 percent of the expected life if rehabilitation or replacement is not performed.

Individual CoF ratings for process components are based on consideration of the effects of failure of each component within the context of the local process. Individual CoF ratings range from 1 to 5, with a score of 1 representing the lowest consequence and 5 representing the highest. **Table 6-4** presents the definition of the CoF scores.

Table 6-4 | Component Consequence of Failure Definitions

CoF Rating	Definition
1	Not Managed. Failure would not affect the treatment plant operation.
2	Not Critical. Could marginally reduce the treatment performance
3	Important (Critical but redundant). The treatment plant performance is significantly impacted without a currently installed redundant component.
4	Critical. The treatment plant performance is significantly impacted upon failure.
5	Highly Critical. Failure will cause an immediate loss of hydraulic throughput.

To fully develop an overall treatment plant process score, the individual condition and CoF scores of each unit process were considered within the larger context of the Central Kitsap WWTP. To accomplish this, an overall treatment plant unit process CoF score (from a plant-wide perspective) is applied to an overall condition score for each unit process. The definition of the overall unit process CoF scores are the same as the definition of the component CoF scores and are summarized in **Table 6-5** below.

Overall condition scores for each unit process are weighted by component CoF and are defined as the quotient of the sum of the products of individual component condition and CoF scores and the sum of individual component CoF scores. This scoring is represented symbolically as follows:

$$Overall\ Condition\ Score = \frac{\sum_{Components}(Condition\ Score\ \times CoF\ Score)}{\sum Individual\ CoF\ \ Scores}$$

This overall condition score is then scaled by the unit process CoF score to obtain the overall treatment process Asset Health Score:

$$Asset\ Health\ Score = Overall\ Condition\ Score\ \times Unit\ Process\ CoF\ Score$$

The results of the analysis described in the preceding paragraphs are summarized in **Table 6-5** and detailed in **Table 6-6**. The Asset Health Score will be used to rank the projects in the CIP.

Table 6-5 | Treatment Plant Process Asset Health Summary

Unit Process	Unit Process CoF Score	Overall Condition Score	Asset Health Score
Civil	1	2.0	2.0
Preliminary Treatment	3	1.6	4.8
Primary Treatment	5	2.9	14.5
Secondary Treatment	5	1.7	8.5
Disinfection and Effluent	3	1.0	3.0
Septage	3	2.0	6.0
Gravity Thickening	5	3.8	19.0
WAS Thickening	4	1.0	4.0
Anaerobic Digestion and Digester Gas Handling	5	3.5	17.5
Digester Gas Treatment and Cogeneration	4	1.0	4.0
Sludge Dewatering	5	1.8	9.0
Support Systems	3	2.3	6.9
Power Distribution	5	1.9	9.5

Table 6-6 | Treatment Plant Unit Process Condition Assessments

Unit Process[1]	Asset Health Score	Process Component	Condition	CoF	Year Installed/ Upgraded/ In-service	Notes	Recommendations
Civil	2.0	**Overall**	**2.0**	**1.0**		➢ The fence is in good condition, and the site has well maintained landscaping	➢ Add an automatically opening gate, intrusion alarms and video surveillance
Preliminary Treatment	4.8	**Overall**	**1.6**	**3.0**		➢ Influent manual screen is in poor condition, with severe corrosion and layers of steel flaking off ➢ The aluminum slide gates in the grit channels are showing signs of premature corrosion	➢ Replace the manual screen
		Equipment	1.7	2.2	2011		
		Instrumentation	N/A	N/A			
		Structural	1.0	2.7	2011		
		Piping	2.0	3.0	2011		
Primary Treatment	14.5	**Overall**	**2.9**	**5.0**		➢ The scum grinder and pumps are 44 years old and have exceeded expected lifespan	➢ Clean and paint the corroded areas on the scum pumps ➢ Plan for the scum pump replacement within the next 12 to 15 years
		Equipment	3.0	3.0	1977		
		Instrumentation	N/A	N/A			
		Structural	2.7	3.0	1977, 2011		
		Piping	3.0	5	1977		
Secondary Treatment	8.5	**Overall**	**1.7**	**5.0**		➢ Aeration Blower 1 is partially dismantled and is not currently operational; blowers and valves are manually controlled due to the frequent shutdown in automatic mode ➢ Channel Blower 1 is partially dismantled and not currently operational; Channel Blower 2 is in poor condition ➢ The walkways on clarifier structures have moderate corrosion; the scraper drives, and rake and skimmer mechanisms have some corrosion ➢ Return activated sludge (RAS) pumps have minor corrosion	➢ Implement the planned most open valve (MOV) control strategy ➢ Replace Aeration Blower 1 in the next 10 to 12 years ➢ Replace Channel Blowers 1 and 2 ➢ Recoat the secondary clarifier walkways; clean and recoat the corroded areas on the clarifier drive ➢ Consider different type of methanol metering pump tubing suitable for outdoor application or different type of metering pump
		Equipment	2.1	2.4	1977, 1992, 1996, 1999, 2016		
		Instrumentation	N/A	N/A			
		Structural	1.8	2.6	1977, 1996, 2016		
		Piping	1.4	2.8	1996, 2016		
Disinfection and Effluent	3.0	**Overall**	**1.0**	**3**		➢ None	➢ Install a new effluent flow meter device to meet flow monitoring requirements of permit
		Equipment	1.0	3.0	2019		
		Instrumentation	N/A	N/A			
		Structural	2.0	5.0	1996		
		Piping	N/A	5.0			
Septage	6.0	**Overall**	**2.0**	**3.0**		➢ The septage pumps, cyclone and classifier are 44 years old and have exceed their expected lifespan ➢ Performance issues are arising	➢ Consider construction of a redundant septage receiving station due to the greater amount of septage and upgrade existing septage receiving station as needed ➢ Plan for increased maintenance for the septage pumps, cyclone, and classifier, and replace the pumps within the next 5 years
		Equipment	3.2	1.7	1977, 2011		
		Instrumentation	N/A	N/A			
		Structural	2.0	1.0	2011		
		Piping	N/A	1.0	2011		
Gravity Thickening	19.5	**Overall**	**3.9**	**5.0**		➢ The gravity thickener control structure and the gravity thickeners are in poor condition ➢ Insufficient overhead space to stand near the degritter and flow control structure ➢ Insufficient ventilation within gravity thickeners ➢ Thickened primary sludge pump motors are not physically supported ➢ Grinders are 44 years old and have exceeded their expected lifespan ➢ The in-plant pump station structure, pumps, and mechanical components are in very poor condition with corrosion; the coating on the manhole is peeling and the pipes are very corroded	➢ Replace the gravity thickener control structure ➢ Clean and repair the corroded areas within the gravity thickeners ➢ Improve ventilation within the gravity thickeners to minimize corrosion ➢ Consider replacing gravity thickeners with other thickening technology ➢ Add support under the thickened primary sludge pump motors ➢ Plan for increased maintenance requirements for the thickened sludge grinders until replacement
		Equipment	4.3	3.3	1977, 1990s		
		Instrumentation	N/A	N/A			
		Structural	3.8	3.5	1977		
		Piping	3.7	4.0	1977		
WAS Thickening	4.0	**Overall**	**1.0**	**4.0**		➢ All the pump motors are not physically supported which can cause unnecessary wear on couplings and bearings	➢ Add support under the pump motors
		Equipment	1.0	2.4	2016		
		Instrumentation	N/A	N/A			
		Structural	1.0	4.0	2016		
		Piping	1.0	2.8	2016		
	17.5	**Overall**	**3.5**	**5.0**			

Unit Process[1]	Asset Health Score	Process Component	Condition	CoF	Year Installed/ Upgraded/ In-service	Notes	Recommendations
Anaerobic Digestion and Digester Gas Handling		Equipment	3.2	3.1	1977, 1999, 2016 (Gas Handling), 2018	➢ The covers and some system components of anaerobic digesters, sludge mixing pumps and hot water circulation pumps are in poor condition ➢ The digested sludge withdrawal pumps will likely require rehabilitation ➢ Sludge recirculation pumps, mixing pumps, boilers and heat exchangers are 44 years old and have exceeded their expected lifespan ➢ Roof penetrations over the two boiler stacks are leaking ➢ Expansion Tanks 6801 and 6802 are near the end of their expected lifespan and are showing signs of exterior corrosion ➢ County has started a digester rehabilitation project in later 2021 to repair the digester annular seal, replace PVRVs, sludge valves, and digester mixing system. The project is anticipated to complete by fall 2022.	➢ Repair digester annular seal and any failed coating, replace PVRVs, mixing system, and sludge valves as planned in the digester rehabilitation project. ➢ Provide additional biosolids handling capacity in the near term for redundancy and reliability ➢ Replace the hot water circulation pumps ➢ Establish a preventative maintenance program to exercise major valves annually ➢ Repair the Digester Control Building roof penetration ➢ Plan for increased maintenance requirements for the digested sludge withdrawal pumps, sludge mixing pumps, sludge recirculation pumps, boilers, and expansion tanks until replacement
		Instrumentation	3.0	4.0			
		Structural	3.8	4.8	1977, 2016 (Gas Handling)		
		Piping	4.0	3.9	1977, 2016 (Gas Handling)		
Digester Gas Treatment and Cogeneration	4.0	**Overall**	**1.0**	**4.0**		➢ The digester gas treatment system is not currently operational but appears to be in good condition with no significant visible degradation ➢ Engine is not used consistently because of insufficient gas quantities and pressure	➢ Improve digester gas supply and consistent quality if the County wishes to resume operation of the cogeneration system. The digester rehabilitation improvements to enhance mixing and stop digester gas leaks should help provide stable gas supply. For long-term improvements, digester gas storage options should be explored. ➢ If restart the system, overall system startup services from a qualified vendor will be required to replacement media, and to service and test equipment for the gas conditioning and chiller system
		Equipment	1.0	1.0	2016		
		Instrumentation	N/A	N/A			
		Structural	N/A	N/A			
		Piping	1.0	1.0	2016		
Sludge Dewatering	9.0	**Overall**	**1.8**	**5.0**		➢ None	➢ Plan for increased maintenance requirements for centrifuge sludge feed grinders and pumps and centrate pumps, until replacement
		Equipment	1.8	2.5	1977, 1999, 2019		
		Instrumentation	N/A	N/A			
		Structural	2.0	2.2	1977, 1996, 1999		
		Piping	1.8	2.3	1999		
Support Systems	6.9	**Overall**	**2.3**	**3.0**		➢ The bearings on the septage odor control fan are near failure, and the blower operation is expected to fail in the next two years if the bearings are not replaced ➢ Gravity thickener odor control biofilter is not effective and the blower is in poor condition ➢ The automatic strainer of 3W system is in very poor condition and appears broken; process water pumps are 31 to 44 years old and have exceed the typical expected lifespan of 25 to 30 years ➢ Carbon tower of dewatering odor control system shows signs of wear and cracking	➢ Replace the bearing on the septage odor control fan immediately ➢ Perform routine biofilter media replacement every 3 to 4 years ➢ Plan for increased maintenance requirements for the gravity thickener odor control blower until replacement ➢ Consider replacing the in-plant pump station ➢ Plan for increased maintenance requirements for process water pumps of 3W system for the next 2 to 10 years until replacement ➢ Reassess dewatering odor control system in 3 to 5 years
		Equipment	2.3	1.8	1977, 1999, 2011, 2016		
		Instrumentation	N/A	N/A			
		Structural	2.0	1.9	1999, 2016		
		Piping	2.5	2.1	1977, 1999, 2016		
Power Distribution	9.5	**Overall**	**1.9**	**5.0**		➢ ATS-1 is not functioning properly ➢ GEN-2994 is not functional ➢ Rusting was observed on the northern exposure of the enclosure of GEN-2996 ➢ MCC-2 is 43 years old and is in poor condition; parts are not readily available ➢ Some panelboards and transformers are rusty ➢ Several control panels that have PLC controllers and OIT's that are at a mature state or that are obsolete ➢ Some control panels are damaged or rusty ➢ Headworks Building electrical room has insufficient HVAC ➢ Electrical equipment in Digester Control Building is in poor condition, showing sign of rust and corrosion, and not consistently acceptable for hazardous areas ➢ Boiler panels are completely rusted. Some conduits are loose with gaps between the end of the conduit and attached fittings, leaving insulated conductors exposed ➢ Large wiring duct in the southwest corner of the Utilidor is very rusted	➢ All electrical equipment shall be maintained, i.e. inspected, cleaned and logged, per NFPA 70 ➢ Repair or replace ATS-1 internal to SWGR-2960 ➢ Complete a process and load study to determine if GEN-2994 is needed and should be replaced ➢ Perform GEN-2996 maintenance ➢ Replace MCC-2 ➢ Replace PNL-1990, PNL-5012, Operations Facilities Buildings 480-volt and 120/240-volt panelboards, Shop and Maintenance Building transformer and 480-volt panelboard fused disconnect ➢ Inspect, clean, and recoat the transformers (XFMR-3010 and XFMR-3020) enclosures ➢ Replace in-plant pump station panel PNL-1090 and biofilter sprinkler panel PNL-1067 ➢ Control panel housekeeping ➢ Replace main switchgear SWBD-1 ➢ Improve headworks electrical room HVAC ➢ Assess Digester Control Building HVAC and hazard rating ➢ Evaluate electrical control and wiring installation for the boilers ➢ Replace rusted wireway in Utilidor
		Equipment	1.9	3.4	1977 - 2019		
		Instrumentation	N/A	N/A			
		Structural	N/A	N/A			
		Piping	N/A	N/A			

Note:
1. See **Table 6-1** for major equipment included in each unit process

6.3.3 Evaluation of Components

Following the description of each major process component is an outline of the observations made by the Murraysmith (now Consor) team and a list of recommended improvements. For each component, the assigned three-digit process area numeric code as shown in **Table 6-7** is included to assist in identifying the process and assets. At the end of the section, the major unit process condition, capacity, and recommendations are summarized in **Table 6-23**.

Table 6-7 | Process Area Codes

Facility Name	Area Code
Preliminary Treatment	
Headworks	100
Grit	110
Primary Sedimentation	120
Odor Control	140
Secondary Treatment	
Power/Blower Building	200
Existing Aeration Basins	210
Ras Mixing Box, WAS Pumps	220
New Aeration Basins	230
Carbon Feed	240
Secondary Clarifiers	250
Disinfection And Effluent	
Process Water Pumps	300
Reclaimed Water Feed Pumps	300
UV Disinfection	310, 320
Outfall	340
Thickening	
WAS Thickening	400
Foul Air	420
Thickened Sludge Blending	450
Gravity Thickening	460
Septage	500
Digester	
Thickened Sludge Blending Tank	600
Thickened Sludge Digester Feed Pumps	600
Thickened Sludge Blend Tank Circulation Pumps	600
Digester 1	610
Digester 2	620
Digested Sludge Storage Tank	650
Digester Gas	670
Boilers	680
Dewatering	
Dewatering	710
Liquid Alum	720
Hypochlorite	730
Reclaimed Water	
Reclaimed Water Feed Pumps	810
Reclaimed Water Filters	820
Reclaimed Water Hydropneumatic Tank	830

Facility Name	Area Code
Reclaimed Water Hypochlorite System	850
Cogeneration	
Hot Water Circulation Pumps	900
Digester Gas Flare	910
Digester Gas Treatment System	920
Engine	930
Additional Standby Engine Generator	950

6.3.3.1 Civil

The Central Kitsap WWTP is secured by a uniform chain link fence. Site access is through a manual gate. There is limited video surveillance onsite. There is extensive foliage on the perimeter of the site, which limits the visibility of the plant from the Brownsville Highway and surrounding neighbors. The site is on two adjacent parcels totaling approximately 40 acres. The County also owns an additional, undeveloped, 40-acre parcel directly to the south. The WWTP has a network of paved and gravel local access roads.

Observation: The fence is in good condition, and the site has well maintained landscaping.

Recommendation: The County may want to consider adding an automatically opening gate, intrusion alarms and video surveillance.

6.3.3.2 Preliminary Treatment

Headworks consists of influent composite sampling, influent screening, and aerated grit removal. The screenings channels and aerated grit tanks are housed in an outdoor structure with removable fiberglass panels at grade level. The Headworks Building has an electrical room, a mechanical room that houses blowers for the channel and grit tanks, and a screening and grit room, which houses a screenings conveyor and compactor, two grit washers, and associated dumpsters. The equipment gallery is below ground on the opposite side of the headworks structure, and contains four grit pumps, a drain pump for the grit tanks, and an equipment gallery sump with two sump pumps. A blower adjacent to the headworks structure ventilates the headspace under the fiberglass panels and foul air is treated in the biofilter (discussed in **Section 6.3.3.12**) near the decant facility.

Raw sewage is pumped from two pump stations to the north and south into separate influent boxes in the headworks structure. Flow is controlled by two drain gates into the influent channel. A vacuum truck decant station collects vacuum truck loads originating from maintenance of the County's collection system pump stations. Decant station loads are unloaded into the headworks influent channel via a third influent pipe. From the influent channel, flow can enter three parallel screenings channels. The two outside channels each contain a 6-millimeter (mm) opening mechanically cleaned bar screen followed by a Parshall flume, and the middle channel contains a ¾-inch opening manual bar screen followed by a Parshall flume. Each of the three screenings channels can be isolated with manual gates for inspection and maintenance. Flow exits the screening channels to a distribution channel, which controls flow to two parallel two-stage aerated grit removal basins. The distribution channel can be isolated with manually controlled gates, but not bypassed. The grit tanks can be drained by the grit tank drain pump, which pumps to the influent grit tank distribution channel. From the aerated grit tanks, de-gritted wastewater flows to the effluent channel and exits headworks through a 36-inch diameter pipe to a flow splitter feeding the primary clarifiers.

Influent screenings are conveyed with a shaftless screw conveyor to a screenings compactor to be compacted and discharged to a dumpster for offsite disposal. Grit collected at the bottom of the grit chambers is pumped by four grit pumps (one for each stage) to two vortex-style grit washers. The grit is washed and discharged to a dumpster for offsite disposal.

Observations and recommendations for each major headworks process component are outlined below.

6.3.3.2.1 Influent Mechanical Fine Screens - 102

Observation: The 6-mm opening mechanical fine bar screens were put into service in 2011 and are in good condition with minor exterior corrosion. The mechanical fine screens are 12 years old with no outstanding performance issues. It is expected that the equipment may have 50 to 90 percent of its expected serviceable life remaining (13 to 27 years) but may require rehabilitation to maintain performance prior to replacement.

Recommendation: None.

6.3.3.2.2 Influent Manual Screen - 102

Observation: The ¾-inch opening influent manual bar screen was put into service in 2011. The influent manual screen is 12 years old and is in poor condition, with severe corrosion and layers of steel flaking off. It is estimated that the manual screen may have 10 to 50 percent of its expected serviceable life remaining (2 to 12 years)

Recommendation: Replace the manual screen.

6.3.3.2.3 Screenings Conveyor and Compactor - 102

Observation: The screenings conveyor and compactor were put into service in 2011 and appear to be in very good condition. They are 12 years old with no performance issues or significant visible degradation. It is expected that the equipment may have more than 90 percent of expected serviceable life remaining (27+ years).

Recommendation: None.

6.3.3.2.4 Grit Removal - 110

Observation: The cast in place concrete grit tanks and channels were put into service in 2011 and appear to be in very good condition. The aluminum slide gates in the grit channels are showing signs of premature corrosion. No performance issues or maintenance issues were reported by plant staff.

All the equipment, including the blowers, grit pumps, grit washers and drain pumps were installed in 2011 and appear to be in good condition. It is expected that the equipment may have 50 to 90 percent of its expected serviceable life remaining (13 to 27 years).

Recommendation: None.

6.3.3.3 Primary Treatment

The Central Kitsap WWTP has two 65-foot diameter primary clarifiers with 10.5-foot side water depths. De-gritted sewage flows from the headworks to a flow splitter structure near the primary clarifiers that distributes flows between the two clarifiers. The flow splitter structure was constructed with the headworks improvements in 2009 and the primary clarifiers were part of the original plant construction in 1977. Primary effluent flows by gravity to the return activated sludge (RAS) mixing box. Primary sludge is pumped by two double-disc positive displacement primary sludge pumps to the gravity thickeners. The primary sludge pumps are in the aeration basin utilidor and were put into service in 2011. Scum from the primary and secondary clarifiers is ground and pumped to the digesters by a scum grinder and two positive displacement plunger scum pumps. The grinder and pumps are in the aeration basin utilidor and were installed in 1977.

Observations and recommendations for each major process component are outlined below.

6.3.3.3.1 Primary Clarifiers Flow Splitter Structure - 120

Observation: The flow splitter structure for the primary clarifiers was constructed in 2011 and appears to be in good condition. No performance issues or maintenance issues were reported by plant staff.

Recommendation: None.

6.3.3.3.2 Primary Clarifiers - 120

Observation: The primary clarifiers were constructed in 1977. The rake and skimmer mechanisms appear to be in fair condition. The clarifier structures were recoated in 2018 and the coating appears to be in good condition. No performance issues or maintenance issues were reported by plant staff.

Recommendation: None.

6.3.3.3.3 Primary Sludge Pumps - 210

Observation: The primary sludge pumps are double disc positive displacement pumps that were installed in the aeration basin utilidor and put into service in 2011. The pumps are 12 years old with no noted performance issues or significant visible degradation. It is expected that the equipment may have 50 to 90 percent of its expected serviceable life remaining (13 to 27 years).

Recommendation: None.

6.3.3.3.4 Scum Grinder and Pumps - 210

Observation: The scum grinder and pumps were installed in 1977 and appear to be in fair condition. The pumps are moderately corroded. No performance issues or maintenance issues were reported by plant staff.

The scum grinder and pumps are 44 years old and have already exceeded their typical expected lifespan of 25 to 30 years. It is expected that the equipment may have half of its expected serviceable life remaining (12 to 15 years) but will likely require rehabilitation to maintain performance prior to replacement.

Recommendation: Clean and paint the corroded areas on the scum pumps. Plan for the pump replacement within the next 12 to 15 years.

6.3.3.4 Secondary Treatment

Primary effluent flows to the RAS mixing box, which also collects RAS flow that has been returned to the classifying selector from the secondary clarifiers. The RAS mixing box distributes mixed liquor to the four aeration basins. The aerated mixed liquor channel conveys effluent from all four aeration basins to a secondary clarifier flow splitting box. The flow splitter evenly divides the flow to the two secondary clarifiers. Secondary clarifier effluent goes to the UV disinfection system. Settled sludge in the secondary clarifiers is pumped by RAS pumps to the classifying selector. From the classifying selector, sludge is either returned to the RAS mixing box by gravity or wasted by two WAS pumps to the rotary drum thickener (RDT). Scum from the secondary clarifiers is pumped to the primary clarifiers.

Air is supplied to the aeration basins by four aeration basin blowers in the adjacent blower building. The blowers supply air to a single aeration air supply header for each basin that connects to one individual aeration dropleg for each stage. An air flow meter on the basin air supply header measures the total air flow to each basin. Each basin is equipped with three air flow control valves to control combined air flows to passes 1 and 2, combined air flows to passes 3 and 4, and combined air flows to passes 5 and 6. Each dropleg also has a manual valve to provide shutoff and flow adjustment if needed.

Aeration air for the secondary treatment influent channels, effluent channels, mixed liquor channel, and classifying selector is provided by five channel blowers. Channel Blowers 1 and 2 are in the aeration basin utilidor and were installed in 1997 to provide aeration for the Aeration Basins 1 and 2 influent channel. Channel Blowers 3 and 4 and the classifier blower are located adjacent to the classifying selector and were installed in 2016 to provide aeration air for Aeration Basins 3 and 4 channels, the mixed liquor channel, and the classifying selector.

The two 90-foot diameter secondary clarifiers provide settling of the mixed liquor from the aeration basins. Each secondary clarifier has a central drive unit, center column and feed well, rake arm, scum scraper, scum box, scum pit, effluent weirs, and inboard launder. Process water is sprayed onto the surface from the center column. Mixed liquor separates in the clarifier, and the active biomass settles to the bottom of the clarifier while treated secondary effluent overflows the launder weir. Secondary effluent from the clarifiers flows to the UV disinfection structure. The secondary clarifiers are equipped with scum scraping mechanisms that remove scum from the surface of the clarifiers. The scum is pushed into a scum hopper on each clarifier where it is pumped to the anaerobic digesters by the scum pumps.

Five RAS pumps in the aeration basins utilidor withdraw activated sludge from the secondary clarifiers and pump it to the classifying selector. The RAS pumps operate with two pumps per clarifier and one backup.

The supplemental carbon addition system supplies methanol as supplemental carbon to the activated sludge system to enhance denitrification. The methanol storage and feed system includes a storage tank, metering pumps, control and manual valves, flow meters and other instrumentation for delivery of methanol to the activated sludge system. The system is under a covered, open-air structure which was constructed in 2016.

Observations and recommendations for each major process component are outlined below.

6.3.3.4.1 RAS Mixing Box - 220

Observation: The RAS mixing box was constructed in 2016 and is in very good condition. No performance issues or maintenance issues were reported by plant staff.

Recommendation: None.

6.3.3.4.2 Aeration Basins 210 & 230

Observation: Aeration Basins 1 and 2 were constructed in 1977 and modified in 1996 and 2016, while Aeration Basins 3 and 4 were constructed in 2016. The aeration basins concrete structures, walkways, and effluent weirs all appear to be in good condition (Aeration Basins 1 and 2) or very good condition (Aeration Basins 3 and 4). Mixers 1 and 2 in Aeration Basins 1 and 2 were installed in 1999 and are in good condition. The remainder of the mixers were installed in 2016 and are in very good condition. The internal mixed liquor recycle (IMLR) pumps and drain pumps were all installed in 2016. They are submerged under normal operation and could not be observed during the site visit, however, staff did not report any problems with these pumps. As part of this General Sewer Plan effort, the County is planning to install ammonia, nitrate/nitrite probes in each basin to assist BNR.

Recommendation: None.

6.3.3.4.3 Aeration Blowers - 200

Observation: Blowers 1 and 2 (Lamson multi-stage centrifugal blowers) were installed in 1996, and Blowers 3 and 4 (Aerzen air bearing turbo blowers) were installed in 2016. Blower 1 was partially dismantled and was not operational in 2020. Blower 2 is in fair condition and only serves as backup to Blowers 3 and 4.

Blowers 1 and 2 are 25 years old. It is expected that these two blowers may have 10 to 50 percent of expected serviceable life remaining (2 to 12 years). Blowers 3 and 4 are five years old and are expected to last for over 90 percent of the expected life (23 to 25 years).

The automatic control of blowers and air control valves was the design intent in the Resource Recovery project, however, currently the operators have to manually control the blowers and valves due to the frequent shutdown of the blowers in automatic mode. As of July 2021, the County is in the process of implementing the most open valve (MOV) control to allow blowers and control valves to be automatically controlled based on the DO set points. This control upgrade will also allow Blower 2 to be brought online automatically when either of the duty blowers (Blowers 3 or 4) fails.

Recommendation: Complete the MOV control strategy update. Replace Blower 1 in the next 10 to 12 years to provide sufficient firm capacity during the peak air demand.

6.3.3.4.4 Aeration System – 210 & 230

Observation: Air piping for Aeration Basins 1 and 2 was installed in 1996 and partially replaced in 2016. Air piping for Aeration Basins 3 and 4 was installed in 2016. The old air piping is in good condition and the newer piping is in very good condition.

The strip diffusers installed in 2016 experienced a high rate of failure to the extent that the failure could put the plant at risk of violating the discharge permit and the upcoming nutrient removal regulation. In 2020, the County decided to replace all the diffusers with membrane disc diffusers for a more economical and reliable operation. See **Appendix H**, *Central Kitsap WWTP Aeration Diffuser Emergency Replacement Basis of Design* (Murraysmith [now Consor], November 2020) for details. The diffuser replacement project was completed in 2022.

Recommendation: None.

6.3.3.4.5 Mixed Liquor Channel, Foam Wasting Station, and Flow Splitter Structure – 210 & 230 & 250

Observation: The mixed liquor channel, foam wasting station, and flow splitter structure were constructed in 2016 and are in good condition. The foam wasting pump could not be observed, but staff did not report any problems with the pump.

Recommendation: None.

6.3.3.4.6 Secondary Treatment Channel Blowers - 210

Observation: Channel Blower 1 was installed in 1977 and is partially dismantled and not currently operational. Channel Blower 2 was installed in 1977 and is in poor condition. Channel Blowers 1 and 2 are 44 years old and have exceeded their typically expected lifespan of 25 to 30 years. Channel Blower 2 may have 10 to 50 percent of its expected serviceable life remaining (2 to 12 years) but will likely require rehabilitation to maintain performance prior to replacement.

Channel Blowers 3 and 4 and the Classifier Blower were installed in 2016 and appear to be in very good condition. These blowers are five years old and are expected to meet or exceed their typical expected service life of 25 to 30 years.

Recommendation: Replace Channel Blowers 1 and 2. Plan for increased maintenance requirements for Channel Blower 2 until the equipment is replaced.

6.3.3.4.7 Secondary Clarifiers - 250

Observation: The secondary clarifier structures were constructed in 1977 and modified with new floors, effluent trough and rake and skimmer mechanisms in 1996. The structures are in fair condition. The walkways on both structures have moderate corrosion. The scraper drives and rake and skimmer mechanisms are in fair condition, with some corrosion.

The clarifier drive equipment is 25 years old and expected to exceed its typical lifespan of 25 to 30 years. It is expected that the clarifier drive equipment may have half of its expected serviceable life remaining (12 to 15 years) but will likely require rehabilitation to maintain performance prior to replacement.

Recommendation: Recoat the walkways. Clean and recoat the corroded areas on the clarifier drive equipment.

6.3.3.4.8 RAS Pumping – 210

Observation: The RAS pumps were installed in 1977 and appear to be in fair condition with minor corrosion. The motors on Pumps 2, 3, and 5 appear to be newer than those on Pumps 1 and 4, but their replacement date is unknown.

The RAS pumps are 44 years old and have already exceeded their typically expected lifespan of 25 to 30 years. Plant staff reported no performance or maintenance issues with operating the RAS pumping system. It is expected that the pumps may have 10 to 50 percent of their expected serviceable life remaining (2 to 12 years) but will likely require rehabilitation to maintain performance prior to replacement.

Recommendation: Plan for increased maintenance requirements for the next 12 to 15 years, until the equipment is replaced.

6.3.3.4.9 Classifying Selector -220

Observation: The classifying selector was constructed in 2016 and is in very good condition. Plant staff reported no performance or maintenance issues with the classifying selector. The strip diffusers installed in 2016 experienced a high rate of failure and were replaced with the membrane disc diffusers in Summer 2024. This is intended to be complete prior to adoption of the Plan.

Recommendation: None.

6.3.3.4.10 WAS Pumping -220

Observation: The WAS pumps were installed in 2016 and are in very good condition. The original WAS pumps, now labeled "TDP #1" and "TDP #2," were installed in 1997, with motors replaced in 1996 and piping modified in 2016. These pumps are in fair condition.

The WAS pumps are five years old are expected to meet or exceed their typical expected service life of 25 to 30 years.

Recommendation: None.

6.3.3.4.11 Carbon Storage and Distribution System – 240

Observation: The carbon storage and distribution system was constructed in 2016 and is in very good condition. The system is five years old and is expected to meet its typical expected service life of 25 to 30 years. The operator reported the tubing of the methanol metering pumps fails and requires replacement very frequently when in use. The marprene process tubing for the Watson-Marlow pumps has a recommended temperature between 41 degrees F and 176 degrees F. Having the pumps sitting outdoors in the wintertime could be the reason for the frequent tubing failure.

Recommendation: Consider different type of tubing suitable for outdoor application or different type of metering pump.

6.3.3.5 Disinfection and Effluent

Secondary effluent flows by gravity to the UV disinfection building. Secondary effluent flows through two parallel channels, where the UV system provides disinfection. A minimum water depth is maintained in the UV channels by the automatically adjustable weir gates immediately upstream of the effluent channel. According to the original design document, UV effluent flow from each UV channel can be calculated using the channel water level relative to the weir gate height. There is one ultrasonic level sensor located downstream of each UV channel and upstream of each effluent weir gate. The UV control system modulates the weir gate height to maintain a constant water level in the channel. The control system can also calculate the rate of the flow that spills over the weir gate based on the monitored UV channel water level and weir gate crest level. However, this original design has not proven to be reliable or accurate.

The UV facility was constructed in 1996 and was upgraded in 2019. The UV equipment was replaced in the two existing channels in 2019 with a Trojan Signa system. Each channel has three banks with 14 bulbs per bank. Each UV channel can treat up to 15.5 MGD with 55 percent UV transmittance (UVT) (estimated to correspond to effluent TSS of 30 mg/L). Under automatic operation, the UV disinfection system is paced by the total effluent flow and UVT to provide the required UV dose of 24,800 uW-sec/cm^2.

Three vertical turbine reclaimed water pumps were installed in the existing UV structure in 2016. One small pump (jockey pump) with a capacity of approximately 1.6 MGD is provided to satisfy the flow demand for process water needs. Two large pumps (one duty, one standby) with a capacity of 4.35 MGD each are sized to match 50 percent of ultimate filter capacity plus 10 percent for backwash water requirements. There is room for the future addition of another large pump that will provide a firm capacity of approximately 8.7 MGD to match the ultimate filter capacity and backwash water requirements.

The reclaimed water filtration system contains three sand filters, each with four modules, all contained in a single, above-grade, concrete structure. The filters are intermittent backwash, countercurrent, up-flow sand filters. Two air compressors in the Reclaimed Water Building provide compressed air for backwash.

The reclaimed water coagulation system was installed in 2016 to condition disinfected secondary effluent prior to filtration. The system includes a bulk storage tank, two coagulant transfer pumps, a day tank, two coagulation metering pumps and an in-line mixer. The bulk storage tank and transfer pumps are in the sludge processing building. The day tank and metering pumps are in the Reclaimed Water Building. The bulk storage tank was originally installed in 1977 to store alum.

The reclaimed water hypochlorite system includes the hypochlorite storage tank and circulation metering pumps which are in the sludge processing building. The peristaltic pumps were installed in 2016 and the storage tank was installed in 1999. The reclaimed water dechlorination system was installed in 2016 and includes the ascorbic acid drum and mixer, the ascorbic acid metering pump, and the chlorine residual sample pump. The ascorbic acid drum, mixer, and metering pump are in the Reclaimed Water Building and the chlorine residual sample pump is next to the final effluent channel.

Currently the plant is not producing reclaimed water due to the lack of reuse demand. To keep the filter system running, approximately 1 MGD disinfected secondary effluent is pumped to the filters, then returned to the final effluent channel before discharging to the outfall. No coagulant or sodium hypochlorite are added. In the future when the recycled water need is identified, additional disinfection, equalization and clearwell will need to be installed to complete the recycled water system.

Composite effluent samples are collected with an automatic sampler located in a manhole along the effluent pipe.

Observations and recommendations for each major process component are outlined below.

6.3.3.5.1 UV Disinfection System -310

Observation: The UV structure concrete channel, grating, and roof were constructed in 1996 and all appear to be in good condition. The UV banks were replaced in 2019. The UV equipment is two years old and is expected to meet its typically expected service life of 25 to 30 years. The plant staff indicated a desire to monitor UV effluent flowrate since currently there is no way to do that.

Recommendation: Consider installing a new effluent flow meter device to measure effluent flow to meet flow monitoring requirements of permit.

6.3.3.5.2 Reclaimed Water Pumps - 301

Observation: The reclaimed water pumps are five years old with no noted performance issues or significant visible degradation. It is expected that the equipment may have more than 90 percent of its expected serviceable life remaining (27+ years).

Recommendation: None.

6.3.3.5.3 Reclaimed Water Filters - 820

Observation: The reclaimed water filters and structure were installed in 2016 are in very good condition. Plant staff reported no operations or maintenance issues with the reclaimed water filters.

Recommendation: None.

6.3.3.5.4 Reclaimed Water Coagulation System - 720

Observation: The reclaimed water coagulation system was installed in 2016. The reclaimed water coagulation system is not currently used and is in good condition.

Recommendation: None.

6.3.3.5.5 Reclaimed Water Chlorination and Dechlorination - 730

Observation: The reclaimed water chlorination system was installed in 2016 and is in good condition. It is not currently used.

Recommendation: None.

6.3.3.5.6 Outfall - 340

The plant effluent is discharged to an outfall in Port Orchard Bay in the Puget Sound by gravity. The outfall consists of a 36-inch diameter DI pipe that terminates with a 126-foot-long diffuser with 5-inch diameter ports on alternating sides, spaced at 10-foot intervals. The discharge zone is located at a depth of approximately 3,200 feet offshore and 40 feet below mean lower low water (MLLW). The most recent underwater outfall inspection was conducted in 2018. The 126-foot-long diffuser assembly was intact and in good condition. The twelve diffuser ports were free of sediments, debris or marine growth and flowing properly.

Observation: The outfall components were not observed.

Recommendation: Conduct outfall inspection when required by NPDES permit renewal.

6.3.3.6 Septage System

The septage receiving system consists of a septage receiving station and septage degritting. The septage receiving station includes a hauler access personal identification number (PIN) entry pad and control panel, rock trap, rotary drum screen, and odor control system (discussed in **Section 6.3.3.12**). Once the hauler unlocks the control panel, a haul truck can discharge septage which passes through a rock trap and rotary drum fine screen. Screenings are washed with process water from the 1000-gallon flush tank and compacted by the rotary drum screw before they are scraped into a dumpster. Screened septage flows by gravity to the septage sump in the dewatering building. Septage pumps pull from the sump and discharge into the septage grit cyclone, which separates out remaining grit not removed by the septage receiving station rock trap. Degritted septage is discharged into the thickener control structure and distributed to the gravity thickeners along with the primary sludge.

Two septage pumps drain the septage sump and pump screened septage to the septage grit cyclone and classifier. The recessed impeller vortex pumps are in the solids handling building and were installed in 1977 as grit pumps, but the piping and process were modified in 1999.

The septage pumps discharge into the septage grit cyclone, which is located at the gravity thickener control structure. The septage cyclone and classifier were installed in 1977. The cyclone separates out the remaining grit not removed by the septage receiving station rock trap. Grit from the cyclone is discharged into the reciprocating rake classifier for additional processing and disposal into the septage grit dumpster. Degritted septage is discharged into the thickener control structure and distributed to the gravity thickeners along with the primary sludge.

Observations and recommendations for septage receiving are outlined below.

6.3.3.6.1 Septage Receiving Station - 500

Observation:

The septage receiving station is 12 years old. Staff reported that the performance issues are arising, including existing damage to the screen and intermittent failures in the PIN entry pad. There is no significant visible degradation. Staff also reported that modifications to the rock trap improved performance. It is expected that the equipment may have less than 10 years lifespan remaining.

Recommendation: The County is currently accepting around 20,000 gallons of septage per day, which is over double the planned volume when the system was designed in 2009. Since septage receiving will continue at the plant, the County should consider construction of a redundant septage receiving station and upgrade the existing septage receiving station as needed.

6.3.3.6.2 Septage Pumps - 500

Observation: The septage pumps were installed in 1977 and piping modifications were made in 1999.

Recommendation: Although the septage pumps are currently operating with no issues, they are 44 years old and have exceeded their typical expected lifespan of 25 to 30 years. The County should plan for increased maintenance for the septage pumps and replace the pumps within the next 2 to 10 years.

6.3.3.6.3 Septage Cyclone and Classifier - 500

Observation: The septage cyclone and classifier were installed in 1977 and are in poor condition. The fittings are corroded and one fitting that was replaced with a plastic flange is cracked.

The septage cyclone and classifier are 44 years old and have exceeded their typical lifespan of 25 to 30 years. The County should plan for increased maintenance for the septage cyclone and classifier and replacement within the next 3 years.

Recommendation: Replace the cyclone and classifier with a new system or install a septage receiving station that includes degritting.

6.3.3.7 Gravity Thickeners

The two gravity thickeners accept settled sludge from the primary clarifiers, and septage that has been screened and degritted. The thickener control structure splits flow to the gravity thickeners using a splitter box with weir plates. The thickener control structure and gravity thickeners were constructed in 1977. Thickened primary sludge pumps normally transfer thickened sludge from the gravity thickeners to the thickened sludge blending tank. Manual control valves can also be used to send the thickened primary sludge directly to the digesters if required.

The gravity thickeners are designed to provide settling time for the primary sludge and septage to increase the solids concentration prior to anaerobic digestion. Increasing incoming solids concentration to the digesters increases hydraulic retention time in the digesters. Primary sludge and septage are pumped into each 45-foot diameter gravity thickener though its center well. Sludge settles to the bottom, is then collected by a rake arm collector mechanism, and directed to the thickened sludge pumps suction line, which removed sludge on a timed interval. Scum is scraped from the surface by a rake arm and is also removed by the thickened sludge pumps. The thickened sludge pumps are progressive cavity pumps located in the Digester Control Building with cross over piping on the suction and discharge sides of the pumps to provide backup in case of failure. Each thickened sludge pump has a sludge grinder. The grinders were installed in 1977, but the pumps were replaced in 2018.

The plant drainage wastewater pump station, referred to as the in-plant pump station, receives flow from various internal plant sources including aeration basin sump pumps, sludge processing building, digester and thickening buildings, and digester overflow. As a part of the 2016 Resource Recovery project, additional waste streams were added to the pump station including WAS thickening filtrate from the RDT, overflow from the thickened sludge blending tank (TSBT), and backwash waste from the reclaimed water filters. The flow streams are combined in the wetwell and pumped to a manhole near the Headworks Building, where the pumped flow is combined with drainage from various headworks area drains. From the manhole at headworks, the combined flow is conveyed by gravity to the grit tank effluent channel and combined with the main primary influent stream. The in-plant pump station was constructed in 2016 and has two 5-HP duplex submersible pumps, one duty and one standby, that operate automatically on level floats. The pump station also includes a local control panel, and associated piping and valves. The pumps are guide-rail mounted and installed inside a cylindrical wetwell/sump. Check and isolation valves for each pump are installed in an adjacent vault. The valve vault has a drain that discharges back into the wetwell. There is also a utility station located adjacent to the valve vault.

Observations and recommendations for gravity thickening are outlined below.

6.3.3.7.1 Gravity Thickener Control Structure - 460

Observation: The gravity thickener control structure was constructed in 1977 and is in poor condition. The flow control structure is extremely corroded, and the control gate functionality may be impaired. The building has numerous locations where rebar is exposed and corroding badly, and the glass doors are broken. There is insufficient overhead space to stand near the degritter and flow control structure.

Recommendation: Replace the gravity thickener control structure.

6.3.3.7.2 Gravity Thickeners - 460

Observation: The gravity thickeners were constructed in 1977 and are in poor condition. Insufficient ventilation within the dome results in severe corrosion. There are several locations of exposed rebar and concrete spalling. The east thickener interior launder is uncoated and is very corroded. The west thickener interior launder is coated, but the coating is peeling away from the concrete.

Recommendation: Clean and repair the corroded areas. Improve ventilation within the gravity thickeners to minimize corrosion. Consider replacing the gravity thickeners with other thickening technology.

6.3.3.7.3 Thickened Primary Sludge Pumps - 600

Observation: The thickened primary sludge pumps are three years old with no noted performance issues or significant visible degradation; therefore, they are expected to meet their typical expected lifespan of 25 to 30 years. However, the pump motors are not physically supported which can cause unnecessary wear on couplings and bearings.

The thickened primary sludge grinders are 44 years old and have exceeded their typical expected lifespan of 25 to 30 years. Because they have no noted performance issues or significant visible degradation, the equipment may have half of its expected serviceable life remaining (12 to 15 years) but will likely require rehabilitation to maintain performance prior to replacement.

Recommendation: Add support under the thickened primary sludge pump motors. Plan for increased maintenance requirements for the thickened sludge grinders for the next 12 to 15 years until the equipment is replaced.

6.3.3.7.4 In-Plant Pump Station - 190

Observation: The in-plant pump station wetwell and pumps were put into service in 2011. As noted in **Appendix I** *Condition Assessment Red Flag Findings and Mitigation Recommendations* (Murraysmith [now Consor], October 2020), the in-plant pump station structure, pumps, and mechanical components are in very poor condition. Cascading water is causing hydrogen sulfide (H_2S) release, which has rapidly corroded the pump station. Operators report the pumps are regularly removed for repairs for extended periods of time and a mobile backup pump is required during these times. The coating on the manhole is peeling and the pipes are very corroded. Although the station is 12 years old it has reached the end of its useful life, requiring continuous maintenance and needing replacement.

Recommendation: The County may want to consider a long-term replacement to the current wetwell and mobile backup pump operating in the in-plant pump station. Replacement of the in-plant pump station is recommended. A bypass route should be considered so that the pump station could be taken offline for maintenance.

6.3.3.8 WAS Thickening

The WAS thickening system thickens Central Kitsap WWTP sludge from the secondary clarifiers and blends it with thickened WAS (TWAS) trucked over from Manchester, Kingston and Suquamish WWTPs. Thickened blended sludge is pumped from the TSBT to the anaerobic digesters by the digester feed pumps.

The WAS is fed to the inlet flocculation tank of the RDT and polymer is added to the WAS immediately upstream of the tank via a mixing valve. Flocculated sludge enters the RDT and unbound water drains through the perforated rotating drum. The TWAS discharges at the opposite end of the RDT into the TWAS pump. The collected filtrate drains by gravity to the in-plant pump station. Spray water is required during RDT operation to wash the screen and is collected with the filtrate. The TWAS discharges from RDT into an open-throated progressing cavity pump, which transfers the TWAS to the TSBT. The TWAS pump is automatically controlled based on the level of sludge in the hopper.

The WAS thickening polymer system mixes, batches, stores, and feeds polymer to the WAS mixing valve to improve thickening in the RDT. The bulk polymer is stored in totes with mixers and is blended with 3W water in the polymer blending unit. After makedown, the polymer is stored in two tanks until it is injected into the WAS by two polymer feed pumps via a mixing valve located upstream of the RDT flocculation tank. The polymer causes flocculation of the solids in the WAS prior to thickening in the RDT.

The hauled sludge pumping system is used primarily for unloading trucks carrying hauled sludges from the County's other WWTPs. In this mode, the hauled sludge transfer pump pulls sludge from the trucks and discharges to the TSBT. If needed, the hauled sludge transfer pump can also be used for mixing the TSBT instead of the TSBT circulation pump.

The TSBT is a concrete tank that blends thickened primary sludge and TWAS from all WWTPs. The TSBT also equalizes peaks in solids production to reduce uneven loading to the anaerobic digesters. Mixing of the TSBT is provided by the progressive cavity thickened sludge circulation pump, which pumps sludge from the bottom of the TSBT to the top or midpoint of the TSBT to induce mixing/turnover of the tank contents and incoming feeds.

There are three digester feed pumps that pump mixed sludge from the TSBT to the anaerobic digesters. The digester feed pumps are progressive cavity pumps and have their inlet piping connected to the discharge piping of the thickened sludge circulation pump. During normal operation, each digester is fed by a dedicated pump while the remaining digester feed pump is a standby. Distribution of flow between Anaerobic Digesters 1 and 2 is controlled by the motorized digester feed control valves.

Observations and recommendations for WAS thickening are outlined below.

6.3.3.8.1 Rotary Drum Thickener and Polymer System - 400

Observation: The RDT system was installed in 2016 and appears to be in very good condition. It is expected that the equipment may have more than 90 percent of its expected serviceable life remaining (27+ years).

Recommendation: None.

6.3.3.8.2 Thickened WAS Pump, Hauled Sludge Transfer Pump, Thickened Sludge Circulation Pump and Digester Feed Pumps – 400 & 450

Observation: These pumps were installed in 2016 and are in very good condition. It is expected that they may have more than 90 percent of their expected serviceable life remaining (27+ years). It was observed that all the motors are not physically supported which can cause unnecessary wear on couplings and bearings.

Recommendation: Add support under the pump motors.

6.3.3.8.3 Thickened Sludge Blending Tank (TSBT) - 450

Observation: The TSBT is a cast-in-place concrete tank that was installed in 2016 and is in very good condition.

Recommendation: None.

6.3.3.9 Anaerobic Digestion and Digester Gas Handling Systems

The anaerobic digestion system provides sludge stabilization in an anaerobic environment to reduce volatile solids (VS) content and produce a final product that meets pathogen and vector attraction reduction standards for biosolids so that the product can be beneficially reused. The plant has two 65-foot diameter, fixed-cover anaerobic digesters, originally constructed in 1977. New fixed digester covers were added in 1991. The digesters are designed to provide anaerobic digestion to meet Class B biosolids requirements, including a minimum 15-day solids retention time (SRT) and a minimum 38 percent reduction in VS. Each digester has a capacity of 645,000 gallons. The digesters are designed such that they can be run either in series or in parallel. They are currently operated in parallel. The digesters are maintained at a mesophilic temperature setpoint of 36.2 °C, as part of the Class B biosolids requirements.

In addition to thickened sludge from the TSBT, these two digesters receive foam from the aeration basins foam wasting station, scum from the scum pits of primary and secondary clarifiers, and any fats, oils, and grease (FOG) that is discharged by sludge haulers into the scum pit. Digested sludge is withdrawn from the digesters and pumped to the dewatering centrifuges by the sludge withdrawal pumps. Sludge within the digesters is heated to maintain the digester temperature with the sludge recirculation pumps and a boiler/heat exchanger system. A separate mixing system is run continuously to keep the sludge in the digesters mixed. Digester gas is collected from the anaerobic digesters to the digester gas header and is conveyed to the waste gas burner and/or to the digester gas treatment and cogeneration system when it is operating. If the waste gas burner or the cogeneration system are unable to combust all the digester gas produced, the digester gas is vented through an assembly of a vacuum breaker, flame arrestor, and pressure relief valve on top of the digester.

Two digested sludge withdrawal pumps were installed in 1999. A portion of the sludge from the loop is sent to the centrifuges; the rest is recycled to the digesters. Manual control valves select the digester from which sludge is withdrawn and to which it will be returned. The sludge is normally recycled to the same digester from which it was withdrawn. Typically, during a dewatering cycle, approximately equal amounts are withdrawn from each digester to keep digester levels balanced.

Each digester has one centrifugal mixing pump to keep the digester contents well mixed. The mixing system is equipped with manually valved crossover piping that allows the Digester 1 mixing pump to be used to mix Digester 2, and vice versa. The cross connection is typically used only if the mixing pump associated with a digester is out of service. The mixing system was designed so that the pumps would continuously pull suction from a central draft tube at mid-level and discharge through three nozzles. Two of the discharge nozzles are on opposite sides of the digester approximately 5-feet above the digester floor and the third is at the top sludge surface to serve as a scum breaker. It is reported in **Appendix J**, *CKTP Digester Improvements* (Brown and Caldwell, 2016) that a section of the suction pipe has been removed from both digesters and that the scum breaker discharge nozzle is not used because its valve does not stay open. Thus, the mixing withdrawal and discharge points are both at approximately the same level in the lower portion of the digesters.

In order to maintain mesophilic temperatures within the digesters, sludge is recirculated through heat exchangers by one sludge recirculation pump for each digester. The sludge recirculation pumps, and heat exchangers are equipped with manually valved crossover piping that allows Sludge Recirculation Pump 1 and Heat Exchanger 1 to be used with Digester 2 and vice versa. Sludge Recirculation Pump 1/Heat Exchanger 1 and Sludge Recirculation Pump 2/Heat Exchanger 2 are always paired. The cross connection is typically only used if the sludge recirculation pump or heat exchanger associated with a digester is out of service.

Hot water for the digester heat exchangers (and for plant space heating) is supplied by two low-pressure boilers on the upper level of the Digester Control Building and pumped to the heat exchangers using Hot Water Pumps 1 and 2. The boilers are equipped to use either gas or light oil as a fuel source and are normally run with fuel oil. The boilers can draw heated water from the cogeneration system, for additional heating and reduced need for the boilers to operate.

There are four hot water circulation pumps in the Digester Control Building. Pumps 1 and 2 circulate hot water from the boilers through the heat exchangers. Pumps 3 and 4 circulate water from the boilers to radiators for space heat. All four pumps were originally installed in 1977, but it appears some or all the motors have been replaced since then.

Digester gas produced by the anaerobic digesters contains approximately 65 percent of methane and is combusted either in the waste gas burner or the cogeneration system. The digester gas is collected from the digester headspace, which has a normal operating pressure of 5 to 10-inch of water column. The low-pressure gas flows through a sediment trap to remove sediment and condensate as the gas cools in the line.

The waste gas burner is a vendor-packaged system that was installed in 2016. It includes a waste gas burner, a pressure regulating valve, a flame arrestor, a flame trap, a propane pilot solenoid valve, a digester gas pilot solenoid valve, a digester gas sustaining gas valve, and a control panel. The waste gas burner has an electrode sparking type ignition system with on-demand digester gas and propane pilot burners. The pilot burner can also be operated continuously. The system also includes a propane storage tank to provide a secondary source of pilot fuel for the waste gas burner.

Observations and recommendations for anaerobic digestion and digester gas handling are outlined below.

6.3.3.9.1 Anaerobic Digesters - 600

Observation: The anaerobic digesters were constructed in 1977, and the digester covers were replaced with new fixed covers in 1991. The concrete structures are in fair condition, but the covers and some system components are in poor condition.

As noted in **Appendix I**, the annular seal between the cover and the wall on the east digester has failed and a large gap has formed. The seal on the west digester shows signs of aging. The pressure and vacuum relief valves (PVRVs) on both digesters were observed to be leaking. The roofs of both digesters and the control building have holes in the insulation, ponding, and plants growing. Leaks in the roof are visible from the interior of the control building.

Note: The County completed a digester rehabilitation project to implement repairs to the digesters, including digester seal repairs and replacement of the PVRVs in the fall of 2022.

Recommendation: Repair digester annular seal and PVRVs, as completed in the digester rehabilitation project.

Additional biosolids handling capacity should be provided in the near term for redundancy and reliability. This will allow the existing digesters to be taken offline for a thorough inspection and repair. **Section 8** provides detailed evaluation of biosolids upgrade alternatives.

6.3.3.9.2 Digested Sludge Withdrawal Pumps - 600

Observation: The sludge withdrawal pumps were installed in 1999 and are in fair condition. The pumps are 22 years old. It is estimated that the equipment may have half of its expected serviceable life remaining (12 to 15 years) but will likely require rehabilitation to maintain performance prior to replacement.

Recommendation: Plan for increased maintenance requirements for the next 12 to 15 years until the equipment is replaced.

6.3.3.9.3 Sludge Mixing Pumps - 600

Observation: The sludge mixing pumps were installed in 1977 and are in poor condition. Sludge Mixing Pump 1 is vibrating badly which may indicate the bearings are near failure. The coupling on Sludge Mixing Pump 2 is worn and making a very loud noise. The mixing piping and valves are in poor condition. Staff report that the recent failure of a pipe in the Digester Control Building caused significant flooding because the control valves are difficult or impossible to turn. The sludge mixing pumps are 44 years old and have exceeded the typical expected lifespan of 25 to 30 years. It is estimated that the pumps may have 10 to 50 percent of their expected serviceable life remaining (2 to 10 years) but will likely require rehabilitation to maintain performance during this time, prior to replacement.

Recommendation: Replace sludge mixing pumps as planned in the digester rehabilitation project. Enhanced sludge mixing may improve digester performance, including increase in percent volatile solids reduction (VSR).

Establish an O&M program to exercise all plant valves at least annually to prevent valves from sticking.

6.3.3.9.4 Sludge Recirculation Pumps - 600

Observation: The sludge recirculation pumps were installed in 1977 and are in fair condition. The sludge recirculation pumps are 44 years old and have exceeded the typical expected lifespan of 25 to 30 years. It is estimated that the equipment may have half of its expected serviceable life remaining (12 to 15 years) but will likely require rehabilitation to maintain performance prior to replacement.

Recommendation: Plan for increased maintenance requirements for the next 12 to 15 years until the equipment is replaced.

6.3.3.9.5 Boilers and Heat Exchangers - 680

Observation: The boilers are 44 years old and have already exceeded the typical expected lifespan of 25 to 30 years. There are no performance issues with the boilers, but there is significant visible exterior corrosion. It is estimated that the Boiler 6801 may have half of its expected serviceable life remaining (12 to 15 years) but will likely require rehabilitation to maintain performance prior to replacement. Boiler 6802 is more severely corroded and may have 10 to 50 percent of its expected serviceable life remaining (2 to 12 years).

The heat exchangers are 44 years old and have exceeded the typical expected lifespan of 25 to 30 years. The heat exchangers appear to be in good condition with no performance issues or significant visible corrosion. It is expected that the heat exchangers may have 50 to 90 percent of its expected serviceable life remaining (13 to 27 years).

Expansion Tanks 6801 and 6802 are 24 years old. They are near the end of their typical expected lifespan of 25 to 30 years and are showing signs of exterior corrosion. It is expected that these tanks have 10 to 50 percent of their expected serviceable life remaining (2 to 12 years). Expansion Tank 6803 was replaced in 2016 and is 5 years old. It is expected that Expansion Tank 6803 may have 50 to 90 percent of its expected serviceable life remaining (13 to 27 years).

Recommendation: As noted in **Appendix I**, the roof penetrations over the two boiler stacks are leaking, and the boilers show significant signs of corrosion. The County should repair the roof to stop further leaking. The County should also plan for increased maintenance for the boilers and Expansion Tanks 6801 and 6802 before replacing them in the next few years.

6.3.3.9.6 Hot Water Circulation Pumps - 680

Observation: The hot water circulation pumps were installed in 1977 and are in very poor condition. Condensation from the boiler exhaust is dripping on the pumps and causing corrosion. The hot water circulation pumps are 44 years old. It is expected that these pumps have less than 10 percent of their expected serviceable life remaining (2 to 3 years).

Recommendation: The County should plan on replacing the hot water circulation pumps in the next 2 years.

6.3.3.9.7 Sediment Trap - 670

Observation: The sediment trap was installed in 2016 and is in good condition.

Recommendation: None.

6.3.3.9.8 Waste Gas Burner - 670

Observation: The waste gas burner was installed in 2016 is in good condition.

Recommendation: None.

6.3.3.10 Digester Gas Treatment and Cogeneration Systems

When the cogeneration system works, the electricity produced is fed to the plant electrical distribution and operates in parallel with utility power. Hot water is produced using cogeneration engine jacket heat and used in a recirculated hot water loop to heat digester sludge and provide space heating at the plant. However, the cogeneration system has not been used since 2019 due to the challenges associated with gas treatment and gas supply. All digester gas is currently flared by the waste gas burner.

The digester gas treatment system upstream of the cogeneration system was installed in 2016. It is a vendor-packaged system that includes an H_2S removal system, a biogas conditioning system to pressurize and remove moisture from the biogas, and a siloxane removal system. The entire system is made up of several pieces of equipment, including an inlet separator, two parallel H_2S removal vessels, a digester gas blower, a digester gas aftercooler, a chilling heat exchanger, a modulating start-up valve, two siloxane removal system vessels, a post-siloxane digester gas particulate filter, an air-cooled glycol chiller, a chilled glycol circulation pump, and a glycol expansion tank.

The cogeneration system is a containerized, vendor-packaged system that was installed in 2016. It includes an engine-generator, an exhaust heat recovery silencer, a supplemental silencer, a heat recovery heat exchanger, a high temperature circuit pump, a high temperature expansion tank, a high temperature control valve, a waste heat radiator, a high temperature pressure safety valve, a low temperature control valve, a low temperature expansion tank, a low temperature circuit pump, an intercooler radiator, a low temperature pressure safety valve, a heat recovery pump, a heat recovery control valve, and a control panel.

For electricity production, the cogeneration system includes a switchboard and electrical protective gear for connection to the plant electrical distribution. The cogeneration system operates in parallel with the utility electrical power and there are several paralleling and interlocks requirements required for operation.

For heat recovery, there are two heat reservoir return (HRR) pumps that are used to recover heat from the cogeneration system and supply it to the plant's heat reservoir system via a pumped secondary loop.

Observations and recommendations for digester gas treatment system and cogeneration system are outlined below.

6.3.3.10.1 Digester Gas Treatment System - 920

Observation: The digester gas treatment system is not currently operational but appears to be in good condition with no significant visible degradation.

Recommendation: If the County wishes to restart the digester gas treatment system, maintenance items including media replacement in the H_2S vessels and siloxane vessels will be required. Equipment for the gas conditioning and chiller systems will need to be serviced and tested. Overall system startup services from a qualified vendor will be required.

6.3.3.10.2 Cogeneration System - 930

Observation: The cogeneration system appears to be in good condition with no significant visible degradation. The engine is five years old but has little runtime. The engine was rebuilt in 2017 due to internal glassification from siloxane breakthrough. Operators report that it is not used consistently because of insufficient gas quantities and pressure.

Recommendation: If the County wishes to resume operation of the cogeneration system, improvements to maintain digester gas supply and consistent quality are recommended. The interim digester improvements to enhance mixing and stop digester gas leaks should help provide stable gas supply. For long-term improvements, digester gas storage options should be explored. To maintain consistent digester gas feed quality as required by the engine, consistent gas quality monitoring at the inlet and outlet of the digester gas treatment system, as well as regular media changeouts, is recommended.

6.3.3.11 Sludge Dewatering

The digested sludge dewatering system includes two centrifuges, sludge feed equipment, polymer solution preparation and feed equipment, and a centrate collection and pumping system. Digested sludge is taken from a withdrawal loop driven by the digester withdrawal pumps. Two centrifuge feed pumps pull from the sludge withdrawal loop, and pump sludge to two centrifuges. Sludge goes through a grinder prior to each centrifuge feed pump. Polymer is added to improve the dewatering performance.

The dewatering polymer system is a vendor-package system that consists of two parallel trains, with each train including a dilution unit, age tank, feed pump and sludge/polymer blender. The system can either use 2W or 3W water supplies for dilution/activation and post-dilution. The dewatering polymer system was installed in 1999, except for the sludge/polymer blender which was installed along with the centrifuges in 2019.

The dewatered sludge exiting the centrifuge is dropped directly into hauling trucks in the truck bay below at approximately 23 percent solids. Dewatered sludge is disposed of from the cake conveyer through a hatch in the centrifuge room, which drops the sludge directly into a truck container for hauling and application off site.

Centrate from the centrifuges flows by gravity to the centrate sump in the bottom floor of the Solids Processing Building. The centrate sump was originally constructed as the scum holding tank in 1977, but the pumps and piping were modified in 1999 so that it could be used to store centrate instead. Two parallel centrate pumps pump centrate back to the headworks structure, where it joins the primary influent in the grit removal effluent channel. The centrate pumps were installed in 1999 in the basement of the Solids Processing Building.

Observations and recommendations for sludge dewatering are outlined below.

6.3.3.11.1 Centrifuge Sludge Feed Grinders and Pumps - 710

Observation: Grinder 1 was installed in 1997 and is in good condition, and Grinder 2 dates back to the original plant construction in 1977 and is in fair condition. They do not have any noted performance issues or significant visible degradation. It is estimated that the equipment may have half of its expected serviceable life remaining (12 to 15 years) and will likely require rehabilitation to maintain performance prior to replacement.

Recommendation: Plan for increased maintenance requirements for the next 12 to 15 years, until the equipment is replaced.

6.3.3.11.2 Dewatering Polymer System - 720

Observation: The dewatering polymer system was installed in 1999 and is in good condition. It is expected that it may have 50 to 90 percent of its expected serviceable life remaining (13 to 27 years).

Recommendation: None.

6.3.3.11.3 Centrifuges - 710

Observation: The centrifuges were installed in 2019 and are in very good condition. The centrifuges are two years old and are expected to meet their typical expected lifespan of 25 to 30 years.

Recommendation: None.

6.3.3.11.4 Truck Loading Station

Observation: The truck loading station is in good condition.

Recommendation: None.

6.3.3.11.5 Centrate Sump

Observation: The centrate sump was not observed. It was built in 1977 and modified in 1999. Plant staff reported no operations or maintenance issues with the centrate sump.

Recommendation: None.

6.3.3.11.6 Centrate Pumps - 710

Observation: The centrate pumps were installed in 1999 and are in fair condition. Plant staff reported no operations or maintenance issues with the centrate pumps. The pumps are 22 years old with no noted performance issues or significant visible degradation; therefore, they are expected to exceed the typical expected lifespan of 25 to 30 years. It is estimated that the equipment may have half of its expected serviceable life remaining (12 to 15 years) but will likely require rehabilitation to maintain performance prior to replacement.

Recommendation: Plan for increased maintenance requirements for the next 12 to 15 years until the equipment is replaced.

6.3.3.12 Support Systems (Odor Control and Plant Water Systems)

Central Kitsap WWTP has four odor control systems to treat foul air. For the headworks, foul air from the influent and grit tank airspace and the screenings and grit room is sent to the headworks biofilter which is located behind the stormwater decant station. For the septage receiving system, foul air from the rock trap, fine screen, and screenings bin is exhausted by a centrifugal blower and passed through a carbon adsorption vessel for treatment before discharge to atmosphere. For the gravity thickeners, foul air from the thickeners and thickener control structure is treated with a blower and biofilter located behind the thickener control structure. The system was constructed sometime in the late 1990s. Foul air is diffused into the biofilter via a manifold of perforated pipes. The biofilter is irrigated manually to add moisture to the air and maintain the biofilter biological activity. For the sludge dewatering system, the odor control system consists of a foul air collection system and carbon media tower in order to provide ventilation and treatment of foul air from the centrifuge room. The carbon tower contains two 3-foot carbon media beds. The foul air blower is driven by an adjustable speed controller to change the speed when the centrifuge is in operation. The speed is determined based on pre-selected foul air volumes. When the centrifuge is not running, the foul air blower operates at a lower volume if the blower is in auto mode. Currently the odor control system is turned off all the time.

The Central Kitsap WWTP plant water and drainage systems include the plant drainage system (discussed in Gravity Thickening), a non-potable water (2W) system, and a process water (3W) system.

The 2W system consists of an air gap tank, three parallel 2W booster pumps, and two hydropneumatic tanks. The 2W booster pumps and air gap system were provided as a vendor package unit. The air gap system protects the potable water utility (1W) from contamination with water from in-plant processes. The air gap tank is automatically filled via a level control valve. The booster pumps are used to maintain system pressure in the plant's 2W water system. The system also contains two hydropneumatic tanks to help mitigate transient pressure surges in the plant's 2W water system. The W2 system was installed in 2016 in a separate room of the WAS Thickening Building.

The 3W system supplies disinfected effluent (non-potable) for use throughout the plant, including but not limited to outdoor hose bibbs, plant irrigation system, aeration basin foam sprayers, utility station, washwater for screenings compactor and grit washer, grit fluidizing, foul air humidifier upstream of the headworks biofilter, biofilter soaker hoses, septage washing and flushing, polymer blending and dilution, spray water for the RDT, and carrier water for sodium hypochlorite solution.

The UV effluent and reclaimed water filter effluent pipes are connected such that either can serve as the source for 3W water. Hypochlorite is added in a vault near the UV system to provide a chlorine residual in the 3W water. The chlorinated effluent flows to three process water pumps in the aeration basin utilidor and a strainer is mounted upstream of the pumps to remove any solids which may cause plugging in the process water system. Pumps 1 and 2 supply 3W water to the north part of the plant and are rotated weekly, while Pump 3 operates continuously delivering 3W water to the south part of the plant. All three pumps are constant speed pumps.

Observations and recommendations for each plant system are outlined below.

6.3.3.12.1 Headworks Odor Control - 140

Observation: The headworks odor control blower and biofilter were put into service in 2011 and appear to be in good condition. It is expected that the equipment may have 50 to 90 percent of its expected serviceable life span remaining (13 to 27 years).

Recommendation: Perform routine biofilter media replacement every 3 to 4 years.

6.3.3.12.2 Septage Odor Control System - 500

Observation: The septage odor control vessel is 12 years old with no noted performance issues or significant visible degradation. It is expected that the equipment may have 50 to 90 percent of its expected serviceable life remaining (13 to 27 years).

The bearings on the odor control fan are near failure, and the blower operation is expected to fail in the next two years if the bearings are not replaced.

Recommendation: The bearing on the odor control fan should be replaced immediately.

6.3.3.12.3 Gravity Thickener Odor Control - 460

Observation: The biofilter and blower were constructed in the late 1990s. The biofilter is in good physical condition and may have 50 to 90 percent of its expected serviceable life remaining (13 to 27 years), however, plant staff report that it does not reduce odor very effectively, therefore the overall condition is poor. The blower is in poor condition. It is estimated that the blower may have 10-50 percent of its expected serviceable life remaining (2-10 years) but will likely require rehabilitation to maintain performance during this time, prior to replacement.

Recommendation: Perform routine biofilter media replacement every 3 to 4 years. Plan for increased maintenance requirements until the gravity thickener odor control blower is replaced.

6.3.3.12.4 Dewatering Odor Control System - 710

Observation: The staff reported that the system is currently running at 15% and the carbon tower shows signs of wear and cracking. Carbon replacement was completed in late 2024. The blowers are in good condition.

Recommendation: Reassess the system in 3 to 5 years as an internally completed O&M project.

6.3.3.12.5 2W System

Observation: The 2W system was installed in 2016. It is in a separate room in the WAS building and was not observed during the site visit. Plant staff reported no issues with O&M for the 2W system.

Recommendation: None.

6.3.3.12.6 3W System - 300

Observation: Process Water Pumps 3001 and 3002 were installed in 1977, and Process Water Pump 3003 was installed sometime in the 1980s. These pumps are in fair condition. The automatic strainer is in very poor condition and appears broken.

The process water pumps are 31 to 44 years old and have exceeded the typical expected lifespan of 25 to 30 years. It is estimated that the equipment may have 10 to 50 percent of its expected serviceable life remaining (2 to 10 years) but will likely require rehabilitation to maintain performance prior to replacement.

Recommendation: Plan for increased maintenance requirements for the next 2 to 10 years until the equipment is replaced.

6.3.3.13 Power Distribution

6.3.3.13.1 Utility Service Entrance

The utility service entrance is owned and provided by the local serving electrical utility company, Puget Sound Energy. Electrical power service to the facility is provided from a 12,470-volt, 3-phase distribution line running underground from utility owned primary metering equipment located at the facility gate entrance to a 600-ampere three phase 15 kilovolt (kV) rated pad-mounted switchgear (SWGR-2940) in the northeast area of the facility property just east of the Administration Building.

6.3.3.13.2 Primary Power Distribution

Central Kitsap WWTP is served by a 12,470-volt, 3 phase, 3-wire primary power distribution system. The primary power distribution equipment consists of 15kV switchgear and transformers located near Administration Building, Power Blower Building, and Solids Processing Building. The main service switchgear (SWGR-2940) near Administration Building and the switchgear and transformers (SWGR-2970, XMFR-2953 & XMFR-2954) near the Solids Processing Building were installed in 2014. The switchgear and transformers (SWGR-2950, XFMR-2952) near the Power Blower Building were installed in 1996 with (XFMR-2951) upgraded in 1999. The primary power transformers step the 12.47kV primary voltage down to 480-Volt low voltage for power distribution throughout the facility.

Observation: The primary power distribution system equipment installed in 2014 is in good condition. The primary power distribution system equipment installed in 1996 and 1999 is in fair condition so it is expected to exceed the typical lifespan of 25 to 30 years. It is estimated that the equipment may have half of its expected serviceable life remaining (12 to 15 years). The enclosures of the switchgear and transformer (SWGR-2950 and XFMR-2952) appear to have been coated or painted to help prevent rusting. The enclosure on transformer (XFMR-2951) shows signs of rust.

Recommendation: Switchgear should undergo regular service including inspection and cleaning. This should include thermal scans and tightening of connections where needed. Logs of such maintenance and corrective actions taken should be maintained.

XFMR-2951 should have its enclosure inspected, cleaned and the rusted areas restored and painted or coated to prevent further degradation.

All electrical equipment should be maintained in accordance with NFPA 70B. An Electrical Safety Plan that complies with NFPA 70E should be implemented. This would include electrical equipment hazard labeling, coordination settings of overcurrent devices, clearly defining working space clearances and many other safety requirements as defined in NFPA 70E.

6.3.3.13.3 Low Voltage Power Distribution

Central Kitsap WWTP's low voltage or utilization power system (480V or less) consists of switchgear, switchboards, standby generators, Automatic Transfer Switches (ATSs), Motor Control Centers (MCCs), various 480-volt power panels, 480: 120/208-volt and 120/240-volt distribution transformers and 120/208-volt and 120/240-volt lighting and power panels.

6.3.3.13.4 Secondary Main Switchboard and Switchgear

Central Kitsap WWTP has two main secondary pieces of electrical equipment for power distribution, switchboard (SWGR-2960) and switchgear (SWGR-2961).

SWGR-2960 is a 4000-ampere, 480-volt, 3-phase switchboard located in the Power Blower Building electrical room. It has two busses (A&B) with a tie-breaker, two ATS controllers (ATS-1 and ATS-2) and distribution breakers for connection to MCCs and blowers. It was installed in 1996 and is connected to the medium voltage step down transformers (XFMR-2951 and XFMR-2952). The interior ATSs connect to emergency backup generators (GEN-2994 and GEN-2995).

SWGR-2961 is a 4000-ampere, 480-volt, 3-phase switchgear located in the Solids Processing Building electrical room. It has two busses (A&B) with a tie-breaker, an intelligent breaker controller for connection to emergency backup equipment and distribution breakers for connection to MCCs. It was installed in 2014 and is connected to the medium voltage step down transformers (XFMR-2953 and XFMR-2954). The emergency backup breakers connect to emergency backup generator (GEN-2996) and a generator terminal box (TB-2996) for connection to a portable generator. The switchgear is also equipped with a manufacturer's energy management equipment package.

Observation: SWGR-2961 is only seven years old and appears to be in very good operating condition.

Although SWGR-2960 is 25 years old, most of its components appears to be in fair operating condition with the exception of the ATS-1. During the site visit, staff indicated that the transfer switch was not functioning properly, and it was observed that the tie-breaker between the two busses was closed and the service feed from XFMR-2951 (normal source) was disconnected.

Recommendation: ATS-1 internal to SWGR-2960 should be repaired and this electrical system should be restored to operate as the current design intended.

6.3.3.13.5 Generators and Automatic Transfer Switches

Central Kitsap WWTP has standby emergency power supplied by three diesel generators.

The first and oldest generator (GEN-2994) is a non-enclosed 500kW generator located in a generator building centrally located at the facility. It does not have a main circuit breaker and was installed at the plant in 1977.

The second generator (GEN-2995) is a non-enclosed 600kW generator located in a secondary generator building centrally located at the facility. It has a 1600-ampere main circuit breaker and was installed new at the plant in 1996.

Both generators are fueled by an external diesel fuel storage tank on the southside of the generator buildings.

The third generator (GEN-2996) is a weather-proof enclosed 600kW generator located on the east side of the Shop and Maintenance Building. It has a 1200A main circuit breaker and skid mounted fuel tank and was installed in 2014.

The facility has multiple transfer switches located throughout the facility, not only for switching loads between the generators and utility sources, but also for switching between facility source feeds to various equipment.

ATS-1 is a 3000-ampere, 480-volt, 3-phase unit connected to a transformer and generator breaker internally located in SWGR-2960. The ATS is fed from the primary service transformers XFMR-2951 (normal side) and standby generators GEN-2994 (emergency side) and connects to SWGR-2960 Buss B.

ATS-2 is a 3000-ampere, 480-volt, 3-phase unit connected to a transformer and generator breaker internally located in SWGR-2960. The ATS is fed from the primary service transformers XFMR-2951 & XFMR-2952 (normal side) and standby generators GEN-2994 & GEN-2995 (emergency side) and connect to SWGR-2960 Busses A and B.

ATS-0900 is a 300-ampere, 480-volt, 3-phase ATS located in the WAS Thickening Building electrical room. It is fed from MCC-4901 (normal side) and MCC-4902 (emergency side). The ATS load side connects to XFMR-0900 powering the Administration Building.

ATS-2937 is a 225-ampere, 480-volt, 3-phase ATS located in the Aeration Basin 3&4 electrical building. It is fed from MCC-2935 (normal side) and MCC-2936 (emergency side). The ATS load side connects to PNL-2937 powering aeration control valves and sub feed to PNL-2938 for building and instrumentation controls.

ATS-3100 is a 600-ampere, 480-volt, 3-phase ATS located in the UV Disinfection area. It is fed from MCC-2973 via XFMR-2973 (normal side) and MCC-2974 via XFMR-2974 (emergency side). The ATS load side connects to UV panels PNL-3101 and PNL-3102 powering both UV channel disinfection equipment.

ATS-3110 is a 30-ampere, 480-volt, 3-phase ATS located in the UV Disinfection area. It is fed from UV panels PNL-3101 (normal side) and PNL-3102 (emergency side). The ATS load side connects to UV low voltage panel MPC-3100 feeding the UV control equipment.

ATS-4903 is a 100-ampere, 480-volt, 3-phase ATS located in the WAS Thickening Building electrical room. It is fed from MCC-4901 (normal side) and MCC-4902 (emergency side). The ATS load side connects to PNL-4903 feeding process equipment and sub feed to PNL-4904 for building and instrumentation controls.

Observation: GEN-2994 is over 44 years old and has reached its expected lifespan. Staff has stated that it is mechanically sound but has electrical issues and is currently nonfunctional.

GEN-2995 is over 25 years old and appears to be in fair condition and well maintained with last servicing in 2018 according to labeling on the installed filters.

GEN-2996 is seven years old and is in good condition internally. Rusting was observed on the northern exposure of the enclosure.

Most of the transfer switches are newer and in good condition. The one exception is ATS-1 located in SWGR-2960. Indication lights on the unit show that service is disconnected and according to staff the unit is not functioning properly.

Recommendation: GEN-2994 and GEN-2995 are both source connections for SWGR-2960, one feeds buss A and the other feeds buss B. Currently the tie-breaker in the switchgear is closed and both busses are using the newer generator GEN-2995 for backup power with GEN-2994 being nonfunctional. Based on the original design and size of bussing for the switchgear it appears that the design was not intended to operate both busses on a single generator to handle full operational loads. Without proper load information and process diversity, it is unclear if GEN-2995 could handle the full operational load of both busses as originally designed.

It is recommended to complete a process and load study for the entire facility including future loads to determine whether GEN-2994 should be replaced in kind or if a different approach to providing the required standby power for the facility should be pursued.

GEN-2996 should have its enclosure inspected, cleaned and the rusted areas restored and coated to prevent further degradation.

ATS-1 internal to SWGR-2960 should be repaired or replaced.

6.3.3.13.6 Motor Control Centers (MCC)

There is a total of 16 MCCs in the Central Kitsap WWTP with varying ages due to the changes throughout the facility's history since 1977.

Table 6-8 below shows the MCCs, their location, model, rating, and year of manufacture.

Table 6-8 | MCC Locations, Models, and Rating

MCC	Location	Model	Rating [Amps]	Mfr Year
2	Digester Control Bldg Electrical Area	GE 7700 Line Control Center	1200	1977
2935	Aeration Bldg 3&4 Elect. Room	Allen-Bradley Centerline Bulletin 2100	800	2014
2936	Aeration Bldg 3&4 Elect. Room	Allen-Bradley Centerline Bulletin 2100	800	2014
2971	Power Blower Bldg Elect. Room	Cutler-Hammer Freedom 2100 Series	1200	1996
2972	Power Blower Bldg Elect. Room	Cutler-Hammer Freedom 2100 Series	1200	1996
2973	Power Blower Bldg Elect. Room	Cutler-Hammer Freedom 2100 Series	1200	1996
2974	Power Blower Bldg Elect. Room	Cutler-Hammer Freedom 2100 Series	1200	1996
2975	Headworks Bldg Elect. Room	Allen-Bradley Centerline Bulletin 2100	600	2011
2976	Headworks Bldg Elect. Room	Allen-Bradley Centerline Bulletin 2100	600	2011
2981	Solids Processing Bldg Elect. Room	Cutler-Hammer Freedom 2100 Series	1200	2000
2982	Solids Processing Bldg Elect. Room	Cutler-Hammer Freedom 2100 Series	1200	2000
2983	Solids Processing Bldg Elect. Room	Cutler-Hammer Freedom 2100 Series	1200	2000
2984	Solids Processing Bldg Elect. Room	Cutler-Hammer Freedom 2100 Series	1200	2000
4901	WAS Thickening Bldg Elect. Room	Allen-Bradley Centerline Bulletin 2100	800	2014
4902	WAS Thickening Bldg Elect. Room	Allen-Bradley Centerline Bulletin 2100	800	2014
8901	Reclaimed Water Bldg Elect. Room	Allen-Bradley Centerline Bulletin 2100	800	2014

Observation: Most of the MCCs are in good overall condition and parts are readily available except for MCC-2 located in the Digester Control Building. MCC-2 is 44 years old and is in very poor condition. It has reached its expected lifespan with parts that are not readily available, and it appears to have been exposed to H_2S for a long time. Blackening of copper conductors and flaking of coated connections in the main fusing sections are just a couple of examples of concerning conditions observed in this MCC. It was also noted that the transformer interior to the MCC shows evidence of degradation.

Most of the components in the rest of the Central Kitsap WWTP MCC's individual buckets are consistent with industry standard hardware and replacement parts are readily available or could be replaced with similar manufacturer's devices.

One notable exception would be MCC's containing DeviceNet communications for control and status of motor controllers. DeviceNet components should be replaced with original manufacturers' components. The MCCs containing DeviceNet connections to a local programmable logic controller (PLC) are (MCC-2935, MCC-2936, MCC-2975, MCC-2976, MCC-4901, MCC-4902 and MCC-8901).

Variable frequency drives (VFDs) in some of the older MCCs from 1996 were observed to be obsolete or replaced with a newer unit from another manufacturer.

Recommendation: Replace MCC-2.

6.3.3.13.7 Low Voltage Distribution Panelboards and Transformers

The Central Kitsap WWTP power distribution system includes many panelboards and dry-type transformers. The panelboards are used for connections to small process loads with low current and for providing power to building lighting, comfort, ancillary loads and control power for miscellaneous control panels. This type of equipment can have a fairly long lifespan and can be easily replaced with the original manufacturers' equipment or replaced with a like manufacturer.

Observation: Most of the panelboards and dry-type transformers are in fair to good condition.

PNL-1990 is a 25-year-old 120/240V panelboard located in the utilidor and provides power to the low voltage loads, including lighting, receptacles and local instrument and control loads. This unit has a very rusty interior and shows rust on the circuit breaker handles.

PNL-5012 which is a 10-year-old “all-in-one” transformer and panelboard located at the septage receiving area. It mostly provides power for local heat tracing. It has an enclosure showing signs of rust and circuit breakers indicating signs of possible H_2S exposure.

The Operations Facilities Building has a 480-volt and a 120/240-volt panelboard that are original to the plant from 1977. Both panels show signs of rusting.

The Maintenance Building transformer and 480-volt panelboard are powered by a fused disconnect on the outside of the building. The enclosure for this unit is very rusted and appears likely to fail soon.

The transformers (XFMR-3010 and XFMR-3020) located at the UV area are 25 years old and appear to be functional however both enclosures show signs of rust.

Recommendation: PNL-1990 should be replaced as soon as possible. The circuiting should also be verified and labeled accurately within the new panel. This panel provides power to local instruments and controls, and failure would cause the loss of use of a significant amount of analyzing probes and similar devices needed to operate the facility. It should be replaced as soon as possible.

PNL-5012 should be replaced within the next few years.

The Operations Facilities Buildings 480-volt and 120/240-volt panelboards should be replaced and circuits for the 120/240-volt panelboard should be re-identified to their associated loads.

The Shop and Maintenance Building transformer and 480-volt panelboard fused disconnect should be replaced.

The transformers (XFMR-3010 and XFMR-3020) enclosures should be inspected, cleaned and the rusted areas coated to prevent further degradation.

6.3.3.13.8 Control Panels

The Central Kitsap WWTP control system consists of control panels located throughout. The control panels are comprised of Industry standard equipment including PLCs, operator interface terminals (OITs), uninterruptable power supply (UPS), small digital readouts, and typical components including circuit breakers, relays, wiring, fuses, terminals, indicator lights, selector switches, etc. **Table 6-9** below shows the panels, their location, PLC and central processing unit (CPU) models and if an OIT is present. Local pushbutton, selector switch, and or indication stations are not listed.

Table 6-9 | Panel Locations and Models

Panel	Location	PLC Model	CPU Model	OIT
PNL-1021 Influent Screen #1	Headworks Bldg Elect. Room	Allen-Bradley SLC 5/05	1747-L552	Y
PNL-1023 Influent Screen #3	Headworks Bldg Elect. Room	Allen-Bradley SLC 5/05	1747-L552	Y

Panel	Location	PLC Model	CPU Model	OIT
PNL-1025 Screenings Conv.	Headworks Bldg Elect. Room	N/A	N/A	N
PNL-1026 Screening Screw Comp	Headworks Bldg Grit Area	Allen-Bradley SLC 5/05	1747-L552	Y
PNL-1027 Grit Washer 1	Headworks Bldg Grit Area	Allen-Bradley SLC 5/05	1747-L552	Y
PNL-1028 Grit Washer 2	Headworks Bldg Grit Area	Allen-Bradley SLC 5/05	1747-L552	Y
PNL-1050 Headworks PLC	Headworks Bldg Elect. Room	Allen-Bradley SLC 5/05	1747-L552	Y
PNL-1067 Biofilter Sprinkler	Headworks Biofilter Area	N/A	N/A	N
PNL-1070 Biofilter Sump Pmp	Headworks Biofilter Area	N/A	N/A	N
Un-tagged Pump 3 Panel	Decant Facility	N/A	N/A	N
PNL-1090 Plant Wastewtr Pmp	Plant Wastewater Pump Station	N/A	N/A	N
PNL-1250 Pri. Gallery Sump Pmp	Headworks Bldg Equip Gallery	N/A	N/A	N
PNL-2401 Meth Metering Pmp 1	Carbon Addition Support Bldg	N/A	N/A	N
PNL-2402 Meth Metering Pmp 2	Carbon Addition Support Bldg	N/A	N/A	N
PNL-2403 Meth Metering Pmp 3	Carbon Addition Support Bldg	N/A	N/A	N
PNL-2404 Meth Metering Pmp 4	Carbon Addition Support Bldg	N/A	N/A	N
PNL-2543 Channel Air Blwr 3	Aeration Bldg 3&4 Elect. Room	N/A	N/A	N
PNL-2544 Channel Air Blwr 4	Aeration Bldg 3&4 Elect. Room	N/A	N/A	N
PNL-2920 Pwr Blwr Bldg PLC	Power Blower Bldg Blower Room	Allen-Bradley Compactlogix	1769-L33ER	Y
PNL-2939 Aer. Bldg 3&4 PLC	Aeration Bldg 3&4 Elect. Room	Allen-Bradley Compactlogix	1769-L33ER	Y
PNL-2990 Pwr Blwr Bldg Input/Output (I/O)	Power Blower Bldg Elect. Room	Allen-Bradley Compactlogix	1769-L33ER	N
PNL-4012 Rot. Drum Thickener	WAS Thickening Bldg Proc. Area	Allen-Bradley Compactlogix	1769-L30ER	Y
PNL-4050 Polymer Blending	WAS Thickening Bldg Proc. Area	Allen-Bradley Compactlogix	1769-L32E	Y
PNL-4080 Polymer Feed Pmp	WAS Thickening Bldg Proc. Area	Allen-Bradley Compactlogix	1769-L32E	Y
PNL-4905 WAS Thickening PLC	WAS Thickening Bldg Elect. Room	Allen-Bradley Compactlogix	1769-L33ER	Y
PNL-5010 Raptor Septg Accept	Septage Receiving Station	Allen-Bradley Micrologix 1100	1763-L16AWA	N

Panel	Location	PLC Model	CPU Model	OIT
Un-tagged RACS Oper Interface	Septage Receiving Station	Allen-Bradley Micrologix 1100	1763-L16BWA	Y
PNL-5020 Septg Rcvng Stn Blwr	Septage Receiving Station	N/A	N/A	N
PNL-6000 Digester Bldg PLC	Digester Control Bldg Electrical Area	Allen-Bradley Compactlogix	1769-L33ER	N
PNL-7105 Solid Proc Analog I/O	Solids Processing Bldg Elect. Room	Allen-Bradley Compactlogix	1769 Remote I/O	N
PNL-7110 Centrifuge 1 PLC	Solids Processing Bldg Control Room	Allen-Bradley Compactlogix	1769-L33ER	Y
PNL-7120 Centrifuge 2 PLC	Solids Processing Bldg Control Room	Allen-Bradley Compactlogix	1769-L33ER	Y
PNL-7167 Septage Classifier	Digester Control Bldg	N/A	N/A	N
PNL-7210 Alum Mtr Pmp 1	Solids Proc. Bldg Chem Dosing Room	N/A	N/A	N
PNL-7220 Alum Mtr Pmp 2	Solids Proc. Bldg Chem Dosing Room	N/A	N/A	N
PNL-7221 Dewtr Poly Dilutn Unit1	Solids Proc. Bldg Chem Dosing Room	N/A	N/A	N
PNL-7222 Dewtr Poly Dilutn Unit2	Solids Proc. Bldg Chem Dosing Room	N/A	N/A	N
PNL-7225 Dewtr Polymer PLC	Solids Proc. Bldg Chem Dosing Room	Allen-Bradley Compactlogix	1769-L33ER	Y
PNL-7225-UPS UPS Panel	Solids Proc. Bldg Chem Dosing Room	N/A	N/A	N
PNL-8200 Filter System PLC	Reclaimed Water Bldg Elect. Room	Allen-Bradley Compactlogix	1769-L32E	Y
PNL-8580A SCADA Network	Solids Processing Bldg Control Room	N/A	N/A	N
SWGR-2961 Control Stack	Solids Processing Bldg Control Room	N/A	N/A	Y
Un-tagged Master Stn CTU	Solids Processing Bldg Control Room	Allen-Bradley Compactlogix	1769-L35E 1769-L33ER	Y
PNL-8905 Reclaim Wtr Bldg PLC	Reclaimed Water Bldg Elect. Room	Allen-Bradley Compactlogix	1769-L33ER	Y

Observation: Overall, most of the control panels installed appear to be operating adequately and are in good condition. Components installed are consistent with industry standard and are readily available or could be replaced with similar manufacturer's devices. The exception to this is the PLC system and OIT equipment, as each brand of PLC and OIT requires special programming. It is not known if the County maintains current PLC and OIT programing equipment and/or the programs needed for these systems to operate.

There are several control panels that have PLC controllers and OIT's that are at a mature state or that are obsolete. See the individual sheet assessments for additional information.

The control panel (PNL-1090) located at the in-plant pump station appears to be damaged from H_2S infiltration. The electrical maintenance staff has applied an anti-corrosion compound to the some of the wiring connections to help retard the corrosion that is destroying the wiring. Staff mentioned that the wires are very brittle and sometimes fall off the terminals when disturbed. The panel components do not appear to be failing yet, but failure is imminent given the corrosive environment.

The biofilter sprinkler control panel (PNL-1067) located at the headworks biofilter area has a fiberglass enclosure that is broken. Yellow jackets have started a nest interior to the enclosure. The panel appears functional but needs replacement.

The biofilter sump pump panel (PNL-1070) located at the Headworks biofilter area shows signs of rust on the bottom interior of the enclosure. It also shows indication of H_2S infiltration as ground bars and wiring are darkened. It appears that the pump and cabling may have been replaced and the conduit was not resealed allowing for gas to migrate inside.

The primary gallery sump pump panel (PNL-1250) located at the headworks equipment gallery area shows signs of rust on the bottom interior of the enclosure along with indications of H_2S infiltration as indicated by the darkening of the panels ground bar and wiring conductors. The enclosure is gasketed and sealed, however the conduits entering the enclosure appear to allow H_2S to enter.

The PLC battery alarm indication light was observed to be illuminated on the west influent screen (PNL-1023) CPU. This indicates that there is an issue with the battery that could create PLC program loss if the panel were to lose power.

Recommendation: Verify back-up copies of all PLC and OIT programs have been created, and if not, have them created and stored in a safe place as soon as possible.

Spare parts for the PLC system including a CPU, power supply, communication module, and a minimum of one spare I/O module per type should be stored by the County in case of failure.

A migration path or replacement plan should be established for all mature or obsolete PLC’s and OIT’S.

The in-plant pump station control panel (PNL-1090) should be replaced as soon as possible and located away from the station. It is recommended to add a pump disconnect panel with an airgap between the wetwell to eliminate conduit seals and a path for gasses to enter the panel.

The enclosure of the biofilter sprinkler control panel (PNL-1067) should be replaced, and the control components should be evaluated for proper operation or replaced.

The interior of biofilter sump pump panel (PNL-1070) should be inspected, cleaned and the rusted areas coated to prevent further degradation. In addition, the conduits entering the enclosure should be re-sealed with a form of duct seal to help prevent further effects of H_2S.

The interior of primary gallery sump pump panel (PNL-1250) should be inspected, cleaned and the rusted areas coated to prevent further degradation. In addition, the conduits entering the enclosure should be sealed with a form of duct seal to help prevent further effects of H_2S infiltration.

The PLC battery indication light in the west influent screen panel (PNL-1023) should be investigated and rectified as soon as possible.

6.3.3.13.9 Miscellaneous

Observation: The main switchgear (SWBD-1) installed in 1977 has been modified and has reached its expected lifespan. The original ATS has been removed and the rest of the equipment has been reconfigured. Parts are obsolete and would not be easily replaced.

The Headworks Building electrical room HVAC appears inadequate or ill functioning. Plant staff indicate that the temperature controls in the room do not maintain the correct setpoint and that the room gets overly warm. During the site visit, it was observed that the plant staff had put a covering over the windows in the entrance doors to keep heat from the sunlight out. The display on the room temperature controller showed the room to be at 79 degrees with the setpoint of 72. In addition to the high temperature in the room there also appears to be inadequate ventilation and or some infiltration of H_2S. During the site visit, it was observed that darkening of the copper grounding conductors routed along the cable tray in the room and additional examples of darkening copper grounding conductors were noticed in local control panels in the room.

The electrical installation and equipment located in the Digester Control Building have created some confusion over the “hazardous or non-hazardous” location rating of the area. It was observed that multiple types of enclosures and equipment were installed, some acceptable for use in hazardous areas and others that are not. Non-hazardous and hazardous wiring practices were also observed such as sealing conduits in a few of the conduit runs, but not others.

There are two electrical panels that are a part of the two boiler systems located in the Digester Control Building that are completely rusted through and show signs of long-term H_2S exposure and pose a hazard. Additionally, some of the conduits were observed to be loose with gaps between the end of the conduit and attached fittings, leaving insulated conductors exposed.

The electrical equipment in the Digester Control Building is in poor condition. The environment in the area is corrosive and the conduits, switches, and lights were observed to be rusty and / or corroding. The area is a classified hazardous location and at least one light fixture is not rated for the area. The building does not house a significant amount of process equipment and the controls for the equipment are located on the exterior of the building, outside the hazardous area, and conduits were sealed accordingly.

While inspecting the electrical equipment in the utilidor during the site visit, it was noticed that a very large wiring duct in the southwest corner of the building is very rusted. Plant staff mentioned that this has been a constant maintenance issue, and that water has been seeping into the area for years.

During the site visit, it was observed that three fire alarm control panels and many local indicators, detectors and fire pull stations located throughout the facility. All the indicators, detectors or fire pull stations observed appeared to be intact and in good condition. The first alarm panel located in the Solids Processing Building control room appears to be a fairly old Fire Control Instruments unit with zone indication for the Administration Building, Operations Facilities Building, utilidor, generator building and Digester Control Building. The panel appears to be functional and did not show any “trouble” indications that would indicate failed sensors.

The second and third fire alarm panels are in the Solids Processing Building lab area and in the Headworks Building electrical room. Both units are Siemens Firefinder XLS systems installed in 2010. The units have stickers indicating they had their annual confidence testing performed in August of 2020. During the visit the panels displayed normal system status and no “trouble” indications. Even though both newer systems appear to be operating correctly, plant staff report they have had many issues with them and that they are overly complicated.

The interior lighting throughout the facility appeared to be adequate. Most interior lighting is controlled with manual switches. Battery backed luminaires were observed throughout the facility for egress purposes.

Plant staff report that as luminaires or bulbs fail, they are replaced with light emitting diode (LED) units. There were several such replacements that have been made throughout the facility. This includes older battery-backed luminaires located in the Solids Processing Building to incandescent style luminaire bulbs replaced with LED units in the hallway at the Administration Building.

The Administration Building currently uses recessed and chain mounted fluorescent luminaires. A plan for updating the luminaires in that building is underway.

Most of the exterior lighting for the Central Kitsap WWTP is provided by wall mounted luminaires located at the individual buildings. There are some pole-mounted luminaires located near the Administration Building for the main drive-up and parking area. The facilities exterior building lights are controlled by individual photocells, hand-off-auto switches and contactors located at each building. The main drive and parking area lighting near the Administration Building is controlled by a digital timer and contactor located in the Administration Building mechanical room. The exterior lights appear to be a mixture of metal halide units and some newer LED units for the Administration Building drive-up and parking area. Lighting levels are assumed to be adequate as the assessment was done during the day and could not be observed.

Recommendation: The main switchgear (SWBD-1) should be replaced and updated for its functional purpose.

The HVAC system for the Headworks Building should be evaluated and options such as positive room pressurization or some other means of keeping chemical gasses from entering the room should be considered.

An assessment of the process in the Digester Control Building and the hazards they present to personnel and to equipment should be completed and the entire facility updated as appropriate to meet the determined hazard rating.

The electrical controls and wiring installation for the boilers in the Digester Control Building should be evaluated by a certified representative and restored to a safe operating condition.

With the overall observance of what appears to be H_2S effects on the overall equipment located in the Digester Control Building, it is recommended to evaluate the HVAC system.

The electrical installation and miscellaneous ancillary equipment, such as receptacles, switches and lights in the Digester Control building should be replaced and updated as appropriate to meet the hazard location and operational needs.

The rusted wireway located in the Utilidor should be replaced.

6.3.3.14 SCADA System

The SCADA system condition assessment and evaluation have been conducted as part of the County-wide SCADA master plan project. See **Appendix D** for the details.

6.4 Code Review

Code requirements for the Central Kitsap WWTP are summarized in Section 6.4.1. Section 6.4.2 includes discussion of general code requirements that would be triggered should major upgrades be completed at the WWTP. Code requirements summarized in this report include:

- Washington State Building Code including the following adopted codes. The 2021 versions of the code went into effect March 15, 2024 and are expected to be updated in approximately 2027.
  - International Building Code (IBC)
  - International Machine Code (IMC)
  - International Fire Code (IFC)
  - National Electrical Code (NEC 70)
  - National Fire Protection Association (NFPA) 820
  - National Fire Protection Association (NFPA) 24
  - Uniform Plumbing Code (UPC)
- Americans with Disabilities Act (ADA)
- Code of Federal Regulations (CFR)

6.4.1 Summary of Existing Buildings and Use

The Central Kitsap WWTP Site Plan is shown in **Figure 6-1**. The occupancy of each of the main building on site is summarized in **Table 6-10** below.

Table 6-10 | Existing Buildings Occupancy Category

Building	Original Construction Year	Occupancy
Headworks Building	2011	Group B, Type II
Power Blower Building	1996	Group B, Type II
Reclaimed Water Building	2016	Group B, Type II
WAS Thickening Building	2016	Group B, Type II
Digester Control Building	1977	Group B, Type II
Solids Processing Building	1977	Group B, Type II
Administration Building	1977	Group B, Type II
Operations Facilities Building	1977	Group B, Type II
Shop and Equipment Maintenance Building	1980's	Group B, Type II

6.4.1.1 Headworks Building

The Headworks Building was constructed in 2011 and contains a screenings and grit room, mechanical room for the grit blowers, and an electrical room. Each room must be accessed by exterior doors. The screenings and grit room has two roll-up doors that allow dumpsters for the screenings and grit to be removed. The influent channels, grit tanks, and equipment gallery are part of the headworks structure, but are not enclosed within the building. The Headworks Building is in good condition; however, operators report that the electrical room gets very warm and does not have adequate ventilation.

6.4.1.2 Power Blower Building

The Power Blower Building was constructed in 1996 and contains the aeration basin blowers, and electrical room, and a mechanical room with ventilation equipment.

6.4.1.3 Reclaimed Water Building

The Reclaimed Water Building contains the coagulation metering and mixing equipment, electrical controls, and air compressors for the reclaimed water filters. The building was constructed in 2016.

6.4.1.4 WAS Thickening Building

The WAS Thickening Building was constructed in 2016 and contains the RDT and associated polymer system, the digester feed pumps, the sludge blending pumps, and a separate non-potable water air gap room.

6.4.1.5 Digester Control Building

The Digester Control Building is a two-story structure located between the two anaerobic digesters with the digesters themselves forming the east and west walls. The boilers are located on the ground level and the pumps and heat exchangers are on the basement level. The building was constructed along with the digesters in 1977. The building is in poor condition. The roof has plants growing in cracks, ponding in many locations and is leaking into the boiler room. On the interior, the paint has chipped in many places.

6.4.1.6 Solids Processing Building

The Solids Processing Building is a three-story concrete structure that was originally constructed in 1977. The building mechanical processes have been modified several times since the building was constructed. Currently, the building houses the centrifuges and associated polymer system, centrate pumps, septage pumps, and hypochlorite system.

6.4.1.7 Administration Building

The Administration Building is a single-story concrete masonry unit (CMU) building with locker rooms, a conference room, and the laboratory. The building was constructed in 1977 but modified about 15 years ago to expand the laboratory into the former training and lunchroom space. The Administration Building is in fair condition. The laboratory space HVAC does not work well since the room was expanded after the original construction. As noted in **Appendix I**, the west lab has negative pressure when the fume hood exhaust is on. Fugitive gas has been noted in the administration room during lab analyses. It has also been observed the air handling fan from 1977 has compromised capacity due to the missing blades, and the heating in the lab cannot keep up with the demand at the temperature setpoint so that supplemental heater has to be used. Lack of ventilation in all lab spaces violates the NFPA 45 Standard on Fire Protection for Laboratories using Chemicals, posing a potential health and safety risk to staff working in or near the lab. As of October 2024, the HVAC upgrades have reached 30% completion.

6.4.1.8 Operations Facilities Building

The Operations Facilities Building was originally constructed as the chlorination building in 1977 and was modified when the UV system was installed in 1996. It is a single-story CMU structure.

6.4.1.9 Shop and Equipment Maintenance Building

The Shop and Equipment Maintenance Building was constructed sometime before 1996. It is a single-story metal frame building with a metal roof and siding. Approximately 60 percent of the building is enclosed while the other 40 percent is open on one side to allow large equipment to pull in underneath the roof. The building is in very poor condition. The purlins in the open-air sections are very corroded and in some locations a portion of the flange has completely corroded away. In many locations the roof has corroded though, and sky is visible from the interior. The main frames also have widespread corrosion. There is also a nuisance bird nesting problem in the open air portion. The enclosed portions are less corroded, but it is difficult to see the purlins well because of the insulation.

6.4.2 General Code Requirements

6.4.2.1 Accessibility

Any new building anticipating personnel occupancy is required to comply with the accessibility requirements of Chapter 11 of the IBC. In general, this means that the building shall have an accessible parking stall and accessible path of travel from the accessible stall to the operations building entrance. Doors shall have lever hardware and accessible rooms shall meet the design and dimensional requirements of Chapter 11. Per the IBC, accessibility is not required for mechanical and process spaces as described in Section 1103.2.9 Equipment spaces.

Existing buildings are governed by the Existing Building Code Section 305. Generally, any portions of the building that are altered, should comply as if it is a new building, including accessibility. But the entire building does not necessarily need to be upgraded. For example, if the alternation of the existing space does not include the toilet/locker area, then that area would not have to be upgraded to meet the accessibility requirement in the IBC.

Although the Administration Building at Central Kitsap WWTP does not comply with the latest IBC code on the accessibility requirement, it is grandfathered in from the code when it was constructed. If the building is to be upgraded or modified, it will need to meet the current accessibility requirements.

6.4.2.2 Means of Egress

The Washington State Building Code mandates in Chapter 10 that in all buildings the means of exit discharge shall meet the following requirements:

- Illumination Required: Means of exit discharge shall be illuminated at all times by not less than 1-foot-candle (11 lux) at the walking surface per IBC 1008.2.
- Egress Sizing: The minimum width of each door opening shall be a minimum width of 32-inch and height of 80-inch, as well as sufficient for the occupant load thereof per IBC 1010.1.1.

6.4.2.3 NFPA 820

NFPA 820 provides requirements for ventilation, electrical classification, materials of construction, and fire protection measures for the Liquid Stream Treatment Process and the Solid Stream Treatment Process in Table 5.2.2 and Table 6.2.2 respectively (NFPA 820, 2020). Applicable locations pertinent to the Central Kitsap WWTP are summarized in **Table 6-11** below.

Table 6-11 | NFPA 820 Requirements Pertinent to the Central Kitsap WWTP

Location	Fire and Explosion Hazard	Ventilation[1]	Extent of Classified Area	NEC Area Electrical Classification (All Class I, Group D)	Materials of Construction	Fire Protection Measures
Screen Channels	Possible ignition of flammable gases and floating flammable liquids	Continuously ventilated at 12 changes per hour	Enclosed – entire space in covered channel	Division 2	Noncombustible, limited combustible, or low flame spread index material	Portable Fire Extinguisher, hydrant protection in accordance with NFPA 820 7.2.4
Grit Removal Tanks	Possible ignition of flammable gases and floating flammable liquids	Continuously ventilated at 12 changes per hour	Enclosed – entire space in covered tank	Division 2	Noncombustible, limited combustible, or low flame spread index material	Portable Fire Extinguisher and hydrant in accordance with NFPA 820 7.2.4.
Primary Sedimentation Tanks	Possible ignition of flammable gases and floating flammable liquids	Open to atmosphere	Interior of the tank from the min water surface to the top of the tank. Envelope includes 0.46 m (18 in) above the top of the tank and extending 0.46 m beyond the exterior wall; envelope 0.46 m above grade extending 3 m (10 ft) horizontal from the exterior tank walls	Division 2	Noncombustible, limited combustible, or low flame spread index material	Hydrant in accordance with NFPA 820 7.2.4.
Aeration Basins	N/A	Not required	N/A	Unclassified	No requirement	Hydrant in accordance with NFPA 820 7.2.4
Secondary Clarifiers	N/A	Not required	N/A	Unclassified	No requirement	Hydrant in accordance with NFPA 820 7.2.4
UV Disinfection	N/A	Not required	N/A	Unclassified	No requirement	Hydrant in accordance with NFPA 820 7.2.4
Reclaimed Water Filters	N/A	Not required	N/A	Unclassified	No requirement	Hydrant in accordance with NFPA 820 7.2.4
Screenings and grit handling building	N/A	Not required	N/A	Unclassified	Noncombustible, limited combustible, or low flame spread index material	Portable Fire Extinguisher, hydrant in accordance with NFPA 820 7.2.4, and Fire Alarm System
Scum pits	Buildup of vapors from flammable or combustible liquids	Open to atmosphere	Within a 10-foot envelope around equipment and open channel	Division 2	Noncombustible, limited combustible, or low flame spread index material	Portable Fire Extinguisher and hydrant in accordance with NFPA 820 7.2.4
Scum pumping area (Utilidor)	Buildup of vapors from flammable or combustible liquids	No ventilation or ventilated at less than 12 air changes per hour	Enclosed – entire space	Division 2	Noncombustible, limited combustible, or low flame spread index material	Portable Fire Extinguisher and hydrant in accordance with NFPA 820 7.2.4
Sludge storage wet wells, pits, and holding tanks (Gravity Thickeners)	Possible generation of methane gas in explosive concentrations; carryover of floating flammable liquids	Continuously ventilated at 12 air changes per hour	Enclosed – entire space	Division 2	Noncombustible, limited combustible, or low flame spread index material	Portable Fire Extinguisher
WAS Thickening Building with Thickened Sludge Pumps and RDT	Accumulation of methane gas	Continuously ventilated at 6 air changes per hour	Enclosed – entire space	Unclassified	Noncombustible, limited combustible, or low flame spread index material	Portable Fire Extinguisher, hydrant in accordance with NFPA 820 7.2.4, and fire alarm system.
Sludge storage tanks (TSBT)	Possible generation of methane gas in explosive concentrations; carryover of floating flammable liquids	Continuously ventilated at 12 air changes per hour	Enclosed – entire space	Division 2	Noncombustible, limited combustible, or low flame spread index material	Portable Fire Extinguisher, hydrant in accordance with NFPA 820 7.2.4
Anaerobic Digester Control Building	Leaking and ignition of sludge gas, possible generation of methane gas in explosive concentrations; carryover of floating flammable liquids	Continuously ventilated at 6 air changes per hour	Entire space when physically separated from gas handling equipment and sludge wet well	Unclassified	Noncombustible, limited combustible, or low flame spread index material	Portable Fire Extinguisher, hydrant in accordance with NFPA 820 7.2.4, and combustible gas detection system.
Anaerobic Digesters	Leakage of gas from cover, piping, emergency relief valves and appurtenances	Open to atmosphere	Tank interior and areas above and around digester 10 feet above the highest point of the cover and 5 feet from any wall	Division 1	Noncombustible material	Portable Fire Extinguisher, hydrant in accordance with NFPA 820 7.2.4
Anaerobic Digesters	Leakage of gas from cover, piping, emergency relief valves and appurtenances	Open to atmosphere	Envelop 15 feet above Division 1 area over cover and 5 feet beyond Division 1 area around walls	Division 2	Noncombustible material	Portable Fire Extinguisher, hydrant in accordance with NFPA 820 7.2.4
Waste gas burner	Gas piping and appurtenances	N/A	Within 10-ft envelope of all fixtures, appurtenances, and housing	Division 1	Noncombustible material	No requirement
		N/A	Envelop 15-feet above Division 1 envelope and 5-feet on all sides	Division 2	Noncombustible material	No requirement
Dewatering building	Accumulation of methane gas	No ventilation	Entire room	Division 2	Noncombustible, limited combustible, or low flame spread index material	Portable Fire Extinguisher, hydrant protection in accordance with NFPA 820 7.2.4, and fire alarm system.
Odor Control	Leakage and ignition of flammable gases and vapors	Not enclosed, open to the atmosphere	Areas within 0.9 m (3 ft) of leakage sources such as fans, dampers, flexible connections, flanges, pressurized unwelded ductwork, and odor-control vessels	Division 2	Noncombustible, limited combustible, or low flame spread index material	Portable Fire Extinguisher

Note:
1. The ventilations are the intended design values. Testing is needed to verify the actual ventilation during operation.

6.4.2.4 NFPA 24

Fire suppression hydrants shall be installed in accordance with NFPA 24. Chapter 7 of NFPA 24 references the local jurisdiction for hydrant spacing requirements. The County fire code mandates hydrants to be located between 50 and 150 feet of the buildings to be protected. The Central Kitsap WWTP has an on-site fire protection water system with hydrants, which were originally installed in 1977 and were expanded and partially replaced in 2016. C.4.1.3 of NFPA 24 generally recommends a minimum residual pressure of 20 pounds per square inch (psi) should be maintained at hydrants when delivering fire flow.

6.4.3 Summary of Code Requirements

No code violation has been observed at the Central Kitsap WWTP. Although the Administration Building at Central Kitsap WWTP does not comply with the latest IBC code on the accessibility requirement, such as the accessible parking stall, path from the accessible stall to the entrance, ADA bathroom, etc., it is grandfathered in from the code when it was constructed. If the building is to be upgraded or modified, it will need to meet the current accessibility requirements.

The following conditions require additional comprehensive analysis, beyond the scope of this review, to evaluate the Central Kitsap WWTP:

- HVAC compliance
- Seismic Anchoring

6.5 Existing Wastewater Treatment Plant Performance

The performance of the existing WWTP in terms of NPDES permit compliance, EPA's reliability requirement, and future nutrient removal requirement is documented below.

6.5.1 Compliance with NPDES Permit

The County's Central Kitsap WWTP NPDES Permit #WA0030520 was renewed on August 1, 2017, allowing the discharge of treated effluent to Port Orchard Bay of the Puget Sound. A copy of the WWTP's NPDES Permit is included in **Appendix B**. The NPDES Permit expired on July 31, 2022. The County submitted the permit renewal application and Ecology determined the application was timely and complete, therefore the permit was administratively continued and remains in effect.

Table 6-12 is a summary of waste discharge limitations for the Central Kitsap WWTP Outfall 001 to Puget Sound as contained in Section S1 of the NPDES Permit.

Table 6-12 | Outfall 001 NPDES Waste Discharge Limits

Effluent Limits: Outfall 001		
Parameter	**Average Monthly**	**Average Weekly**
BOD	30 mg/L	45 mg/L
	1,501 ppd	2,252 ppd
	85% removal of influent BOD	
TSS	30 mg/L	45 mg/L
	1,501 ppd	2,252 ppd
	85% removal of influent TSS	

Effluent Limits: Outfall 001		
Parameter	**Daily Minimum**	**Daily Maximum**
pH	6.0	9.0
Parameter	**Monthly Geometric Mean**	**Weekly Geometric Mean**
Fecal Coliform Bacteria	200/100 mL	400/100 mL

Notes:
From current Central Kitsap WWTP NPDES Permit # WA0030520
mL=milliliter

The plant design criteria listed in Section S4 of the current permit set the upper limits for the influent flow, BOD and TSS loads, as following.

- Maximum month design flow is 6.0 MGD
- Influent BOD loading for maximum month is 14,100 ppd
- Influent TSS loading for maximum month is 11,400 ppd

The County is required to submit a plan and a schedule for continuing to maintain capacity to Ecology when:

1. The actual flow or waste load reaches 85 percent of any one of the above design criteria for three consecutive months.
2. The projected plant flow or loading would reach design capacity within five years.

Figure 6-3 through **Figure 6-6** show the 7-day and the 30-day rolling average concentrations and loads for both effluent BOD and TSS between January 2018 and June 2020. **Figure 6-7** shows the daily effluent ammonia concentrations and monthly averages. The corresponding NPDES permit limits are shown for comparison. These figures indicate Central Kitsap WWTP has not exceeded the permit effluent BOD and TSS limits during this time period. The daily maximum ammonia concentration has not been exceeded, but the average monthly ammonia limit was exceeded slightly in April of 2019 when the single sample taken in that month was measured at 37.7 mg/L comparing to the limit of 37 mg/L. In addition, the plant has not exceeded pH or Fecal Coliform limits during this same time period based upon review of the monthly DMRs.

Figure 6-3 | 7-day Rolling Average Effluent BOD and TSS Concentrations

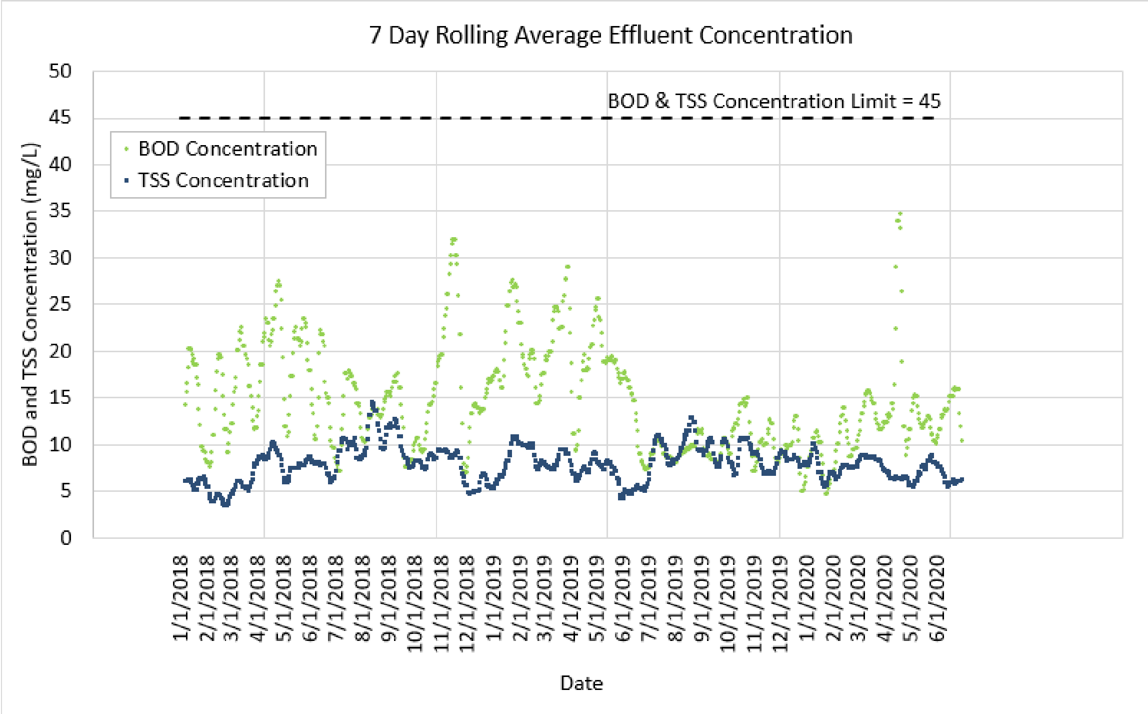


Figure 6-4 | 30-day Rolling Average Effluent BOD and TSS Concentrations

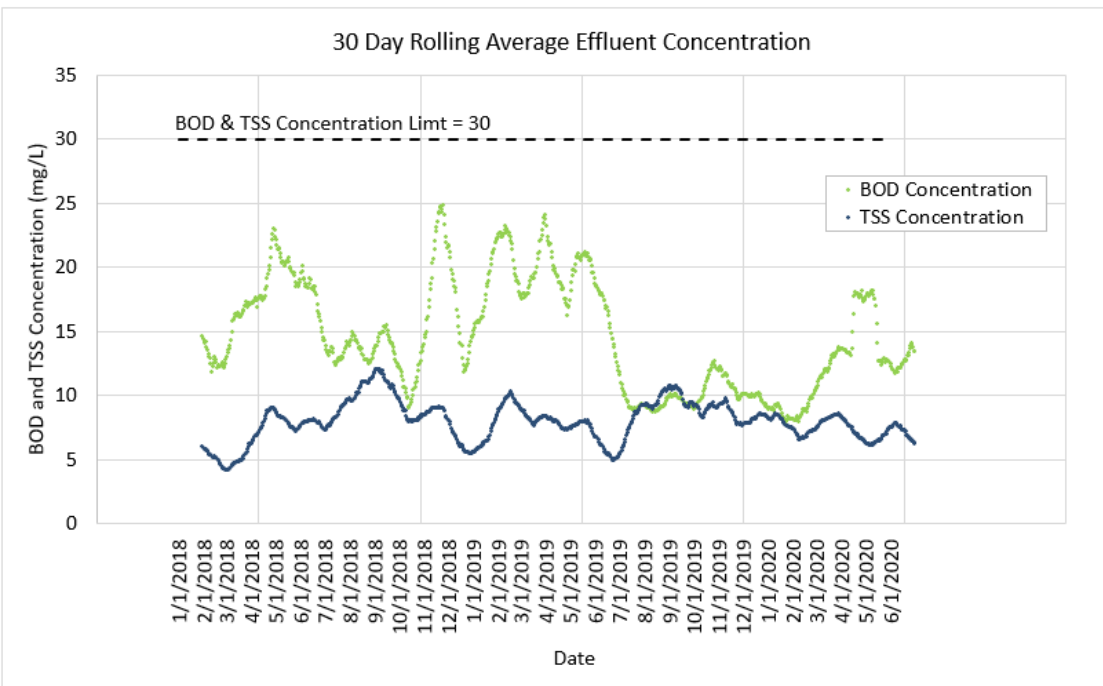


Figure 6-5 | 7-day Rolling Average Effluent BOD and TSS Loads

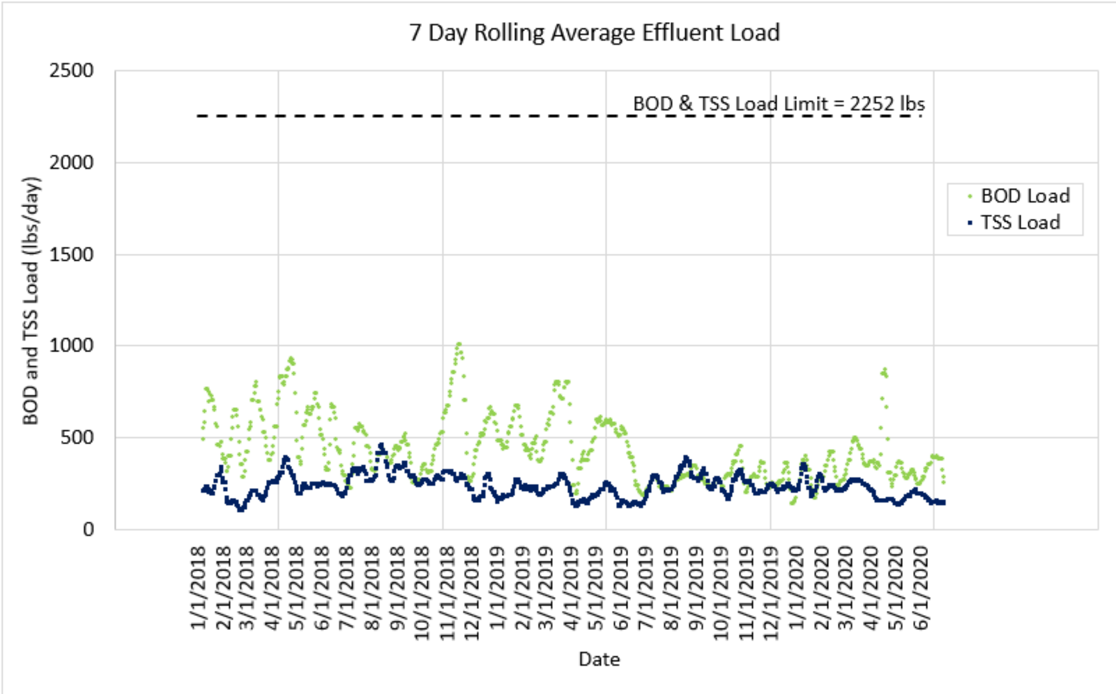


Figure 6-6 | 30-day Rolling Average Effluent BOD and TSS Loads

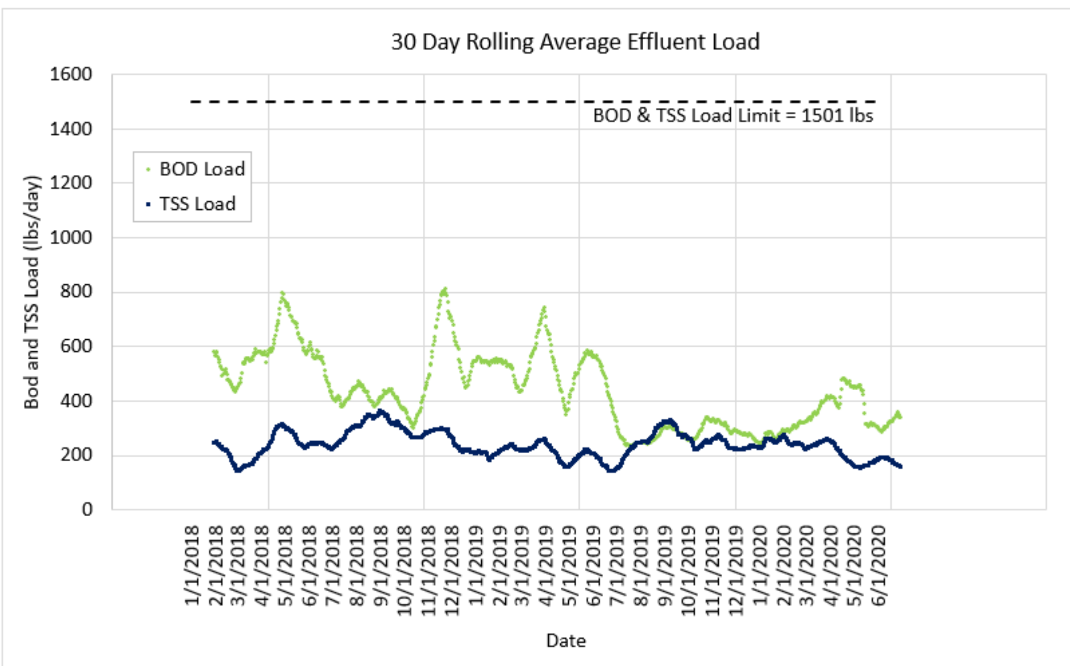


Figure 6-7 | Effluent Ammonia Concentrations

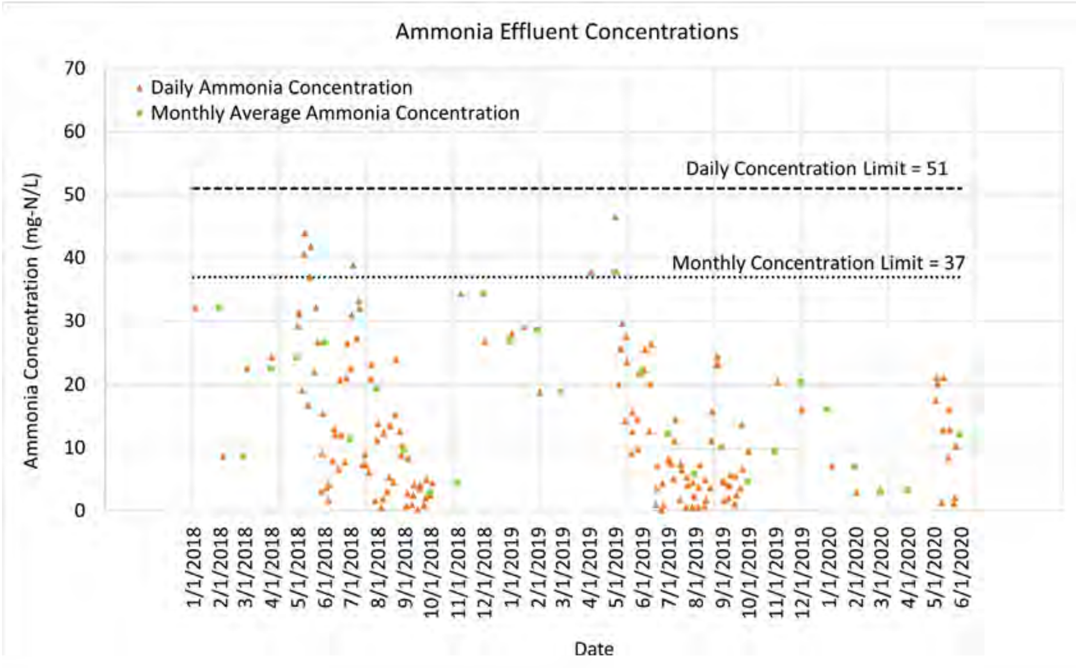


Figure 6-8 and **Figure 6-9** show the plant 30-day rolling average influent flow and BOD and TSS loads to compare with the design criteria in the permit. Influent flow has approached but not exceeded the 85 percent of the design flow value. BOD loads are well below 85 percent of the designed values but TSS loads exceeded the design maximum in the winter of 2018/2019. Further review of the DMR data showed that the plant only exceeded the 85 percent of the TSS load criterion in the months of December 2018 and January 2019, therefore the planning requirement was not triggered.

Figure 6-8 | 30-day Rolling Average Influent Flow

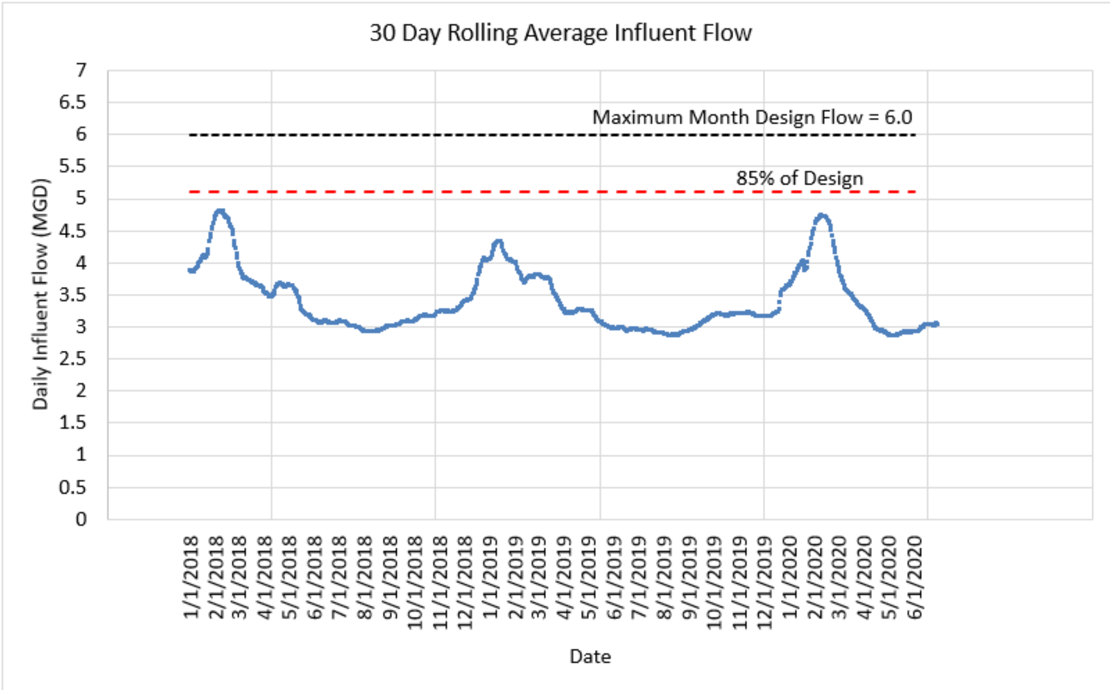
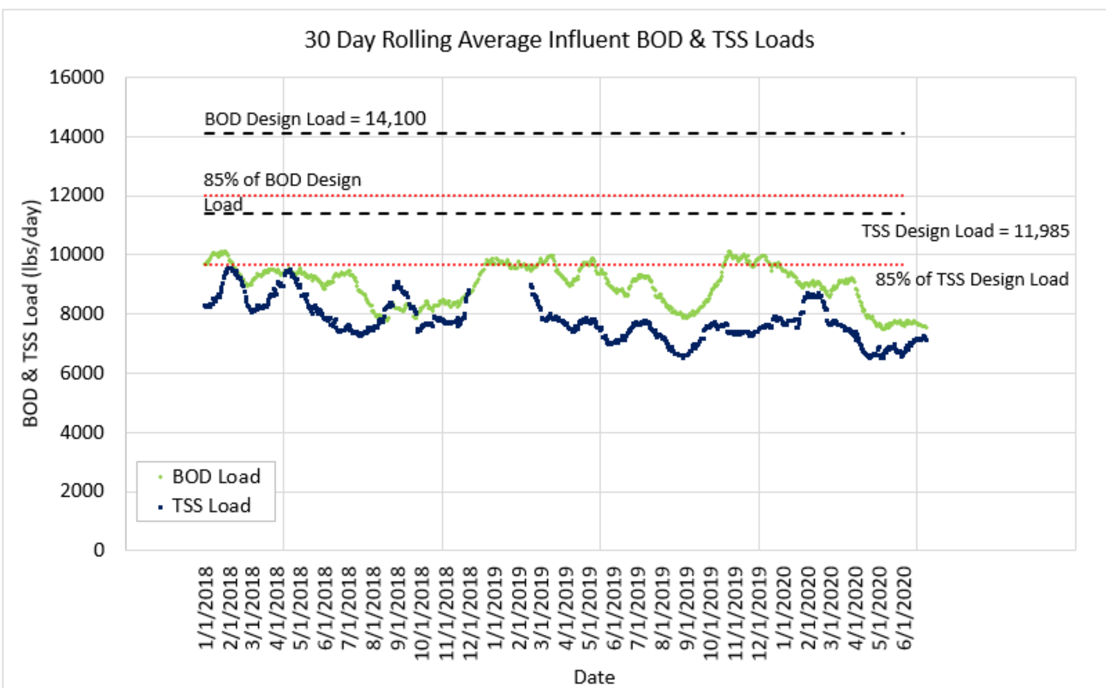


Figure 6-9 | 30-day Rolling Average Influent BOD and TSS Loads



6.5.2 EPA Plant Reliability Criteria

The Central Kitsap WWTP is required to meet the Reliability Class I standards, as defined in EPA's Technical Bulletin "Design Criteria for Mechanical, Electrical, and Fluid System Component Reliability," EPA 430-99-

74-001. **Table 6-13** includes a summary of the reliability criteria and requirements to be considered as part of the Alternatives Evaluation and Recommended Plan.

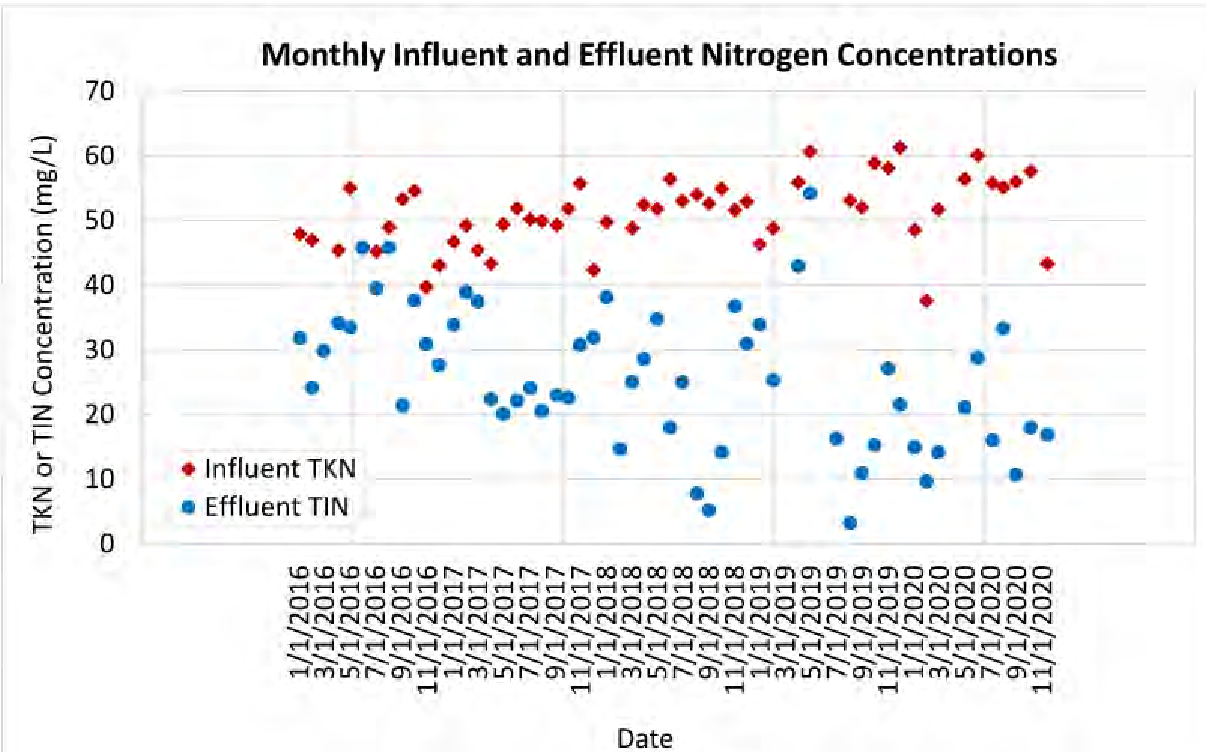
Table 6-13 | EPA Class I Reliability Criteria

Treatment Unit Process	Reliability Class I Requirements	Current Deficiencies
Influent Screening	A backup bar screen designed for mechanical or manual cleaning shall be provided. Facilities with only two bar screens shall have at least one bar screen designed to permit manual cleaning.	None. A manual screen is provided to back up the two mechanical screens.
Pumps (Liquids, Solids & Chemical Feed)	A backup pump shall be provided for each set of pumps performing the same function. The capacity of the pumps shall be such that, with any one pump out of service, the remaining pumps will have the capacity to handle the peak flow.	None. Backup is provided to grit pumps, process water pumps, nonpotable water pumps, reclaimed water feed pumps, chemical feed pumps, WAS pumps, RAS pumps, and sludge pumps.
Primary Clarification	The units should be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units should have a design flow capacity of at least 50 percent of the total design flow.	One of two primary clarifiers will not be able to handle 50 percent of the total design flow in 2042, based on the hydraulic and capacity analysis below.
Secondary Clarification	The units shall be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 75 percent of the total design flow.	One of two secondary clarifiers will not be able to handle 75 percent of the total flow in 2028, based on the hydraulic and capacity analysis below.
Aeration Basin	A backup basin will not be required; however, at least two equal-volume basins shall be provided.	None. Four aeration basins are provided.
Aeration Blowers and/or Mechanical Aerators	There shall be a sufficient number of blowers or mechanical aerators to enable the design oxygen transfer to be maintained with the largest-capacity-unit out of service. It is permissible for the backup unit to be an uninstalled unit, provided that the installed units can be easily removed and replaced. However, at least two units shall be installed.	None. Critical aeration blowers are designed to provide design airflow with one backup.
Air Diffuser Systems	The air diffusion system for each aeration basin shall be designed so that the largest section of diffusers can be isolated without measurably impairing the oxygen transfer capability of the system.	None. Six grids of diffusers are provided in each aeration basin. Isolation of any will not impair the oxygen transfer capability of the system.
Disinfection	The units should be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units should have a design flow capacity of at least 50 percent of the total design flow.	None. One of two UV channels will be able to handle more than 50 percent of the total design flow.
Sludge Disposal	An alternative method of sludge disposal shall be provided for each sludge treatment unit process without installed backup.	None. If RDT is down, WAS could be sent to the gravity thickeners and co-thickened with primary sludge. There are two gravity thickeners, two anaerobic digesters and two centrifuges with piping in place so that one can be taken offline if needed.
Electrical Power Supply	Two separate and independent power sources, either from two separate utility substations or from a single substation and an on-site generator. The backup power supply shall be sufficient to operate all vital components during peak wastewater flow conditions, including critical lighting and ventilation.	None. On-site generators are provided.

6.5.3 Preliminary Nutrient Loading at Central Kitsap WWTP

The first PSNGP has proposed an action level TIN load limit of 306,000 pounds per year for Central Kitsap WWTP. Since 2016, Central Kitsap WWTP staff has been conducting monthly testing of the influent and effluent for nitrogen species in addition to the more frequent ammonia testing required in the NPDES permit and submitted this information to Ecology. The monthly nitrogen species testing results are shown in **Figure 6-10**. Average influent TKN concentration was 50.1 mg/L and effluent TIN concentrations ranged from 3.5 to 54.2 mg/L, with an average concentration of 25.8 mg/L.

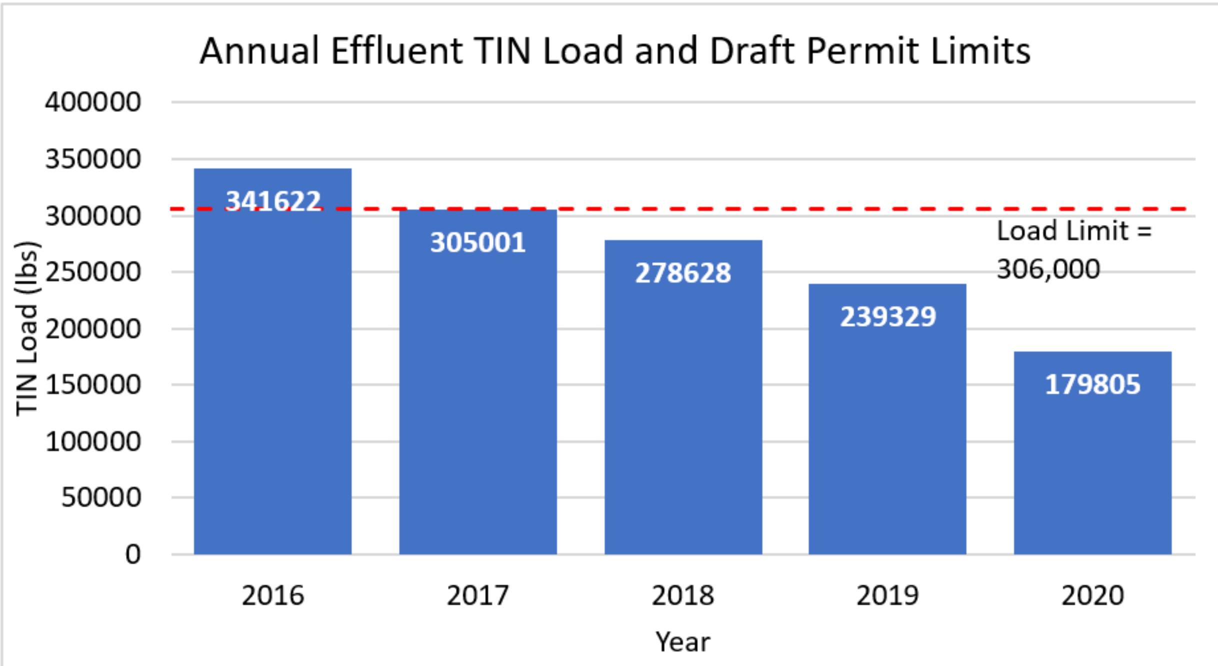
Figure 6-10 | Influent and Effluent Nitrogen Concentrations



The preliminary nutrient data was used in conjunction with effluent flow data to estimate annual TIN loading for comparison with the permit load limit in **Figure 6-11**. In a few instances, monthly data was not collected and the effluent TIN concentration was interpolated to estimate the load for that month. Estimated TIN effluent loading has decreased each year since 2016 and dropped below the proposed load limit starting 2017. An optimization study has been completed to evaluate the capacity of the secondary treatment system to achieve higher nitrogen removal, as documented in **Appendix K** *Summary of Field Testing of Biological Nutrient Removal Optimization* TM (HDR, 2022) and summarized in **Section 8**.

Additionally, it will be possible to further reduce TIN loading to the Puget Sound by implementing a recycled water program to divert effluent from the outfall. Central Kitsap WWTP has the treatment infrastructure needed to produce recycled water partially completed and additional work on the system is in progress. The water reuse program is discussed in more detail in **Section 9**.

Figure 6-11 | Central Kitsap Annual Effluent TIN Loads



6.6 Existing Wastewater Treatment Plant Capacity Evaluation

This section of the Plan documents the capacity of the existing WWTP. Capacity at the treatment plant consists of equipment capacity, hydraulic capacity, and process capacity. The Central Kitsap WWTP is required to meet the treatment process capacity based on the MMWWF rate but must be able to hydraulically handle the PHF rate with enough freeboard to prevent a spill. Current and projected flows were developed in **Section 3**, Population, Flow and Load Projections and are shown in **Table 6-14**, below.

Table 6-14 | Existing and Projected Central Kitsap WWTP Flows

Flow Description	Current Flows (Years 2018-2020)	2028 Projected flows	2042 Projected flows
Annual Average Flow (AAF)	3.50	4.0	5.4
Max Month Wet Weather Flow (MMWWF)	4.93	5.7	7.6
Max Month Dry Weather Flow (MMDWF)	4.00	4.6	6.2
Peak Daily Flow (PDF)	8.55	9.9	13.2
Peak Hour Flow (PHF)	14.0	16.2	21.6

Central Kitsap WWTP was originally constructed in 1977 with a PHF of 12.0 MGD. The Resource Recovery project in 2016 increased capacity to a design AAF of 6.6 MGD and PHF of 22.7 MGD. The plant is rated for a maximum month design flow of 6.0 MGD in the NPDES permit.

6.6.1 Mechanical Equipment Capacity

The design capacity of each existing major unit process is listed in **Table 6-15**.

Table 6-15 | Design Capacity of Unit Processes at Central Kitsap WWTP

System	Value
Septage Receiving Station	
Quantity of Screen	1
Capacity, each	250 gpm
Mechanical Fine Screen	
Quantity	2
Capacity, each	30 MGD
Grit Chambers	
Quantity	2
Volume, each	65,000 gal
Primary Clarifiers	
Quantity	2
Diameter	65 feet
Sidewater Depth	10.5 feet
Aeration Basins	
Number of Basins	4
Volume (each)	0.81 million gallons (MG)
Average Sidewater Depth	15.5 ft
Secondary Clarifiers	
Quantity	2
Diameter	90 feet
Sidewater Depth	12 feet
UV System	
Type	Low pressure, high output
Quantity	2 channels, 3 banks per channel, 14 lamps per bank
Dosage	24,800 uW-sec/cm^2
Capacity	15.5 MGD per channel
Rotary Drum Thickener	
Quantity	1
Capacity	400 lb/hr
Gravity Thickener	
Quantity	2
Diameter	45 ft
Sidewater depth	10 ft
Thickened Sludge Blend Tank	
Quantity	1
Volume	14,900 gallons
Anaerobic Digesters	
Quantity	2
Volume, each	86,000 cubic feet
Centrifuge	
Quantity	2
Capacity, each	1500 lb/hr

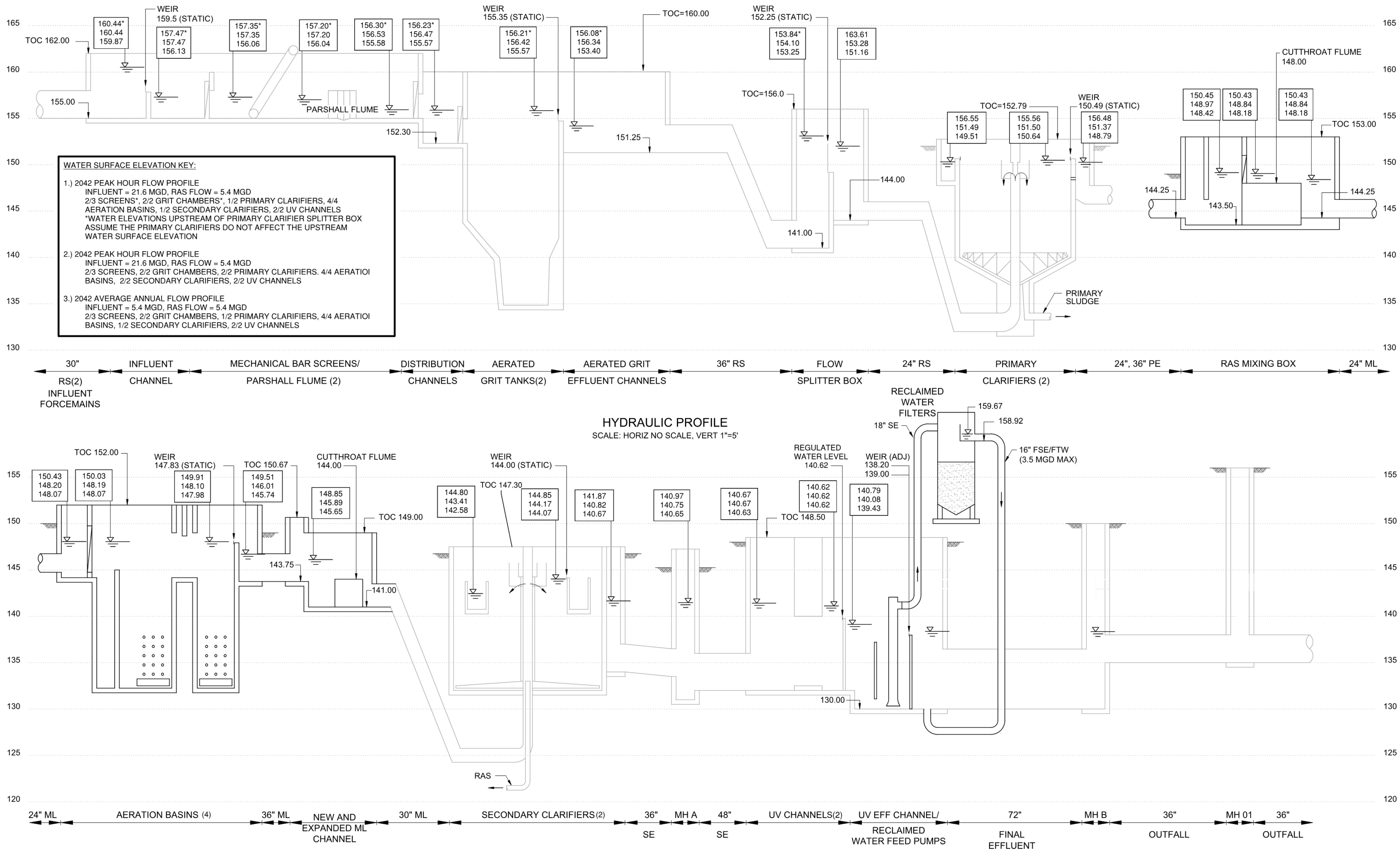
6.6.2 WWTP Liquid Stream Hydraulic Capacity

6.6.2.1 Hydraulic Capacity Analysis

To evaluate the hydraulic capacity of the existing WWTP, the treatment plant was modelled using Visual Hydraulics© based on the design and record drawings.

The hydraulic capacity was evaluated for flows up to the 2042 PHF of 21.6 MGD to identify how the existing plant hydraulics can be expected to perform during future flowrates. The model was run under two different flow scenarios, 2042 PHF and 2042 AAF. Under both scenarios all four aeration basins are put into service since no redundant aeration basin is required per Ecology's reliability requirement. Under 2042 PHF scenario, two sub-scenarios were modeled to simulate operation with one or two primary and secondary clarifiers in service, since a redundant primary and secondary clarifier is required per EPA's reliability requirement. As part of the analysis, hydraulic limitations were identified when the water level reached within 12-inch of freeboard below the top of a containment structure. The hydraulic profile at the projected 2042 AAF and PHF is shown in **Figure 6-12** below. The RAS flowrate was assumed to match the design of recycle rate of 100 percent of the AAF for all influent flowrates. A detailed summary of the input parameters used in the Visual Hydraulics Model is included as **Appendix L**.

Figure 6-12 | Central Kitsap WWTP Hydraulic Profile



6.6.2.2 Headworks Hydraulic Capacity

The headworks structure consists of an influent box, a manual bar screen and two mechanical fine screens in parallel each with a Parshall flume, and two grit chambers. Influent is pumped to the headworks structure from two off-site pump stations which pump into the headworks structure via two parallel 30-inch diameter forcemains. The 30-inch diameter forcemain piping is appropriately sized to pump flows up to the 2042 peak flow. The maximum rated flow capacity for each of the mechanical fine screens is 30 MGD. The hydraulic model predicts that at a flowrate of 18.5 MGD the grit chamber effluent weirs will become submerged (the downstream water surface elevation is higher than the weir crest). In this instance, this does not result in a critical hydraulic failure and is not expected to have any effect on the functionality of the grit chambers. The remainder of the headworks has sufficient hydraulic capacity in excess of the 2042 PHF of 21.6 MGD.

6.6.2.3 Primary Treatment Hydraulic Capacity

From the headworks structure, screened and de-gritted sewage flows through a single 36-inch diameter raw sewage pipe to the primary clarifiers flow splitter box, which distributes flows between the two primary clarifiers. Each primary clarifier has a 24-inch diameter influent pipe and effluent pipe.

Primary clarifiers flow splitter box, primary clarifiers and associated piping will be able to pass 2042 AAF without any issue. However, both the clarifier effluent weir and the flow splitter box weir will be submerged by about 12 inches at 2042 PHF with both clarifiers are online. The clarifier and flow splitter structure will be flooded at 2042 PHF if only one clarifier is online because the 24-inch diameter influent and effluent pipes are not big enough for that high flow.

6.6.2.4 Secondary Treatment Hydraulic Capacity

Effluent from the primary clarifiers combines in a common pipe that feeds the RAS splitter box, which mixes the primary effluent with RAS and distributes it between the four aeration basins. The aeration basins have several modes of operation, some of which keep the RAS and primary effluent separate, but the higher mixed liquor flows were modeled to provide sufficient capacity for all operational modes. Flow in the aeration basins passes through six zones separated with baffle walls before it is collected in a common mixed liquor channel then split between two secondary clarifiers. The 90-foot diameter secondary clarifiers have 30-inch diameter influent pipes and 36-inch diameter effluent pipes.

The aeration basins are capable of passing the 2042 PHF with all four basins in operation.

The secondary clarifiers are capable of passing the 2042 PHF with both clarifiers in operation. With only one secondary clarifier operating, the clarifier effluent weir and upstream mixed liquor channel weir will be submerged, resulting in potentially high effluent solids level.

Ecology requires the secondary clarifiers be capable of passing 75 percent of the PHF with the largest clarifier out of service. At Central Kitsap WWTP, the secondary clarifier effluent launder will back up and clarifier weir will be submerged by approximately 3 inches under this condition.

6.6.2.5 UV Channels and Effluent Basin Hydraulic Capacity

Secondary effluent from the clarifiers flows though separate effluent pipes into a common UV influent channel which splits flow between two disinfection channels, each with three UV banks. The water surface in the UV channels is controlled by motor operated slide gate which automatically adjusts to maintain the upstream water level at a constant elevation. After the UV control weir, disinfected effluent passes through a channel where the reclaimed water pumps can draw water for reuse. Any unused effluent goes over a final weir and in to a 72-inch diameter effluent pipe which ultimately conveys flows to the outfall. All these components have hydraulic capacity that exceeds the 2042 PHF of 21.6 MGD. The outfall piping and the outfall structure were not modeled.

6.6.2.6 Summary

The hydraulic analysis indicates that the headworks, aeration basins, and UV disinfection structure have sufficient capacity to convey flows throughout the entire 20-year design period.

The primary clarifier effluent weir will be submerged at 2042 PHF even when both clarifiers are in operation. At the same time, they do not meet Ecology's redundancy criterion of having capacity for 50 percent of design flow with one largest unit out of service. Therefore, one additional primary clarifier is needed by 2042.

Although the secondary clarifiers can pass 2042 PHF with both units in operation, they do not meet Ecology's redundancy criterion of having capacity for 75 percent of design flow with one largest unit out of service. Therefore, one additional secondary clarifier is needed by 2042.

6.6.3 Treatment System Process Capacity

6.6.3.1 Primary Clarifier Capacity

Primary clarifier capacity is mainly assessed based on the surface overflow rate. The typical primary clarifier surface overflow rate under average flows is 800 to 1,200 gallons per day per square foot (gpd/sf). The typical primary clarifier surface overflow rate under peak flows is 2,000 to 3,000 gpd/sf.

Table 6-16 summarizes the surface overflow rate under various operating conditions. It appears the surface overflow rate will be reaching the upper limit when a single primary clarifier is in operation during 2028 AAF. Both primary clarifiers will be needed when flow exceeds AAF for a reliable performance. A single primary clarifier will be able to handle 50 percent of the peak flow in 2028 per Ecology's redundancy requirement. However, before flows reach 2042 conditions, additional primary clarifier will be required to treat maximum month and peak flows with a more reasonable surface overflow rate.

Table 6-16 | Primary Clarifier Surface Overflow Rate

Parameter	AAF	MMWWF	PHF	50% of PHF [1]	AAF	MMWWF	PHF	50% of PHF[1]
Design Year	2028	2028	2028	2028	2042	2042	2042	2042
Flow (MGD)	4.0	5.7	16.2	8.1	5.4	7.6	21.6	10.8
No. of clarifiers in service	1	2	2	1	2	2	2	1
Surface Overflow Rate (gpd/sf)	1,205	859	2,441	2,441	814	1,145	3,255	3,255
Surface Overflow Rate Target (gpd/sf)	800-1,200	800-1,200	2,000-3,000	2,000-3,000	800-1,200	800-1,200	2,000-3,000	2,000-3,000

Note:
1. Condition representing Ecology's redundancy requirement

6.6.3.2 Aeration Basin Capacity

The existing primary clarifiers, aeration basins, secondary clarifiers, gravity thickeners, RDT, TWAS blending tank, anaerobic digesters, and dewatering centrifuges were modeled using Biowin™ software to establish the solids mass balance and determine the existing treatment process capacity. The process model was evaluated under both current and future AAF, MMWWF, and MMDWF conditions.

The County conducted a two-week wastewater sampling campaign in October 2020 to characterize various wastewater and sludge streams throughout the plant processes. The sampling results were used to develop the influent characteristics for the process model.

Since the purpose of this modeling analysis is to establish a baseline mass balance for the process unit capacity evaluation, instead of optimizing the BNR performance, the modeling was conducted in steady state with the following goals:

- Meeting the current BOD and TSS limits of 30 mg/L on a monthly average basis
- Meeting the proposed action level TIN load limit of 250,000 pounds per year (equivalent to 685 ppd) as part of the Final Draft Nutrient General Permit for Central Kitsap WWTP. Note that the final PSNGP revised the load limit to 306,000 pounds per year.
- Providing sufficient SRT to allow year-round full nutrification and denitrification while maintaining a reasonable mixed liquor suspended solids (MLSS) level

The assumptions of this modeling include:

- All the models are executed at 14 days of total SRT with all four aeration basins and two secondary clarifiers in service in 4-stage configuration. The 14-day total SRT corresponds to 9-day aerobic SRT per nitrification design basis for 12 deg C minimum winter temperature.
- All the models are executed with 65 percent RAS rate, 200 percent IMLR rate, and no methanol addition. The change of these parameters will not impact the solids production much. Thus, these runs represent a uniform baseline case.
- DO levels in all aerobic zones are set at 2 mg/L.
- Septage and grease/scum flow ad loads are assumed to be stable in all runs.
- TWAS from Manchester, Kingston and Squamish WWTPs are included based on the characteristics from the BioWin modeling results of those individual plants

The results of various simulations at AAF, MMWWF and MMDWF in 2020, 2028 and 2042 are shown in **Table 6-17.** The process model simulations predict that the plant can achieve the effluent BOD and TSS levels and TIN load that are much lower than the current or upcoming permit. At a total SRT of 14 days, the MLSS is within a reasonable range through 2042, indicating the four existing aeration basins have sufficient capacity to treat the flow and loads as well as achieve BNR through 2042.

It is anticipated the Nutrient General Permit will become more stringent with potential effluent TIN limit of 3 to 10 mg/L in the future. The alternatives to optimize the current BNR operation in order to meet those TIN limits are discussed in **Appendix K**. The implication of BNR optimization on the plant capacity is also discussed in that document.

Table 6-17 | BioWin™ Process Model Simulation Results

Parameter	2020 AAF	2020 MMWWF	2020 MMDWF	2028 AAF	2028 MMWWF	2028 MMDWF	2042 AAF	2042 MMWWF	2028 MMDWF
Flow (MGD)	3.5	4.9	4.0	4.0	5.7	4.6	5.4	7.6	6.2
Temperature (°C)	18	12	18	18	12	18	18	12	18
Influent Alkalinity (mg/L)	225	190	250	225	190	250	225	190	250
No of AB Basins	4	4	4	4	4	4	4	4	4
Target DO (mg/L)	2	2	2	2	2	2	2	2	2
SRT (days)	14	14	14	14	14	14	14	14	14
MLSS (mg/L)	1,600	2,100	1,900	1,800	2,400	2,200	2,500	3,200	2,900
Effluent TSS (mg/L)	5.3	6.8	6.3	6.1	7.8	7.2	6.1	7.8	7.3
Effluent BOD (mg/L)	2.3	3.0	2.6	2.6	3.3	3.0	2.7	3.4	3.0
Effluent Ammonia (mg/L)	0.08	0.18	0.08	0.08	0.18	0.08	0.08	0.17	0.07
Effluent Nitrate and Nitrite (mg/L)	12.8	10.4	10.7	12.3	10.0	10.3	11.2	9.2	9.3
Effluent TIN (mg/L)	12.8	10.6	10.8	12.4	10.1	10.4	11.3	9.3	9.4
Annual TIN Load (lbs/yr)	136,800			151,100			185,900		
Effluent Alkalinity (mg/L)	64	61	100	66	62	101	69	65	105
Primary Sludge (ppd)	5,400	6,100	5,900	6,100	7,000	6,800	8,300	9,300	9,200
Septage (ppd)	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600
WAS Solids (ppd)	3,000	3,700	3,500	3,400	4,300	4,000	4,600	5,600	5,300
TWAS Solids (ppd)	2,900	3,600	3,400	3,300	4,100	3,800	4,400	5,400	5,100
TWAS EXT Solids (ppd)	700	1,100	1,000	900	1,400	1,300	1,300	2,000	1,700
Digester Feed (ppd)	12,400	14,200	13,700	13,700	15,900	15,300	17,300	20,100	19,300
Centrifuge Feed (ppd)	6,200	7,100	6,900	6,800	7,900	7,700	8,700	10,200	9,900
Dewatered Biosolids (% Solids)	22%	23%	23%	24%	24%	24%	24%	24%	24%
Dewatered Biosolids (ppd)	6,000	6,800	6,700	6,600	7,600	7,400	8,400	9,800	9,500

6.6.3.3 Secondary Clarifier Capacity

Secondary clarifier capacity is mainly assessed based on the surface overflow rate and solids loading rate. The typical secondary clarifier surface overflow rate is 400 to 700 gpd/sf under average flows, and 800 to 1,600 gpd/sf under peak flows. The typical secondary clarifier solids loading rate is 20 to 30 pounds per day per square foot (ppd/sf) under average flows, and 40 ppd/sf under peak flows.

Table 6-18 summarizes the surface overflow and solids loading rates under various operating conditions. From solids loading perspective, the two existing clarifiers will have sufficient capacity in 2028, but not under 2042 peak flow condition. From surface overflow rate perspective, two secondary clarifiers will be able to treat flows through nearly 2042. However, they will not meet Ecology's redundancy requirement where a single clarifier needs to handle 75 percent of peak flow even in 2028. Considering the hydraulic constrains discussed above, it is recommended to install a third secondary clarifier before 2028.

Table 6-18 | Secondary Clarifier Surface Overflow Rate

Parameter	AAF	MMWWF	PHF	75% of PHF[1]	AAF	MMWWF	PHF	75% of PHF[1]
Design Year	2028	2028	2028	2028	2042	2042	2042	2042
Flow (MGD)	4.0	5.7	16.2	12.2	5.4	7.6	21.6	16.2
No. of Secondary Clarifiers in service	1	2	2	1	2	2	2	1
Surface Overflow Rate (gpd/sf)	629	448	1,273	1,910	424	597	1,698	2,546
Surface Overflow Rate Target (gpd/sf)	400-700	400-700	800-1,600	800-1,600	400-700	400-700	800-1,600	800-1,600
Solids Loading Rate (ppd/sf)	16	15	34[2]		15	26	57[2]	
Solids Loading Rate Target (ppd/sf)	20-30	20-30	40		20-30	20-30	40	40

Notes:

1. Condition representing Ecology's redundancy requirement
2. Solids loading rate at PHF is calculated based on the MLSS at MMWWF and RAS flowrate equal to MMWWF.

6.6.4 Solids Stream Capacity

The Central Kitsap WWTP solids handling system consists of two gravity thickeners, one RDT and polymer system, a TSBT, two anaerobic digesters, and two centrifuges. The following sections discuss the capacity of each major component in the solids handling system.

6.6.4.1 Gravity Thickener Capacity

Gravity thickener capacity is assessed based on the surface overflow rate and solids loading rate. The typical gravity thickener surface overflow rate is 400 to 800 gpd/sf. The typical gravity thickener solids loading rate is 20 to 30 ppd/sf. **Table 6-19** summarizes the gravity thickener surface overflow and solids loading rates under various operating conditions. When only one gravity thickener is online, the surface overflow rates and solids loading rates are all well below the design upper limit, suggesting these two gravity thickeners are over designed for primary sludge and septage flow and load. At this low loading rate, septic conditions will likely be developed and cause odors problems. Fermentation may also occur thus reduce the thickened sludge volatile solids content. This could be one of main reasons that the anaerobic digesters normally have low VSR since certain VSR occurs within the gravity thickeners. Considering the age and poor condition of these gravity thickeners, it is recommended to replace them with the new thickening process.

Table 6-19 | Gravity Thickener Surface Overflow Rates and Solids Loading Rates

Parameter	AAF	MMWWF	AAF	MMWWF
Design Year	2028	2028	2042	2042
Primary Sludge & Septage Flow (gpd)	265,800	301,800	353,700	393,700
No. of Gravity Thickeners in service	1	1	1	1
Surface Overflow Rate (gpd/sf)	167	190	222	248
Primary Sludge & Septage Solids (ppd)	10,320	11,220	12,520	13,520
Solids Loading Rate (ppd/sf)	7	7	8	9

Note:

Primary sludge TSS ranges 2000 to 8000 mg/L. A conservative TSS of 3000 mg/L is used to calculate the primary sludge flow and gravity thickener surface overflow rate.

6.6.4.2 RDT Capacity

The RDT can be operated continuously or intermittently and has a hydraulic capacity of 208 gallons per minute (gpm) and maximum solids loading rate of 400 pounds per hour (lb/hr). A single 20 gpm TWAS pump feeds thickened sludge from the RDT to the TSBT. Currently the RDT produces an average of approximately 19,000 gpd of thickened sludge at 5.8 percent solids.

Table 6-20 summarizes the projected WAS production by the process model and the anticipated RDT operating hours in each week. The RDT has sufficient capacity to meet existing and future WAS thickening needs.

Table 6-20 | Projected RDT Operation

Parameter	AAF	MMWWF	AAF	MMWWF	AAF	MMWWF
Design Year	2020	2020	2028	2028	2042	2042
WAS Solids (ppd)	3,000	3,700	3,400	4,300	4,600	5,600
Assumed WAS Concentration (mg/L)	4,100	5,200	4,700	6,000	6,300	8,000
WAS Flow (gpd)	87,600	85,500	87,100	84,500	86,700	84,400
RDT Operating Hours (hours per week)	53	65	60	74	80	99

6.6.4.3 Anaerobic Digester Capacity

Central Kitsap has two 65-foot diameter, 645,000-gallon anaerobic digesters which are operated in parallel. Sludge is pumped to the digesters by the digester feed pumps which are equipped with VFDs and can pump flows from 4 to 30 gpm.

To meet the pathogen reduction requirement per EPA's Part 503 Biosolids Rule, the SRT in the mesophilic anaerobic digestion process must be longer than 15 days at 55 degree C and higher. As a general design guideline, the volatile solids loading shall be maintained at 0.02 to 0.14 ppd/sf to not overload the digesters. **Table 6-21** summarizes the estimated digester SRT and volatile solids loading rate under various conditions. The SRT and volatile solids loading appears to be within the range through 2042 when both digesters are in operation. But in the case when one digester needs to be taken offline, both the SRT and volatile solids loading will approach the limit in 2020 and exceed the limit in 2028. Given the poor condition of the existing digesters discussed in the condition assessment section, additional biosolids handling capacity is recommended in the near term for redundancy and reliability.

Table 6-21 | Projected Digester Operation

Parameter	AAF	MMWWF	AAF	MMWWF	AAF	MMWWF
Design Year	2020	2020	2028	2028	2042	2042
Digester Feed Flow (gpd)	35,000	40,000	39,000	45,000	49,000	67,000
Digester Feed Solids (ppd)	12,400	14,200	13,700	15,900	17,300	20,100
Digester Feed TVS%	86%	86%	86%	86%	86%	86%
SRT (days)[1]	37	32	33	29	26	23
VS Loading (ppd/ft^3)[1]	0.06	0.07	0.07	0.08	0.09	0.10

Note:
1. when both digesters are in operation

6.6.4.4 Centrifuge Capacity

The centrifuge sludge feed pumps draw sludge from the digested sludge withdrawal loop and pump sludge to the centrifuges at flows of 80-265 gpm. The remainder in the loop is recycled back to the digester. Currently one of two centrifuges is run three days per week for 10-12 hours. Each centrifuge has a maximum flow rate of 225 gpm and a maximum solids loading rate of 3,300 dry lbs/hr. The centrifuges dewater the digested solids from approximately 2 percent to 25 percent. **Table 6-22** summarizes the projected centrifuge feed and the anticipated centrifuge operating hours in each week. Two centrifuges have sufficient capacity to meet existing and future dewatering needs.

Table 6-22 | Projected Centrifuge Operation

Parameter	AAF	MMDWF	AAF	MMDWF	AAF	MMDWF
Design Year	2020	2020	2028	2028	2042	2042
Centrifuge Feed Solids (ppd)	6,200	7,100	6,800	7,900	8,700	10,200
Centrifuge Feed Solids Conc.	2%	2%	2%	2%	2%	2%
Centrifuge Feed Flow (gpd)	37,200	42,600	40,800	47,400	52,200	61,200
No. of Centrifuges in service	1	1	1	1	1	1
Centrifuge Operating Hours (no. of hrs per week)[1]	19	22	21	25	27	32

Note:
1. Based on the hydraulic loading capacity of the centrifuges (225 gpm), which is the limiting factor for the centrifugate capacity

6.7 Summary of Deficiencies and Recommendations

Table 6-23 provides a summary of the main findings for each unit process based on the condition assessment, code review, hydraulic analysis and treatment capacity analysis described above.

Table 6-23 | Overall Unit Process Capacity and Deficiencies

Unit Process	Physical Condition[1]	Capacity	Recommendation
Preliminary Treatment			
Fine Screen	Good (mechanical screens) Poor (manual screen)	30 MGD x 2, peak	Replace the manual screen
Grit Removal	Good	30 MGD, peak	None
Grit Pump	Good	220 gpm x 4	None
Grit Washer	Very Good		None
Primary Treatment			
Primary Clarifiers	Fair	< 21.6 MGD (2042 PHF)	Install a new clarifier by 2042
Primary Sludge Pumps	Good	200 gpm x 2	Install more pumps with the new primary clarifier
Secondary Treatment			
Aeration Basins	Good (AB 1 and 2) Very Good (AB 3 and 4)	Over 7.6 MGD, maximum month	Install ammonia/nitrate/nitrite probes. Perform BNR optimization
Aeration Blowers	Fair (Blower 2) Good (Blowers 3 &4)	Approximately 9,000 SCFM @ 7.7 psi, firm	Implement the MOV control strategy. Replace Aeration Blowers 1 & 2. Replace Channel Blowers 1 & 2
Aeration basin piping and valves	Good	N/A	Complete the planned diffuser replacement
Secondary Clarifiers	Fair	Between 16.2 MGD (2028 PHF) and 21.6 MGD (2042 PHF). Cannot meet EPA redundancy requirement by 2028	Recoat the walkways. Clean and recoat the corroded areas on the clarifier drive equipment. Install a new clarifier by 2028
RAS Pumping	Fair	900 gpm x 5	Install more RAS pump with the new secondary clarifier
WAS Pumping	Fair	N/A	None
Disinfection and Effluent			
UV System	Good	31 MGD, Peak	None
Septage			
Septage Receiving Station	Good	400 gpm	Construct a redundant septage receiving station and upgrade existing station as needed
Septage Pumps	Poor	205 gpm x 2	Replace the cyclone and classifier within the next 5 years
Septage Cyclone and Classifier	Poor	N/A	Replace the cyclone and classifier within the next 5 years
Gravity Thickenings			
GT Control Structure	Poor	N/A	Replace the gravity thickener control structure
Gravity Thickeners	Poor	Oversized for 2042 primary sludge and septage	Clean and repair the corroded areas and improve ventilation. Replace gravity thickeners with other thickening technology
Thickened Primary Sludge Pumps and Grinder	Very Good (pumps) Fair (grinders)	163 gpm x 2	Add support under the pump motors. Replace grinders in the next 12 to 15 years

Unit Process	Physical Condition[1]	Capacity	Recommendation
WAS Thickening			
Rotary Drum Thickener	Very Good	208 gpm & 400 lb/hr	None
Thickened Sludge Blending Tank	Very Good		None
TWAS Pump	Very Good	20 gpm	Add support under the motor
Hauled Sludge Transfer Pump	Very Good	400 gpm	Add support under the motor
Thickened Sludge Circulation Pump	Very Good	400 gpm	Add support under the motor
Anaerobic Digestion and Digester Gas Handling			
Anaerobic Digesters	Very Poor	0.64 MG x 2. Can handle 2042 solids without redundant unit	Repair digester annular seal, PVRVs, and any failed coating, as planned in the digester rehabilitation project. Provide additional biosolids handling capacity in the near term for redundancy and reliability. Establish a preventative maintenance program to exercise major valves annually
Digester Withdrawal Pumps	Fair	1175 gpm x 2	Plan for increased maintenance requirements for the next 12 to 15 years until replacement
Sludge Mixing Pumps	Poor	4440 gpm x 2	Replace sludge mixing pumps and sludge valves, as planned in the digester rehabilitation project
Sludge Recirculation Pumps	Fair	250 gpm x 2	Plan for increased maintenance requirements for the next 12 to 15 years until replacement
Boilers	Fair (Boiler 1) Poor (Boiler 2)	2,929,000 BTU/HR x 2	Repair the roof Plan for increased maintenance before replacing in the next few years
Heat Exchangers	Fair	250 gpm x 2	Plan for increased maintenance before replacing in the next few years
Hot Water Circulation Pumps	Very Poor	250 gpm x 2, 120 gpm, 50 gpm	Plan on replacing the hot water circulation pumps in the next 2 years
Sediment/Condensate Trap	Good	N/A	None
Waste Gas Burner	Good	N/A	None
Digester Gas Treatment and Cogeneration			
Gas Treatment System	Good	N/A	Improve digester gas supply and consistent quality
Cogeneration System	Good	N/A	Necessary maintenance and improvement to restart the system
Sludge Dewatering			
Centrifuge Feed Pumps	Fair	80-265 gpm x 2	Plan for increased maintenance requirements for the next 12 to 15 years, until replacement
Centrifuges	Very Good	225 gpm and 3,300 dry lbs/hr, x 2	None
Centrate Pumps	Fair	220 gpm x2	Plan for increased maintenance requirements for the next 12 to 15 years, until replacement
Power Distribution			

Unit Process	Physical Condition[1]	Capacity	Recommendation
Electrical Service	Fair		All electrical equipment shall be maintained, i.e. inspected, cleaned and logged, per NFPA 70. Repair or replace ATS-1 internal to SWGR-2960. Inspect, clean and recoat the transformers (XFMR-3010 and XFMR-3020) enclosures. Replace main switchgear SWBD-1
Generator	Very Good or Good except GEN-2994 is Very Poor		Complete a process and load study to determine if GEN-2994 is needed and should be replaced. Perform GEN-2996 maintenance
MCCs	Very Good or Good except MCC-2 is Very Poor		Replace MCC-2
Panels	Fair to Good		Replace PNL-1990, PNL-5012, Operations Facilities Buildings 480-volt and 120/240-volt panelboards, Shop and Maintenance Building transformer and 480-volt panelboard fused disconnect. Replace in-plant pump station panel PNL-1090 and biofilter sprinkler panel PNL-1067. Control panel housekeeping
Others	N/A		Improve headworks electrical room HVAC. Assess Digester Control Building HVAC and hazard rating. Evaluate electrical control and wiring installation for the boilers. Replace rusted wireway in Utilidor
Support Systems			
Headworks Odor Control	Good	9900 SCFM	Perform routine biofilter media replacement every 3 to 4 years
Septage Odor Control	Poor	N/A	Replace the bearing on the fan
Gravity Thickener Odor Control	Good (Biofilter) Poor (Blower)	N/A	Perform routine biofilter media replacement every 3 to 4 years. Plan for increased maintenance requirements until replacement
Dewatering Odor Control	Good	N/A	Reassess in 3 to 5 years
In-plant pump station	Very Poor	675 gpm	Replace pump station
2W Water	Fair	150 gpm x 3	None
3W Water	Fair Very Poor (Automatic strainer)	400 gpm x 3	Plan for increased maintenance requirements for the next 2 to 10 years, until replacement

Note:

1. Component condition rating based on **Table 6-3**

SECTION 7

Collection and Conveyance System Analysis

7.1 Introduction

The Central Kitsap system was modeled previously using the Danish Hydraulic Institute's (DHI's) MIKE URBAN 2019 and documented in **Appendix A**. The previous modeling effort included assessment of three planning horizons: 2017 (existing condition), 2038, and Build-Out. Additionally, CIP projects for the 2038 and Build-Out planning horizons were developed and modeled. The provided models were assessed as being appropriate for this analysis by Murraysmith [now Consor] accepting the limitations as outlined in the Central Kitsap *Collection and Conveyance System Model Review/Coordination* TM (Murraysmith [now Consor], 2021), included as **Appendix M**. Based on documentation from the PER, the models provide results for a PHF condition for a 25-year 24-hour storm for the 2017, 2038 and Build-Out planning horizons which were used to analyze the system capacity. Comparison of peak flows simulated in the 2017 model scenario to 2020 flow data indicated that the planning horizons used of the modeling are in line with more recent flows, therefore the model results are appropriate for capacity analysis. Population and low projections in the model are similar to current projects and the model results are still valid for the planning horizon.

7.2 Limitations

Murraysmith (now Consor) did not model the Central Kitsap collection and conveyance system. The results in this section are taken from the 2017_KitsapCo_Final, 2038_KitsapCo_FINAL, and Buildout_KitsapCo_FINAL model as provided by BHC. The 2017 Peak, 2038 Peak and Build Out Peak scenarios were used to run the model.

7.3 Capacity Criteria

The following criteria were used to determine if a collection and conveyance facility was capacity limited and in need of upsizing:

- Manholes are considered to have SSOs when the water surface elevation in a manhole exceeds the rim elevation. SSOs at manholes and pump stations are public health hazards and a source of contaminants that adversely impacts the water quality of streams, lakes, marine waters, and groundwater.

- Pipes are considered surcharged when the water surface elevation in the upstream or downstream manhole connection exceeds the pipe crown. This condition indicates that the sewer has reached flow capacity and hydraulic flow characteristics have worsened.

- Pipes with velocities exceeding 7 feet per second (fps) are considered capacity limited. High velocities cause increased scouring and wear of pipe materials and shorten the useful life of pipe. High velocities also cause turbulent flow conditions and higher energy requirements for pumping equipment.

- Lift stations are under capacity when the flow to a pump station meets or exceeds the pump station firm capacity. The firm capacity of a pump station is the pumping capacity of the station when the largest pump is out of service.

7.4 Analysis Results

The results of the model from BHC are summarized in this section. Assets that were modeled as failing the criteria for the planning horizons are shown in **Figure 7-1** and **Figure 7-2**, and the total counts of SSOs and surcharged gravity pipes are included in **Table 7-1**. The pipe surcharge shown in **Table 7-1** and in **Figure 7-1** flags any gravity pipe whose end node has a water surface elevation greater than the crown of the pipe at that node connection. Force mains are only considered under capacity if they fail the velocity criteria.

Table 7-1 Pipe and Manhole Capacity Criteria

Scenario	Surface Sewer Overflows (SSO)	Number of Pipes Surcharged (Either end)	Number of Pipes Velocity Exceeding 7fps
2017	0	76	22
2038	1[1]	114	27
Build-Out	22	279	26

Note:

1. This is being alleviated with construction of Johnson to Norum.

There are pipes that fail the velocity criteria in the 2017 planning horizon that do not fail in the later planning horizons and pipes that fail the velocity for the 2038 planning horizon that do not fail in the Build-Out planning horizon. These instances were checked, and the explanation is that the locations are subject to greater downstream surcharging in the later planning horizon, resulting in a backwater effect that slows the velocities.

The results of the Pump Station Capacity and Peak Hour Inflows are included in **Table 7-2**. The firm capacity values match the analysis included in **Section 5** and the flows shown here are taken from the BHC PER for consistency across these modeling efforts.

Figure 7-1 | Central Kitsap Basin Capacity Limitations with SSOs

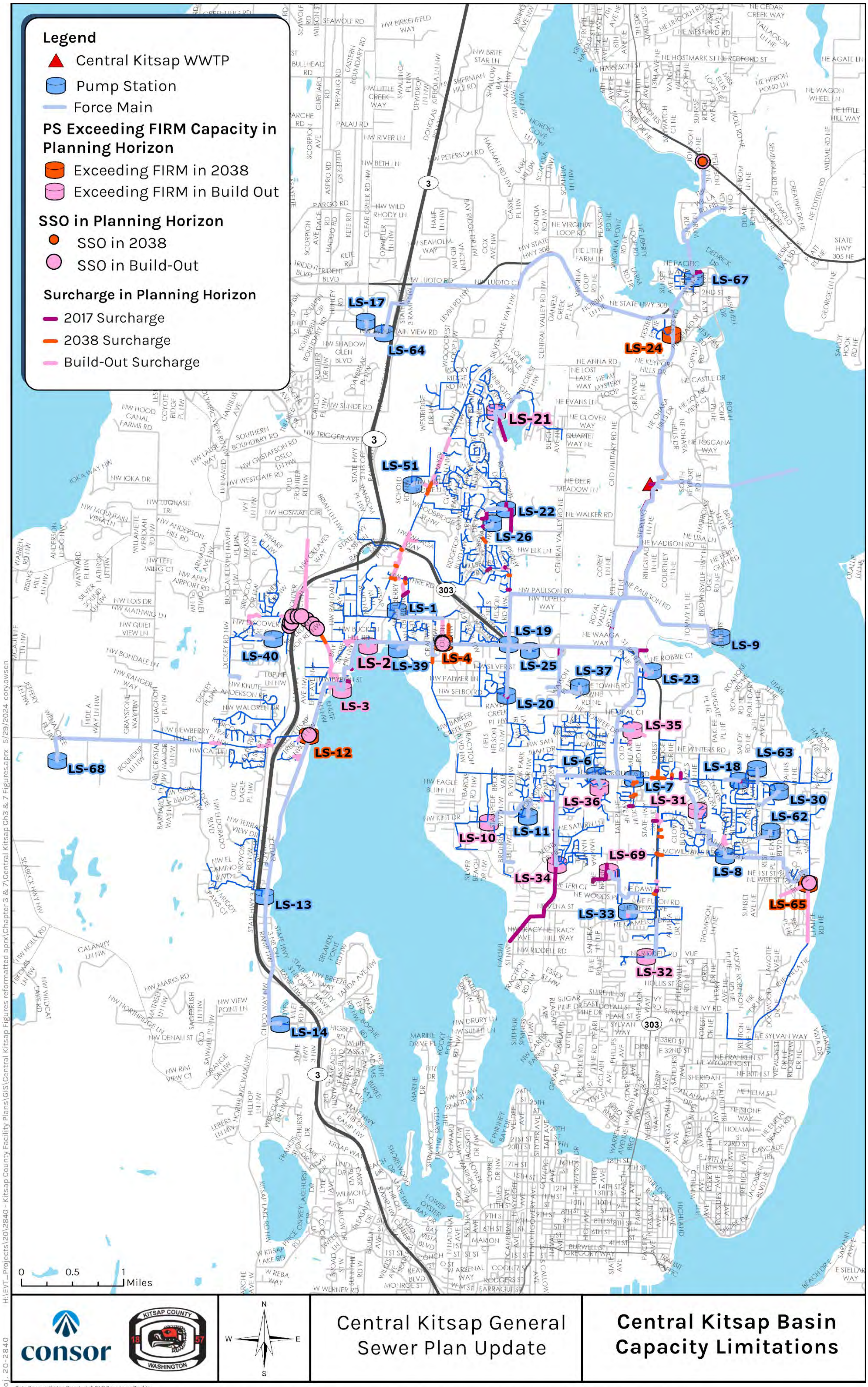
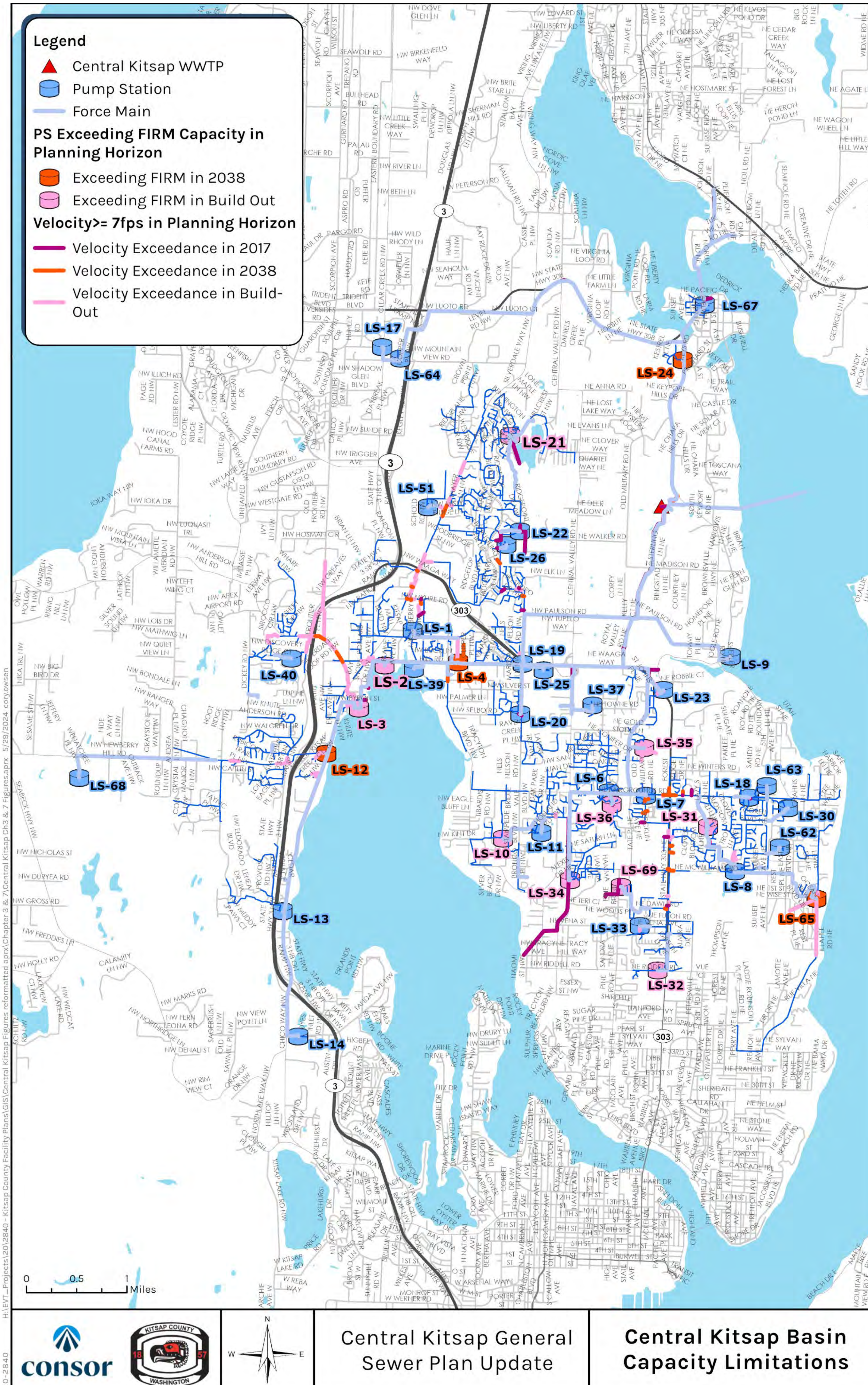


Figure 7-2 | Central Kitsap Basin Capacity Limitations



Data Sources: Kitsap County, WA DNR Base Layer Credits:
Disclaimer: Consor Engineers and Kitsap County make no representations, express or implied, as to the accuracy, completeness and timeliness of the information displayed. This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.

Table 7-2 | Pump Station Capacity and Peak Hour Inflows

Pump Station	Firm Capacity (gpm)	2017 Peak Flow (gpm)	2038 Peak Flow (gpm)	Build-Out Peak Flow (gpm)
PS-1	2,800	1,005	1,770	2,315
PS-2	320	125	230	***[320]***
PS-3	1,800	580	1,200	***[2,315]***
PS-4	3,000	1,965	***[3,825]***	***[4,950]***
PS-6	2,990	1,205	1,285	1,340
PS-7	4,200	1,365	2,155	3,320
PS-8	1,200	470	510	725
PS-9	400	10	10	10
PS-10	270	30	150	***[280]***
PS-11	230	40	55	120
PS-12	545	400	***[660]***	***[1,520]***
PS-13	400	210	275	375
PS-14	300	40	40	40
PS-17	3,000	2,055	2,640	2,640
PS-18	300	120	220	260
PS-19	3,000	480	780	1,075
PS-20	426	85	155	250
PS-21	220	85	195	***[220]***
PS-22	450	405	390	415
PS-23	600	60	120	555
PS-24	6,400	5,215	***[6,800]***	***[6,800]***
PS-25	150	15	15	15
PS-26	70	10	10	10
PS-30	160	25	30	35
PS-31	40	20	30	***[80]***
PS-32	165	75	105	***[175]***
PS-33	220	25	40	155
PS-34	900	830	830	***[1,790]***
PS-35	112	60	85	***[370]***
PS-36	150	100	110	***[170]***
PS-37	150	10	20	60
PS-39	110	5	5	5
PS-40	70	5	10	20
PS-51	100	5	45	95
PS-62	50	5	35	40
PS-63	129	40	40	40
PS-64	70	5	5	5
PS-65	313	40	***[330]***	***[675]***
PS-67	4,500	4,445	4,445	4,445
PS-68	310	5	5	5
PS-69	141	40	110	***[165]***

Note:
Flows exceeding the firm capacity are bracketed and in bold italics.

These results indicate that no pump stations exceed the firm capacity in the 2017 planning horizon, four pump stations (PS-4, PS-12, PS-24, and PS-65) exceed the firm capacity in the 2038 planning horizon, and fourteen pump stations (PS-2, PS-3, PS-4, PS-10, PS-12, PS-21, PS-24, PS-31, PS-32, PS-34, PS-35, PS-36, PS-65, and PS-69) exceed the firm capacity in the Build-Out planning horizon.

7.5 Capital Improvement Plan Model Runs

Model runs were performed with improvements to both pump stations and pipe sizes to remove flow restrictions and to size improvements. These improvements are described in Section 11 Capital Improvement Plan.

Assets violating the capacity criteria for the 2017 model scenario are generally planned to be addressed on the 6-year (2023-2028) CIP. Assets needing increased capacity for the 2038 and build-out model scenarios are planned to be addressed on the 20-year CIP.

Given the age of the model, it is recommended to update the system-wide model with additional control points for more accurate model results.

SECTION 8

Wastewater Treatment System Analysis

The Central Kitsap WWTP improvement alternatives considered for plant improvements for the 6-year and 20-year planning horizons are described in this section. Projected increases in flow and loading to the WWTP, aging equipment and the new PSNGP are the primary drivers for the improvements to allow the plant to consistently achieve the required effluent quality.

This section primarily summarizes two previous alternatives analysis TMs. Minor maintenance, repairs, and direct replacements identified in the condition assessment Table 6-23 are discussed briefly herein, but are not subject to a full alternatives analysis. These items as well as the preferred alternatives identified in this section will be included in the CIP in Section 11.

The *Central Kitsap WWTP Solids Handling Improvement Recommendations* (Appendix N) focuses on the solids process analysis including septage receiving, gravity thickening, anaerobic digestion, the in-plant pump station, and associated support systems because these processes were identified as being in poor condition and therefore are high priority for replacement. The memo was produced ahead of the larger facility planning effort to allow the County to identify and begin design of solids process improvements ahead of completion of the Plan.

The *Summary of Field Testing of Biological Nutrient Removal Optimization* (Appendix K) focuses on optimization of the secondary treatment system for nitrogen removal. This was prioritized because of the implementation of the PSNGP, which imposed a nitrogen limit on Central Kitsap WWTP for the first time.

Other processes, namely the headworks, primary treatment, and disinfection processes, have been upgraded recently and are generally in good condition, so they did not receive extra focus but are briefly summarized here also.

8.1 Overview of Improvements

The current condition of each unit process and any needed improvements and alternative analysis are briefly summarized in the paragraphs that follow. Figure 8-1 shows the site plan of WWTP with the major unit process requiring improvements and alternatives analysis identified. Minor replacements are not included in the figure. More detailed descriptions of each process and associated alternatives analysis and improvements can be found later in this section.

The headworks facility provides preliminary treatment systems at Central Kitsap WWTP and include the screening and grit removal. The manual bar screen is in poor condition and should be replaced in-place with a corrosion-resistant screen and the HVAC system should be improved to provide more ventilation. Otherwise, the headworks facility and associated equipment is in good condition and has sufficient capacity, so no additional upgrades are required and further analyses are not considered in this section. These improvements are relatively minor, so they are not included in Figure 8-1.

Primary treatment at Central Kitsap WWTP is achieved with primary clarifiers. The clarifiers are in fair condition but do not have sufficient capacity to meet 2042 flows, so installing an additional primary clarifier and associated primary sludge pump will be required. Additionally, the scum pumps are aging and will need to be replaced. The required capacity expansion and pump replacement is relatively straightforward, so alternatives were not developed and analyzed for the primary treatment process and further discussion is not included in this section. The planned location of the new primary clarifiers is shown in **Figure 8-1**.

Secondary treatment systems at Central Kitsap WWTP include aeration basins and secondary clarifiers. The primary driver for improvements to the secondary treatment system is the PSNGP and the system's ability to remove nitrogen. The previous facility plan for Central Kitsap, completed in 2011, analyzed secondary treatment process alternatives and recommended construction of new aeration basins and modification of the existing aeration basins so the system could be operated as a BNR process. This was implemented with the 2016 Resource Recovery project, but the process was never fully commissioned to provide nutrient removal. Therefore, an alternatives analysis for the secondary process was not conducted, and no process alternatives are analyzed or discussed herein. Instead, the existing BNR process was 're-commissioned' and optimized to provide nutrient removal. This effort is documented in **Appendix K** and summarized in this section. Additionally, the secondary treatment systems are expected to reach their capacity by 2042, so additional aeration basins and another secondary clarifier will be needed. The location of the aeration basins improvements, new aeration basins, and new secondary clarifier are shown in **Figure 8-1**.

The UV disinfection system is in good condition and has sufficient capacity, so alternatives were not developed or analyzed, and further discussion is not included in this section.

The entire solids treatment process, including liquid hauled waste (LHW) receiving, primary sludge and WAS thickening, anaerobic digestion, and dewatering were discussed in **Appendix N**, which references two other TMs, the *Liquid Hauled Waste Study* (Murraysmith [now Consor], 2022) (**Appendix O**) and the *Class A Biosolids Evaluation* (Murraysmith [now Consor], 2022) (**Appendix P**).

Appendix O evaluated five alternative approaches for thickening, treatment and dewatering of both LHW and WAS from Central Kitsap, they are designated with a code identifying the study and alternative number as LHW-#.

- **Alternative LHW-1: Treat Septage with Other Solids Streams** continues the existing process of mixing septage with primary sludge for thickening, followed by anaerobic digestion of all sludge together.
- **Alternative LHW-2: Separated Septage Treatment with Anaerobic Digestion** separates septage from the existing solids treatment process and treats the septage with a separate, dedicated anaerobic digester. Other sludges are treated in the existing anaerobic digesters.
- **Alternative LHW-3: Separated Septage Treatment with Lime Stabilization** separates septage from the existing solids treatment process and treats the septage with a separate, lime stabilization process. Other sludges are treated in the existing anaerobic digesters.
- **Alternative LHW-4: Entire Solids Treatment with Sedron Varcor System** treats the entire solids stream, including septage, with the Sedron Varcor vapor recompression process.
- **Alternative LHW-5: Separated Septage Treatment with Wetlands and Composting** separates septage from the existing solids treatment process and thickens and dewaters the septage with a separate, treatment wetland, then treats either the septage with a composting system.

Appendix P evaluated three alternative approaches for solids treatment and disposal, they are designated with a code identifying the study and alternative number as BIO (Biosolids)-#

- **Alternative BI0-1: Continue Existing Class B Process** which uses anaerobic digestion to provide Class B treatment and hauling to eastern Washington for land application.
- **Alternative BI0-2: Class A Composting** treats sludge to Class A standards with a static, aerated pile composting system so that it can be distributed locally to public and private users
- **Alternative BI0-3: Class A Drying** treats sludge to Class A standards with a conventional heat dryer so that is can be distributed locally to the public and private users or incorporated into fertilizer by regional manufacturers

The TM in **Appendix N** coalesced the recommendations and developed a timeline for implementation of improvements. The conclusions of the TMs are summarized in this section. **Table 8-1** provides a summary of the solids treatment alternatives that were analyzed and the locations of the alternatives are shown in **Figure 8-1**. The recommended improvements are identified and further detailed in **Section 8.6**.

Table 8-1 | Solids Treatment Alternatives Summary

Test Period or Alternative	Name	Description	Deficiency Addressed
LHW-1	Treat Septage with Other Solids Streams	Construct new septage receiving station, a FOG receiving station, and replace septage pumps and grit removal system. Replace gravity thickeners with a new thickening process. Build a new anaerobic digester for all mixed sludge.	Septage, Primary Sludge Thickening, Anaerobic Digestion, Dewatering
LHW-2	Separated Septage Treatment with Anaerobic Digestion	Construct new septage receiving station, aFOG receiving station, and replace septage pumps and grit removal system. Replace gravity thickeners with a new thickening process. Build a new, separate anaerobic digester for septage.	Septage, Primary Sludge Thickening, Anaerobic Digestion, Dewatering
LHW-3	Separated Septage Treatment with Lime Stabilization	Construct new septage receiving station, a FOG receiving station, and replace septage pumps and grit removal system. Replace gravity thickeners with a new thickening process. Build a new anaerobic digester for primary sludge, WAS, and FOG and a lime stabilization process for septage.	Septage, Primary Sludge Thickening, Anaerobic Digestion, Dewatering
LHW-4	Entire Solids Treatment with Sedron Varcor System	Construct new septage receiving station, a FOG receiving station, and replace septage pumps and grit removal system. Replace gravity thickeners with a new thickening process. Replace anaerobic digesters and centrifuges with Sedron Varcor system to treat all thickened solids.	Septage, Primary Sludge Thickening, Anaerobic Digestion, Dewatering
LHW-5	Separated Septage Treatment with Wetlands and Composting	Construct new septage receiving station, a FOG receiving station, and replace septage pumps and grit removal system. Replace gravity thickeners with a new thickening process for primary sludge. Build a new anaerobic digester for primary sludge, WAS, and FOG. Construct a wetland treatment system and composting system for septage.	Septage, Primary Sludge Thickening, Anaerobic Digestion, Dewatering

Test Period or Alternative	Name	Description	Deficiency Addressed
BIO-1	Continue Existing Class B Process	Uses anaerobic digestion to provide Class B treatment and hauling to eastern Washington for land application	Biosolids Disposal
BIO-2	Class A Composting	Treats sludge to Class A standards with a static, aerated pile composting system so that it can be distributed locally to public and private users	Biosolids Disposal
BIO-3	Class A Drying	Treats sludge to Class A standards with a conventional heat dryer so that is can be distributed locally to the public and private users or incorporated into fertilizer by regional manufacturers	Biosolids Disposal

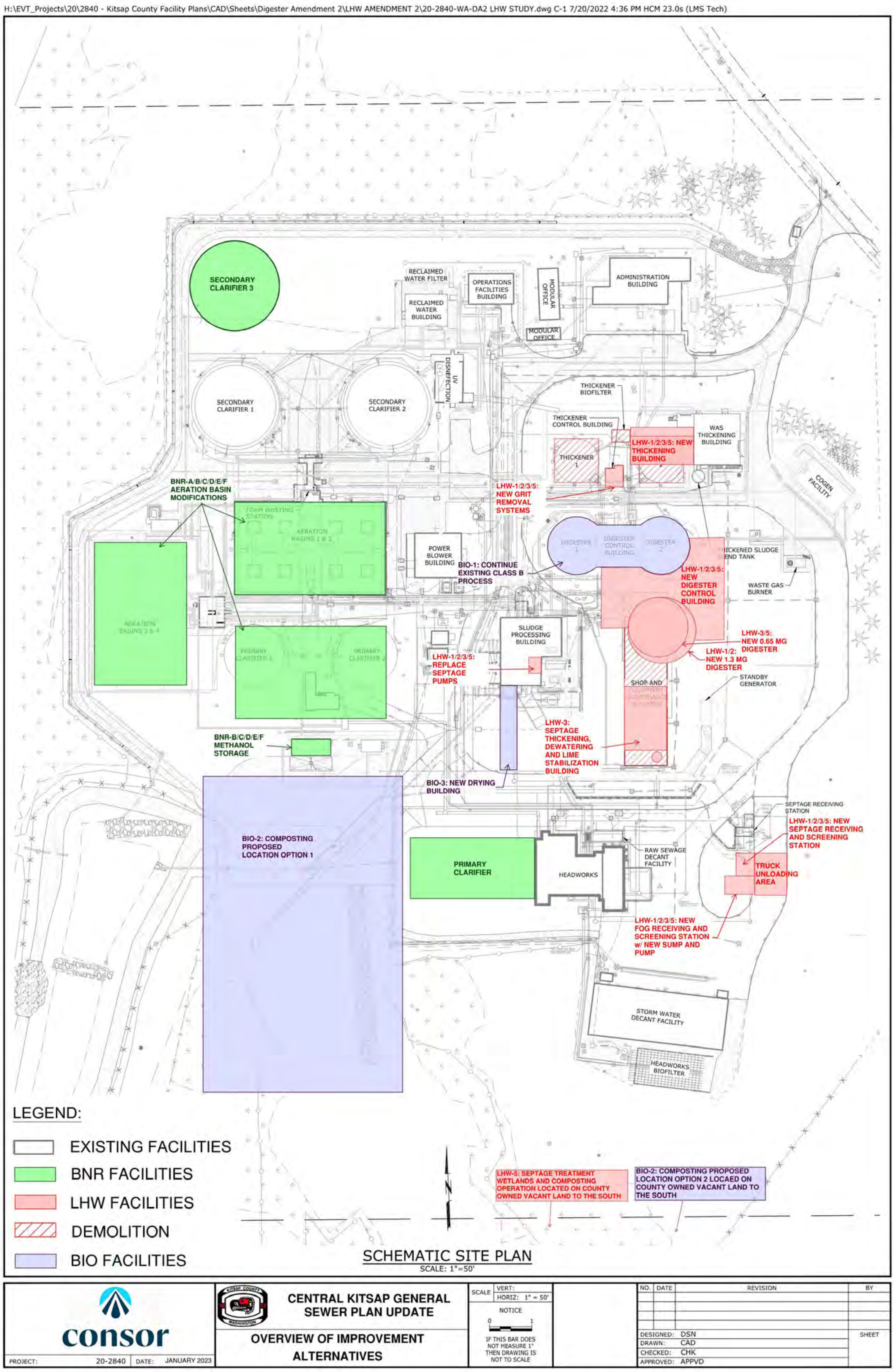
The non-potable water system and process water system are in fair condition and have sufficient capacity. Some equipment related to these systems will require in-kind replacement, but analysis of alternative processes is not considered in this section. These improvements are relatively minor, so they are not included in **Figure 8-1**.

Central Kitsap has four odor control systems, which treat foul air from the headworks, septage receiving station, gravity thickeners, and sludge dewatering system. The gravity thickener odor control system is in poor condition and should be replaced opportunistically in conjunction with other work on the primary sludge and septage thickening processes. The preferred approach for odor control may vary depending on thickening process and should be evaluated during design of the process. The other odor control systems are in fair or good condition and do not require upgrades, therefore a further analysis of odor control is not considered in this section.

The electrical and power distribution system has equipment of various age and conditions. Transformer repairs, replacement of the main switchgear, a process and load study, and replacement of select electrical panels are needed, but because these are all direct replacements an alternatives analysis is not necessary, further analysis is not considered in this section, and are they shown in **Figure 8-1**.

Additionally, the County has been working on a series of SCADA Master Plan TMs which includes an overview of the existing SCADA system, review of use and needs, selection of preferred technologies, and a project identification, estimate and CIP. Because the SCADA system improvements are generally implemented across the sewer division as a whole and are not specific to process improvements at Central Kitsap WWTP, the plan is not incorporated into this section.

Figure 8-1 | Overview of Improvement Alternatives at Central Kitsap WWTP



8.2 Opinion of Probable Project Costs

Class 5 opinions of probable project costs (OPPC) for the 20-year planning period were developed for each alternative. The Class 5 OPPCs were prepared in accordance with the guidelines of the Association for the Advancement of Cost Engineering (AACE) for planning-level evaluations with a range of -50 percent to +100 percent, based on the *AACE International Recommended Practice No. 18R-97 Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries – TCM Framework: 7.3 – Cost Estimating and Budgeting.*

The OPPCs were developed using RSMeans Heavy Construction Cost Data, recent County project bid tabs, County input, industry experience, and local contractor and supplier costs. All costs were developed based on the preliminary concepts and layouts of the system components in 2022 dollars should be escalated with the future Consumer Cost Index for use in project budgeting. The OPPC includes both construction and project costs. The construction costs include construction work and materials plus markups for mobilization, general contractor markups, overhead, and profit, taxes, and a construction contingency of 30 percent. The project costs account for a markup of 25 percent for engineering, legal, and administration costs associated with project delivery.

Costs for O&M and the 20-year net present values were also developed based on the following assumptions:

- Labor cost: $60/hour
- Electricity Cost: $0.10/kilowatt-hour
- Discount rate: 3 percent
- Inflation rate from 2023 to 2024: 12 percent
- Inflation rate from 2025 to 2026: 8 percent
- Long term inflation: 5 percent

8.3 Secondary Treatment Improvements

8.3.1 Existing Condition Description

Aeration basins and secondary clarifiers provide secondary treatment at Central Kitsap WWTP. Basin aeration is accomplished with a fine bubble diffuser system in each stage that connect via droplegs to a common supply header. Multi-stage and turbo blowers in the blower building provide air for the system. The 2016 Resource Recovery project provided air control valves with the intent to operate the aeration basins as a BNR system, but the basins were never fully commissioned as such and has operated as a conventional activated sludge process instead.

According to the assessment in Section 6, the secondary treatment structures are in good or very good condition but have some capacity limitations and will have to meet evolving nitrogen removal requirements. Therefore, optimization of the secondary treatment system is the primary goal of the secondary treatment investigations detailed below.

8.3.2 Nitrogen Removal Criteria

The County recognized the need to evaluate the ability of Central Kitsap WWTP to remove nutrients when the General Sewer Plan was initiated because nutrient regulations were forthcoming and the BNR process was never fully commissioned when the process equipment was installed in 2016. Ecology issued the PSNGP on December 1, 2021, which includes an annual TIN discharge limit of 306,000 lbs/yr for Central

Kitsap WWTP. As reported in **Section 6**, the plant effluent TIN exceeded the permit limit in 2016, which highlights the need to adjust operation to improve performance. The secondary treatment process was evaluated and optimized for TIN removal in 2022 and the findings are documented in **Appendix K**.

8.3.3 BNR Optimization

The BNR optimization began by developing and modeling seven operating scenarios with BioWin to gain a greater understanding of the expected performance of the aeration basins, which was documented in **Appendix K**. Following the process modeling, the results were used to develop a field optimization plan. In preparation for the BNR operational testing effort, several control upgrades and modifications were made:

- Upgraded instrumentation (both DO and ammonium/nitrate)
- Implementation of MOV and improved DO system
- Implementation of ammonia-based aeration control (ABAC) control
- Implementation of improved IMLR control
- Implementation of improved methanol control
- Additional miscellaneous programming modifications:
  - RAS control
  - Basin influent hydraulics
  - Backup aeration

Six periods of operational testing were developed with iterative operational improvements occurring throughout the testing, they are designated with a code identifying the study and alternative number as BNR-#.

- **BNR-A: Baseline Nitrification** adjusted solids inventories to allow for complete nitrification under standard DO control
- **BNR-B: Nitrate Control of Methanol** began operation with methanol addition based on the newly installed combination ammonium and nitrate probes
- **BNR-C: Nitrate Control of IMLR** added variable control of IMLR pumps based on the nitrate probe readings
- **BNR-D: ABAC** introduced full control of the aeration system based on ammonia probe readings
- **BNR-E: Optimize ABAC with Methanol** was planned to use ABAC control with modified methanol feeding but was not implemented due to time constraints
- **BNR-F: Optimize ABAC without Methanol** was planned to use reduced methanol dosing to determine best case nitrogen removal with minimal supplemental carbon but was not implemented due to time constraints

Operating scenarios A through D were tested, but time constraints due to construction projects on site did not allow for scenarios E and F to be implemented. Nevertheless, the optimization effort results were useful and observation provided several items for future improvement. Overall, the intent of the of the test periods was not to compare the operational methods against each other, but to sequentially introduce BNR control parameters in an organized manner so that a clear understanding of the effects of each introduced variable could be understood and adjusted.

Optimization showed that basic BNR operation with the current plant can achieve effluent TIN concentrations of approximately 5-10 mg/L, which allows the plant to remain at roughly half of the annual load limit in the PSNGP with four operating aeration basins, even at the 2042 annual average flow conditions, see **Table 8-2**. Therefore, the aeration basins have adequate capacity to meet the current permit through the planning period.

Table 8-2 | Observed and Forecasted Secondary Treatment TIN Performance

Condition	Average Daily Flow (MGD)	Annual Average TIN Load (lbs/yr)[1]
Stable Optimization Testing Period	3.4	83,530
2028 Annual Average Flow	4.0	99,530
Current Permit Annual Average Design Flow	4.6	114,008
2042 Annual Average Flow	5.4	133,836
PSNGP Limit	N/A	306,000

Note:
1. Loading for future flow conditions is forecasted based on optimization testing results

Further optimization beyond the results of the field testing is possible and may be needed if future permit requirements are more restrictive. Additionally, if Central Kitsap plans to begin reclaimed water production, the plant will be required to meet the Class A reclaimed water average monthly TIN limit of 10 mg/L. Additional details regarding opportunities for reclaimed water will be discussed in **Section 9**. Optimization efforts indicate that achieving effluent TIN of less than 10 mg/L is feasible under current conditions, but further optimization is required so that the limit can consistently be met. Additionally, if the plant implements improvements, it should be possible to reach a seasonal (summer) TIN below 3 mg/L. The timing of the improvements will depend on the success of optimization efforts, timeline of reclaimed water implementation, and future permit structure and limits.

Additionally, the BNR optimization noted several challenges and limitations:

- Influent Hydraulic Distribution – the RAS and primary effluent do not mix fully in the influent distribution box, which results in uneven loading to the aeration basins.
- RAS Clow Control – the RAS pumps control is a constant flow setpoint, so they do not automatically adjust flow to maintain consistent RAS:primary effluent ratio. This causes diurnal swings in the solids inventory as primary effluent flows change and makes precise control of solids inventory difficult.
- Probe Accuracy – the new combination ammonia and nitrate proves were challenging to maintain and accuracy appears to decrease at levels below 1 mg/L
- Air Control Limitations – measured DO did not always track consistently with the aeration system set point, which may indicate control or systemic problems.
- Centrate and Ammonium Loading Variability – there is no centrate equalization, so ammonium loading is higher on days when the centrifuge is operated and lower when it is not. In addition to

this operational variability, it appears that loading to the basins themselves may be imbalanced, possibly due to the influent hydraulic distribution issues.

Several projects to address these issues and further optimize the secondary treatment system are identified in the TM. These are identified and discussed below, in the Recommendations subsection.

8.3.4 Secondary Treatment Cost Analysis

Since an alternatives analysis was not conducted for the secondary treatment, a cost analysis for alternatives were not developed. Costs for optimization projects, however, are included in **Appendix K** and are also included in the CIP in **Section 11**.

8.4 Solids Handling and Treatment Improvements

8.4.1 Existing Condition Description

Several unit processes are utilized at Central Kitsap WWTP to treat the solids stream. Solids originate at several sources; primary sludge comes from the primary clarifiers, WAS comes from the secondary clarifiers, septage and FOG are hauled from around the County, and TWAS is hauled in from the County's three other WWTPs. Septage is unloaded at a receiving station and is combined with primary sludge for thickening in the gravity thickeners. A WAS Thickening Building houses an RDT for WAS thickening. The thickened primary sludge, TWAS from Central Kitsap, TWAS from the other WWTP's, and FOG are all mixed and treated in the anaerobic digesters. The in-plant pump station receives flows from many sources withing the plant including thickening filtrate, digesters overflow and the dewatering building.

The condition and capacity of the solids treatment equipment varies widely, as reported in **Section 6**. The septage receiving station is in good condition but does not have any redundancy, septage flows are significantly higher than originally planned, and it cannot receive FOG loads, so they are discharged separately. The gravity thickeners are in poor condition. The anaerobic digesters have reached capacity and are generally in poor condition, although some support equipment has been replaced and is in better condition. The WAS RDT and centrifuges were installed in 2016 and 2019, respectively, and are in very good condition. The in-plant pump station has corroded severely since it was installed in 2011 and is in very poor condition.

8.4.2 Solids Handling and Treatment Alternatives Analyses

The County embarked the Plan on its Central Kitsap WWTP and associated sewer basin in 2020. Recognizing the age and condition of the existing solids handling processes at the Central Kitsap WWTP, the County has made assessing and improving the solids processes one of the top priorities during the General Sewer planning effort, and hopes to implement the identified improvement in a timely manner to support the reliable operation and performance of the solids handling processes. To expedite the planning process and provide a wholistic look at the entire solids processing system, Consor completed a TM in October 2022, which is included as **Appendix N**. This TM summarized previous work, documented the evolvement of the process from identifying the needs and evaluating alternatives to determining the best solutions and prioritizing capital improvement projects, and made recommendations on the solids handling improvement strategy with implementation timeline (near-term and long-term).

Five alternatives to handle the solids stream were evaluated in **Appendix O** from the following perspectives:

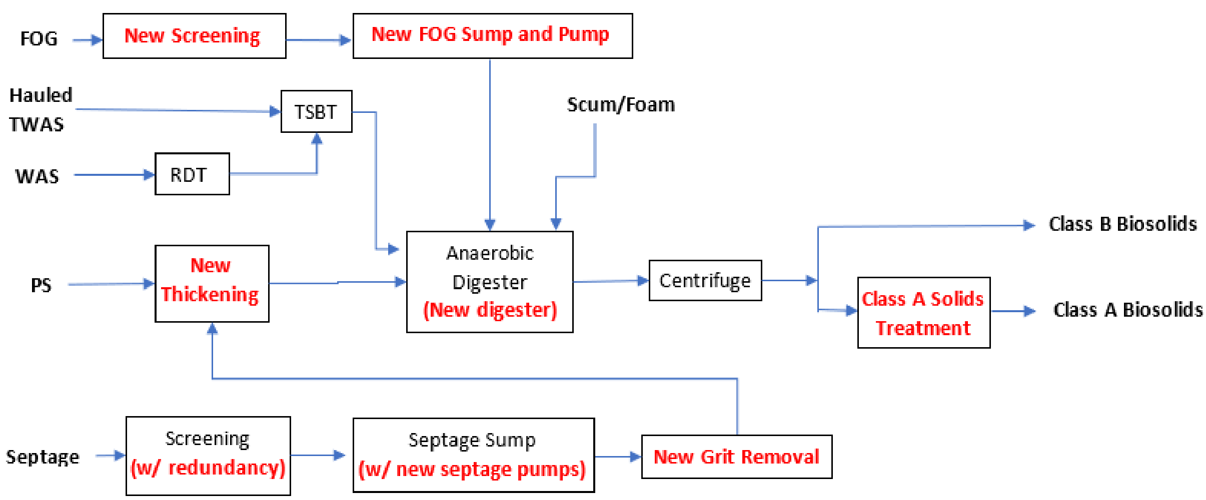
- Regulatory requirements

- ➢ Technology
- ➢ Equipment design
- ➢ Layout
- ➢ Site plan
- ➢ Cost
- ➢ O&M requirements.

8.4.2.1 LHW-1: Treat Septage with Other Solids Streams

LHW-1 continues the current approach of mixing septage with other solids streams and treating it using the existing processes by improving the capacity, redundancy, and performance of these processes. Figure 8-2 shows the process flow diagram of LHW-1, with new or modified components indicated in red text.

Figure 8-2 | LHW-1 Process Flow Diagram



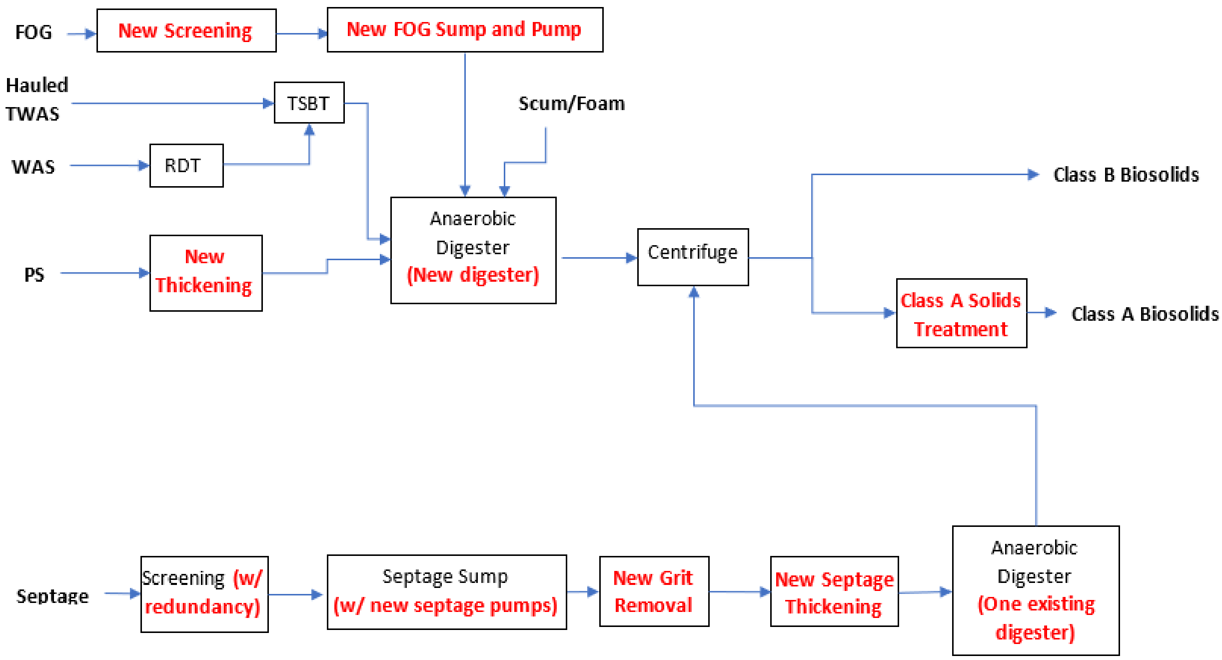
The proposed improvements include:

- ➢ The existing septage receiving station will be expanded to provide redundancy.
- ➢ Two existing septage pumps will be replaced with two new septage pumps.
- ➢ The existing grit cyclone will be replaced with a new grit removal system.
- ➢ A new FOG receiving station and associated sump and pump will be constructed.
- ➢ The existing GTs will be replaced with a new thickening process.
- ➢ A third, 1.3 MG anaerobic digester will be constructed to add digestion capacity for mixed thickened sludge, septage, and FOG.
- ➢ All other existing solids treatment components are sufficient to continue operating through 2042.

8.4.2.2 LHW-2: Separated Septage Treatment with Anaerobic Digestion

LHW-2 separates the septage out from the existing solids treatment processes and treats the septage with a dedicated anaerobic digester to Class B biosolids standards. Improvements are made to the capacity and performance of the main solids stream by updating select processes. Separating the septage treatment allows for the septage and WWTP sludge processes to be optimized independently and provides greater flexibility and control. **Figure 8-3** shows the process flow diagram of LHW-2, with new or modified components indicated in red text.

Figure 8-3 | LHW-2 Process Flow Diagram



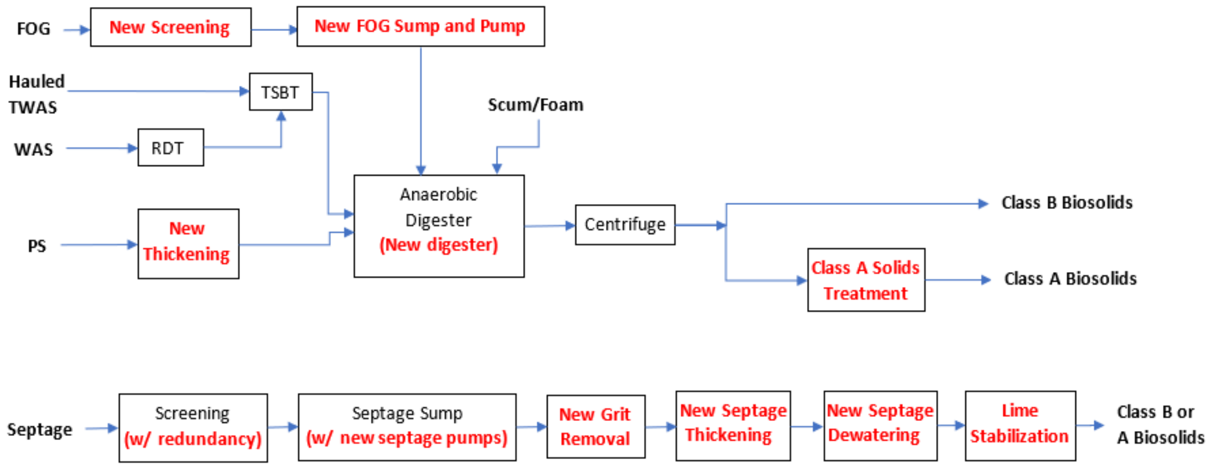
The proposed improvements include:

- ➢ The existing septage receiving station will be expanded to provide redundancy.
- ➢ Two existing septage pumps will be replaced with two new septage pumps.
- ➢ The existing grit cyclone will be replaced with a new grit removal system.
- ➢ A new FOG receiving station and associated sump and pump will be constructed.
- ➢ Septage will be thickened separately by new thickening equipment.
- ➢ The existing GTs will be replaced with a new thickening process.
- ➢ A third, 1.3 MG anaerobic digester will be constructed for thickened sludge and FOG treatment. One of the existing digesters will be used for septage treatment.
- ➢ All other existing solids treatment components are sufficient to continue operating through 2042.

8.4.2.3 LHW-3: Separated Septage Treatment with Anaerobic Digestion

LHW-3 separates the septage out from the existing solids treatment processes and treats the septage with pasteurization and lime stabilization. Improvements are made to the capacity and performance of the main solids stream by updating select processes. Separating the septage treatment allows for the septage and WWTP sludge processes to be optimized independently and provides greater flexibility and control. Septage treatment with lime stabilization is a reliable chemical process that eliminates the challenge of digesting partially stabilized septage solids. **Figure 8-4** shows the process flow diagram of LHW-3, with new or modified components indicated in red text.

Figure 8-4 | LHW-3 Process Flow Diagram



The proposed improvements include:

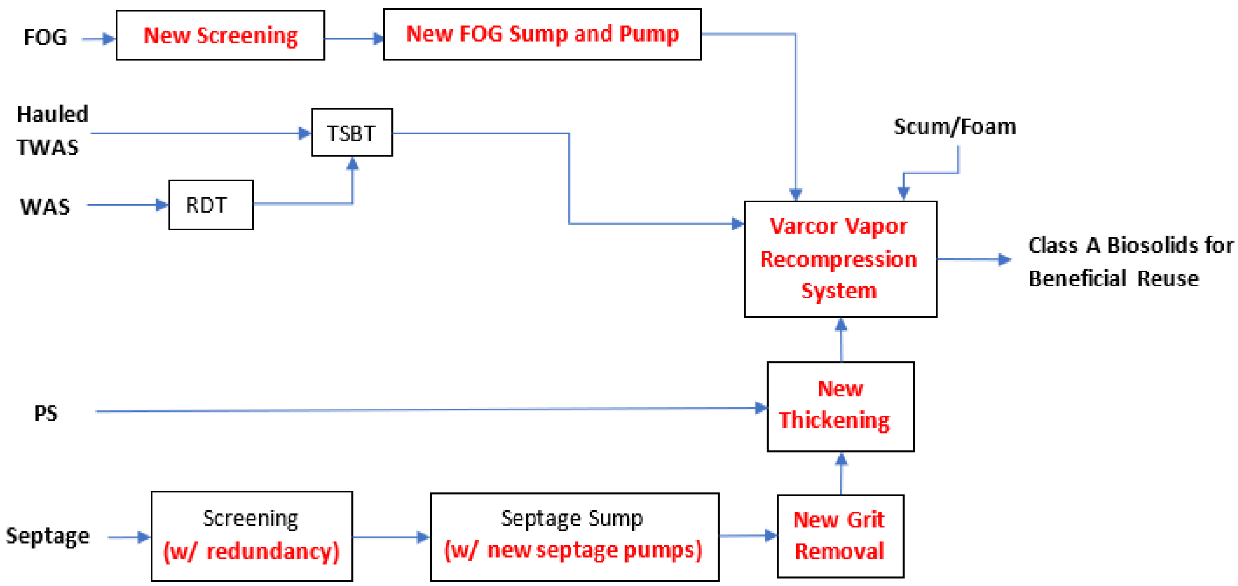
- The existing septage receiving station will be expanded to provide redundancy.
- Two existing septage pumps will be replaced with two new septage pumps.
- The existing grit cyclone will be replaced with a new grit removal system.
- A new FOG receiving station and associated sump and pump will be constructed.
- Septage will be treated separately with new thickening and dewatering equipment prior to a pasteurization and lime stabilization system which will stabilize the dewatered septage to either Class B or Class A biosolids.
- The existing GTs will be replaced with a new thickening process.
- A third anaerobic digester at the same size as the existing ones will be constructed to add digestion capacity for thickened sludge and FOG treatment.
- All other existing solids treatment components process are sufficient to continue operating through 2042.

8.4.2.4 LHW-4: Entire Solids Treatment with Sedron Varcor System

LHW-4 treats the septage and all other solids streams with a new vapor recompression machine and also improves the capacity, redundancy, and performance of the septage receiving, and grit removal and thickening processes. **Figure 8-5** shows the process flow diagram of LHW-4, with new or modified components indicated in red text.

Ultimately, it was determined that this alternative is not feasible because the only manufacturer of this type of system does not currently make a unit of appropriate size for Central Kitsap WWTP.

Figure 8-5 | LHW-4 Process Flow Diagram



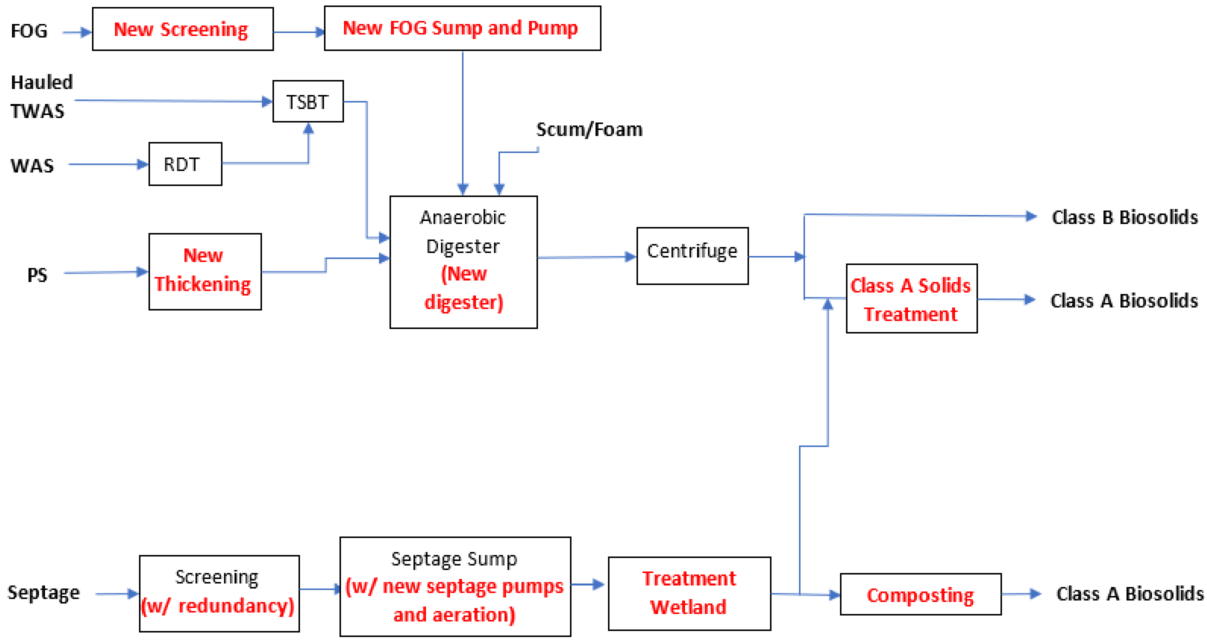
The proposed improvements include:

- The existing septage receiving station will be expanded to provide redundancy.
- Two existing septage pumps will be replaced with two new septage pumps.
- The existing grit cyclone will be replaced with a new grit removal system.
- A new FOG receiving station and associated sump and pump will be constructed.
- The existing GTs will be replaced with a new thickening process.
- Varcor system provided by Sedron Technology will be installed to treat all the thickened solids to Class A biosolids, therefore, the existing digesters and dewatering equipment at Central Kitsap WWTP will be abandoned.

8.4.2.5 LHW-5: Separated Septage Treatment with Wetlands and Composting

LHW-5 completely separates the septage treatment from the existing solids treatment processes and uses a constructed wetland system to dewater the septage followed by composting to provide Class A biosolids treatment. Improvements are also made to the capacity and performance of the main solids stream by updating select processes. **Figure 8-6** shows the process flow diagram of LHW-5, with new or modified components indicated in red text.

Figure 8-6 | LHW-5 Process Flow Diagram



The proposed improvements include:

- The existing septage receiving station will be expanded to provide redundancy.
- Two existing septage pumps will be replaced with two new septage pumps.
- The existing grit cyclone is not required.
- A new FOG receiving station and associated sump and pump will be constructed.
- A constructed wetland and composting system will be constructed to treat the septage to Class A standard.
- The existing GTs will be replaced with a new thickening process.
- A third anaerobic digester will be constructed to add digestion capacity for thickened sludge and FOG.
- All other existing solids treatment components are sufficient to continue operating through 2042.

8.4.2.6 Boiler Fuel Options

As noted in **Appendix N**, the existing boilers are reaching the end of their useful life and will need to be replaced for alternatives LHW-1, LHW-2, LHW-3, and LHW-5. The existing boilers use diesel fuel, but the TM recommended that other alternatives should be considered as replacement options. Since that memo was published, Cascade Natural Gas Corporation (CNGC) has provided additional information about the availability and cost of natural gas, so some additional discussion of fuel source is included here. Three general approaches to fueling the boilers have been identified:

1. Boilers Fueled with On-site Fuel Source: This alternative would use dual fired boilers that can burn either digester gas or a backup fuel source which would be stored on site. The cogen system will be restarted to optimize use of digester gas and reduce boiler fuel consumption. The backup fuel source could be either diesel, #2 fuel oil, and or propane. Diesel and #2 fuel oil have similar weights and heat content, so they can be operated interchangeably using the existing diesel tank. Using propane would require a different burner and a new propane storage tank. The County currently spends approximately $250,000 each year on diesel fuel for the boilers.

2. Boiler Fueled with Natural Gas: This alternative would use dual fired boilers that can burn either digester gas or natural gas supplied by a new connection to the CNGC distribution system. The cogen system will be restarted to optimize use of digester gas and reduce boiler natural gas consumption. The CNGC system will need to be extended with approximately 6500 linear feet (LF) of 4-inch gas main to support this connection. CNGC can complete the construction work, but the County will be required to pay for the extension. CNGC estimates the cost to the County will be approximately $256,000. Several years ago, the County investigated this option and CNGC offered to install the natural gas line in a trench that would be excavated and restored by the County in an effort to reduce costs. This approach was not discussed recently, but may still be an option. Gas will be available at Central Kitsap WWTP to fuel the boilers and any other use on site, and will be billed at standard industrial rates. Generally, natural gas is the most cost-effective heat source.

3. Renewable Natural Gas (RNG) Sales: This alternative would construct additional digester gas treatment and an intertie facility to facilitate the sale of the treated digester gas to CNGC. RNG is a valuable commodity worth several times more than conventional natural gas due to the ability to generate and sell Renewable Identification Numbers under the Renewable Fuel Standard Program. Dual fired boilers that can burn either digester gas or natural gas will be used to heat the digesters, but because of the value of selling the RNG to CNGC, the cogen system could be abandoned, thus making it a stranded asset. Decommissioning this expensive asset may be undesirable from a public policy and public perception perspective. CNGC has proposed a 20-year contract to purchase the RNG at a combined fixed and variable rate in exchange for constructing a 2.5-mile gas main and interconnect facility. The County would be required to provide easements to support the gas main and interconnect facility and to construct and operate treatment equipment. The volume of gas that is produced at Central Kitsap is relatively low compared to other similar installations which makes it economically challenging for the RNG sales to offset the cost of upgrades for both CNGC and the County. The gas treatment system equipment is estimated, as described in **Section 8.2**, to cost the County approximately $1.8 million dollars and sale of gas is estimated to generate an average gross revenue of $260,000 per year during the 20-year contract term. Actual revenue will vary depending on natural gas prices, which can fluctuate dramatically. Additionally, the system will increase operation and maintenance costs, which have not been estimated. Natural gas will be available at Central Kitsap WWTP to fuel the boilers and any other use on site, and will be billed at standard industrial rates.

A more detailed analysis of each boiler fuel option should be conducted during the pre-design phase of the hot water system to determine the preferred approach.

8.4.3 Solids Treatment Alternatives Cost Analysis

Class 5 OPPCs for the solids treatment improvements were developed in the TM and are summarized in **Table 8-3**.

Table 8-3 | Solids Treatment Alternatives Cost Estimate

Alternative Number	Project Name	Project Cost	O&M 20-year Net Present Cost	Total 20-year Net Present Cost
LHW-1	Treat Septage with Other Solids Streams	$43M	$7.7M	$50M
LHW-2	Separated Septage Treatment with Anaerobic Digestion	$46M	$7.9M	$54M
LHW-3	Separated Septage Treatment with Lime Stabilization	$49M	$16M	$65M
LHW-4	Entire Solids Treatment with Sedron Varcor System	N/A, Infeasible	N/A, Infeasible	N/A, Infeasible
LHW-5	Separated Septage Treatment with Wetlands and Composting	$51M	$5M	$56M

8.5 Biosolids Improvements

8.5.1 Existing Condition Description

Washington state law requires that biosolids be put to beneficial use. To meet this mandate, all solids from Central Kitsap WWTP and the County's three smaller WWTPs are currently treated to Class B requirements in the anaerobic digesters. The digested sludge is dewatered with centrifuge in the Solids Handling Building to approximately 22 percent solids and is loaded into a tractor trailer for hauling to Natural Selections Farms near Moxee, WA for land application. Although not currently required by law, the County is interested in evaluating Class A biosolids alternatives to produce a more sustainable product and reduce disposal costs.

8.5.2 Biosolids Alternatives Analysis

Appendix P analyzed three alternatives for biosolids treatment and disposal. The conceptual design, product reuse potential, and capital, O&M and life cycle costs were developed for each alternative and was used to recommend a biosolids approach.

8.5.2.1 BIO-1: Continue Existing Class B Process

BIO-1 continues the existing Class B process in which sludge is treated to Class B requirements by anaerobic digestion, then is dewatered with a centrifuge to approximately 23 percent solids. The dewatered biosolids are loaded into a truck through a hatch in the dewatering room and hauled away for land application. Class B land application meets Washington beneficial reuse requirements. The only existing beneficial use facilities for land disposal are on the east side of the Cascades and large-scale, non-food farming is uncommon in western Washington, so it is not feasible to reuse the Class B biosolids at a closer location. Hauling the biosolids to eastern Washington results in occasional operational challenges when mountain passes close due to inclement weather or fires, and carbon emissions from the lengthy trip are high. Additionally, there are a very limited number of farms that will accept Class B biosolids which leaves the County vulnerable to permitting or other problems, which happened in 2015 when the County's previous reuse site was closed due to a permit violation.

8.5.2.2 BIO-2: Class A Composting

BIO-2 constructs a new statically aerated pile composing system to treat the biosolids to Class A requirements. The anaerobic digestion and dewatering processes remain the same as the existing process. The total area required for a yard waste receiving area, composting bays, mixing, screening, storage is approximately 2 acres. The composting area could be placed on the existing developed area of the WWTP site, or on the adjacent undeveloped parcel, which the county also owns. An example of a static aerated pile compost system is shown in **Figure 8-7** below.

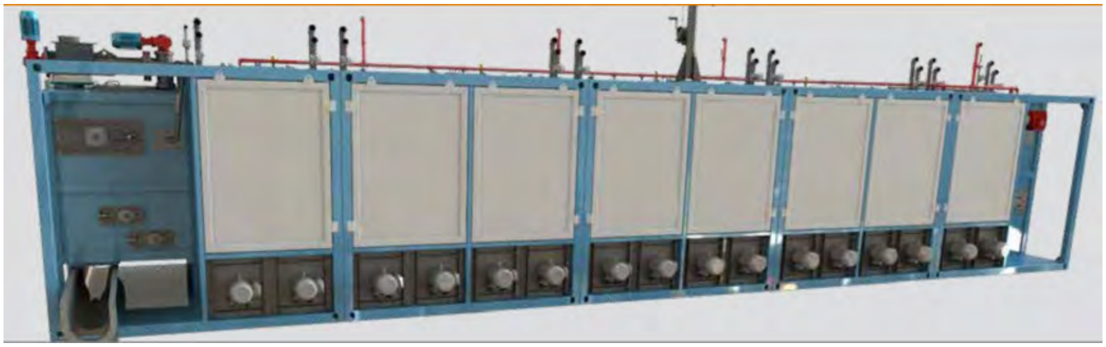
Figure 8-7 | Static Aerated Pile Composting Facility

Class A biosolids can be used by the public without restrictions if it meets the Exceptional Quality designation for metals content. Composted biosolids are a useful and well received product when the composting process is managed well. Several regional utilities have been successful in implementing composting systems and selling the product to individual members of the public, landscapers, nurseries, and general contractors in varying quantities, containers, and product blends. Distribution of compost will require some marketing and it may take several years to generate significant demand as awareness and comfort with the product spread. The experience of other composters in Washington suggests that demand for compost is generally high and can be a significant source of income.

8.5.2.3 BIO-3: Class A Drying

BIO-3 constructs a dryer system to treat the biosolids to Class A requirements. The anaerobic digestion and dewatering processes remain the same as the existing process. There are a few different configurations for dryer systems, but they all use heat to dry the biosolids to greater than 90 percent solids. **Figure 8-8** shows a typical belt dryer. An odor control system is required to treat the exhaust gas. The resulting dried Class A biosolids are small cylindrical pellets which could be hauled for land application or distributed locally as a 'soil amendment' product, however, the dried product can be challenging to manage and use. Pelletizing equipment may be needed to produce a consistent enough pellet size for end users. The low water content of the solids reduces the weight and thus the hauling costs by about a factor of three compared to the existing Class B process. Additionally, problems with the biosolids generating dust if they get too dry or smoldering or combusting if exposed to moisture are common.

Figure 8-8 | Belt Dryer



Class A drier systems are relatively uncommon in the region; the only facility at Pierce County's Chambers Creek WWTP has had mixed success with finding end users for their biosolids and therefore only produces dried pellets seasonally for fertilizer producers that haul the product out of state. It may be possible to generate more local demand with a focus on marketing and distribution effort.

8.5.3 Solids Handling Cost Analysis

Class 5 OPPCs for the biosolids treatment improvements were developed in the TM and are summarized in **Table 8-4**. Ranges are estimated for the biosolids options due to uncertainty surrounding future hauling costs and composting O&M effort and sales revenue.

Table 8-4 | Biosolids Treatment and Disposal Alternatives Cost Estimate

Alternative Number	Project Name	Project Cost	O&M 20-year Net Present Cost	Total 20-year Net Present Cost
BIO-1	Continue Existing Class B Process	$0	$9.3 – 12.0M[1]	$9.3 – 12.0M[1]
BIO-2	Class A Composting	$10.6M	$(1.1M) – 16.0M (best estimate: $6.7M)[2]	$9.5 – 26.6M (best estimate: 17.2M)[2]
BIO-3	Class A Drying	$16.4M	$10.6M	$27.1M

Notes:

1. Range is based on the Class B biosolids hauling and disposal prices from the County's current and historical contracts.
2. Range is based on the conservative and optimal assumptions on the O&M effort and revenue from compost sales. The best estimate is based on the most likely assumptions on these items.

8.6 Recommendations

This section provides a recommendation for each process and list of related improvement projects.

8.6.1 Secondary Treatment Improvements

The secondary treatment process has the ability to meet permit requirements but has not been fully optimized, therefore, the focus it is recommended to continue optimization to fully assess the capacity. Additionally, some components of the secondary treatment will need to be expanded to provide additional capacity or replaced as equipment ages. The following secondary treatment improvements and optimization efforts are recommended as outlined in either **Appendix K** or **Section 6**:

- Primary Clarifier Improvements: The primary clarifiers are expected to reach the maximum recommended surface overflow rate near the end of the planning horizon. Installing an additional primary clarifier and/or replacing the existing primary clarifiers will be needed to maintain capacity.

- Secondary Clarifier Improvements: The secondary clarifiers will not be capable of meeting redundancy requirements by 2028. Installing an additional secondary clarifier will provide sufficient capacity. Additionally, the existing secondary clarifiers' walkways and drives and the RAS pumps should be replaced at the same time.

- Centrate equalization: The plant experiences ammonia spikes and decreased effluent quality on centrate processing days relative to non-centrate days. Equalizing centrate flow to distribute the loads more evenly across the week would provide stability to BNR operation and improve overall average effluent TIN.

- Further testing of IMLR and methanol automated feed methods: Field operation of the ABAC mode using close tracking and observation of IMLR and methanol feeds at alternative set points was not completed during the original testing. Refinement of these controls may help optimize BNR performance and provide field confirmation that methanol is accurately split between each online aeration basin (Zone 5).

- Full year operation: It is recommended to continue BNR operation in warmer months and through the next winter and summer to gain additional data and operational experience for refinement of operating protocols and control programming. Operators should continue to test optimal ammonium/nitrate set points to determine best operating procedures. It may be possible to reduce methanol feed rates or operate without methanol during certain periods of the year given the flexibility with regard to the PSNGP load allocations. This would also present an opportunity to refine the calibration of the Zone 1 and Zone 5 probes, particularly as influent hydraulics are revised and there is more confidence that flows and loads to each basin are equal.

- Influent hydraulics: Conduct an engineering study (potentially with computational fluid dynamics modeling) of the influent hydraulic box to determine modifications necessary to allow efficient mixing of RAS and PE and distribution to each basin. Correcting this imbalance, and the potential current arrangement in which PE and RAS are not equally distributed between basins, is critical to maintaining consistent effluent performance as well as efficiently integrating other optimization strategies (i.e., centrate equalization is less effective if flow cannot be accurately distributed between basins).

- RAS flow improvements: Implement fully automated flow pacing of the RAS pumping system (within current constraints). This can be combined with an engineering study into the value of increasing RAS capacity and potentially modifying the secondary clarifiers to lower the minimum RAS rate required for clarifier mechanism operation.

- Methanol storage: Add a second methanol storage tank to provide the flexibility for Central Kitsap WWTP staff to maintain consistent methanol dosing with flexibility in scheduling methanol deliveries.

- Aeration distribution: Conduct an engineering study to review flow meters, control valve sizing and locations, and the air distribution network to develop design improvements to the physical air distribution and control equipment.

- ➢ Blower capacity: Initiate replacement of the existing centrifugal blowers with additional high-speed turbo blowers. This will allow for additional capacity and redundancy and keep the aeration operation consistent with one type of blower.

- ➢ Upgraded probes: To address the challenges with low-end accuracy for ammonium/nitrate probes, particularly for the Zone 5 and effluent locations, upgrade to wet chemistry probes such as the Amtax and Nitratax (Hach) to allow for low-level (less than 1 mg/L) monitoring and control.

- ➢ Aeration Basins 5 and 6: Although optimization will help improve the aeration basins ability to remove TIN, eventually capacity will be limited by hydraulic retention time. Installing a new set of aeration basins will provide more hydraulic retention time to allow for lower effluent TIN concentrations and/or additional flow. The need for additional capacity will depend on TIN permit requirements, recycled water use, and plant flows.

- ➢ Sidestream treatment: may provide an excellent long-term option to reduce nitrogen loads as Central Kitsap WWTP digestion dewatering centrate stream loads continue to increase (with septage loads, etc.).

- ➢ Step-feed Field Testing: A study to test step-feed operation is recommended because it may provide a lower cost means to extend the life of existing infrastructure prior to additional basin construction.

8.6.2 Solids Handling and Biosolids Improvements

As outlined in **Appendix N**, solids handling alternatives LHW-2 and BIO-1 are recommended. **Table 8-5** summarizes the recommended alternatives and reasons why they are recommended.

Table 8-5 | Recommended Alternatives for Central Kitsap WWTP

Recommended Alternative	Alternative Name	Project Cost	Benefit
LHW-2	Separated Septage Treatment of Anaerobic Digestion	$46M	➢ Relatively low cost ➢ Familiar technology and minimal change from current operation ➢ Reduces septage impact on other solids treatment ➢ Ability to customize septage treatment approach
BIO-1	Continue Existing Class B Process	$0	➢ No additional capital cost ➢ No marketing effort required ➢ Low lifecycle cost ➢ Ability to implement upgrades in future

Alternative LHW-2: Separated Septage Treatment with Anaerobic Digestion is recommended because it provides a more reliable septage treatment with relatively low cost. LHW-2 proposes the same technologies for thickening and stabilization which will allow the County staff to quickly adjust to new treatment approach. Although O&M effort will be slightly higher than LHW-1, the use of familiar technologies and equipment can minimize additional effort. Overall, LHW-2 provides flexibility, redundancy, and ability to customize treatment of septage and other WWTP sludge streams independently which will help foster consistent and efficient operation.

Alternative BI0-1: Continue Existing Class B Process is recommended for biosolids treatment and disposal because it is the lowest cost option with the simplest infrastructure and operation. There is not an immediate need or financial incentive to upgrade the existing solids handling process further to produce Class A biosolids, and the existing process in cost effective.

Composting also provides a lot of non-financial benefits, such as reducing carbon footprint associated with Class B biosolids hauling to eastern Washington, reducing risk of relying on limited land application sites for Class B product disposal, providing a valuable soil amendment to the local community and home growers, and providing a convenient location for the public to recycle green waste. These non-financial considerations make composting an attractive alternative, however, other parts of Central Kitsap WWTP are in urgent need of refurbishment or replacement. Therefore, it is recommended to reserve land area for the composting site as other improvements are considered, but delay implementation of the composting until other more critical improvements are addressed and/or the financial outlook becomes more favorable.

Several capital improvement projects are encompassed within the recommended solids handling and biosolids alternatives:

- New FOG receiving station: The existing septage receiving station cannot accept FOG so it is dumped into the clarifier scum pits. A new, dedicated FOG receiving station allow the plant to accept FOG loads in a more organized manner.
- New septage receiving station: The existing septage receiving station will be expanded with a second receiving and screening station to provide redundancy.
- Replace septage grit cyclone and classifier: The existing septage grit cyclone and classifier is in poor condition and needs to be replaced.
- Replace septage pumps: The existing septage pumps are aging and will need to be replaced.
- Primary sludge and septage thickening: The existing gravity thickeners are in poor condition and will be replaced with new, separate thickening equipment for the primary sludge and septage. Separate equipment will allow for optimized operation, flexibility, and redundancy.
- New 1.3 MG anaerobic digester: A new digester will increase plant digestion capacity and redundancy.
- In-plant pump station: The in-plant pump station is in poor condition and over capacity. It will be replaced.
- Digester hot water system: The existing digester hot water system is reaching the end of its useful life and should be replaced in conjunction with the new digester construction, since the new digester will increase hot water demand.
- Existing anaerobic digesters rehab or replacement: The existing anaerobic digesters are in poor condition and will be rehabilitated or replaced after the new digester is in operation.
- Replace existing scum grinder and pumps: The existing scum grinder and pumps are aging and will need to be replaced.
- Replace centrifuge sludge feed grinders: The existing centrifuge sludge feed grinders are aging and will need to be replaced.

- Restart the biogas treatment and cogeneration system: The biogas treatment and cogeneration system are fairly new but have not been successfully operational in the recent years. The system should be restarted to leverage the benefit of the system. It is expected that other digester upgrades will contribute to operational stability which should help make operation of the biogas treatment and cogeneration system easier. Additionally, gas storage can be considered to provide a buffer and further improve system stability.

- Replace centrate pumps: The existing centrate pumps are aging and will need to be replaced.

- Replace centrifuge feed pumps: The existing centrifuge feed pumps are aging and will need to be replaced.

- Replace digester withdrawal pumps: The existing digester withdrawal pumps are aging and will need to be replaced.

SECTION 9

Recycled Water

Recycled water provides multiple potential benefits from wastewater management, water supply, and environmental enhancement perspectives. Because of these benefits, the County identified recycled water as a key strategy in its *Water as a Resource* policy, adopted in 2009 and reaffirmed in 2016, which aims to conserve groundwater resources, restore the natural hydrologic flow in local streams and creeks, and reduce water pollution. In short, implementation of recycled water efforts would be a direct expression of the County's guiding principle to preserve water as a resource rather than treating it as a waste stream. This section summarizes the County's assessment to date of the potential for developing and implementing a recycled water program involving the Central Kitsap WWTP, as well as an update to potential recycled water demands, an assessment of existing recycled water related treatment processes, an evaluation of disinfection and chlorine residual management options, and identification of proposed capital improvements.

9.1 Recycled Water Regulatory Framework

Wastewater that is reused for beneficial purposes in a municipal context must meet certain regulatory and water quality requirements. In Washington, recycled water (also referred to as reclaimed water) is defined in WAC 173-219 as: "water derived in any part from a wastewater with a domestic wastewater component that has been adequately and reliably treated to meet the requirements of WAC 173-219, so that it can be used for beneficial purposes." As such, recycled water is no longer considered a wastewater once it is put to use.

WAC 173-219 defines the requirements and constraints pertaining to the use of recycled water for a wide range of purposes. Recycled water permits are issued by Ecology and the DOH. Ecology is generally the lead permitting agency, with the primary exception being when the source water is generated by an on-site sewage system with a design flow of less than or equal to 100,000 gpd.

There are three classes of recycled water defined in WAC 173-219: Class B, Class A, and Class A+. These are defined by varying degrees of treatment and water quality, and are each applicable for various uses, as summarized below.

- Class B (meets oxidation and disinfection requirements) recycled water can be used for some construction and industrial purposes, and certain irrigation uses where access to the general public is restricted.

- Class A (meets Class B requirements, plus coagulation and filtration, or use of membrane filtration) recycled water can be used for a wide range of commercial uses (such as toilet/urinal flushing and street sweeping) and irrigation of areas that have open access to the public. This can also be used for groundwater recharge, assuming additional requirements are met, such as maintaining monthly average total nitrogen concentrations at or below 10 mg/L and adhering to applicable elements of the State's groundwater standards (WAC 173-200) and drinking water contaminant levels (WAC 246-290-310).

- Class A+ (meets Class A requirements, plus additional needs to be health protective, as defined on a case-by-case basis) recycled water is required for direct potable reuse (i.e., drinking or direct ingestion).

The public access restriction requirements for Class B are typically difficult to meet for a municipal entity like the County, whereas Class A does not require access restriction, so Class A has a wider range of potential uses. Therefore, it is water of this quality that is considered in this Plan when evaluating potential reuse opportunities. While opportunities for use of lower quality water may exist, they are anticipated to be few in number with very limited benefit being received, based upon the experience of other Puget Sound utilities.

9.2 Prior Recycled Water Planning and Plant Improvements

This section describes previous recycled water planning activities and improvements that have already been made to the Central Kitsap WWTP related to recycled water production.

9.2.1 Planning Activities

In the early 2000's, the County began assessing opportunities for using recycled water that could be produced at the Central Kitsap WWTP to meet an array of long-term water resource management objectives. Multiple studies have been conducted over the two decades since then, culminating in the development of a plan for how a recycled water program could be implemented at the Central Kitsap WWTP. The recent County recycled water planning efforts include:

- *Central Kitsap Treatment Plant – Reclamation and Reuse Project – Volume I: Basis of Design Summary* (August 2011). This is referred to hereafter as the 2011 Basis of Design.

- *Central Kitsap County Wastewater Facility Plan Addendum* (May 2013).

- *Central Kitsap Treatment Plant Reclaimed Water Feasibility Analysis - Memorandum* (February 10, 2020). This document, building upon the previous efforts, was prepared by the County to demonstrate to Ecology how the requirements for a reclaimed water feasibility study per WAC 173-219-180 have been met. This is referred to hereafter as the 2020 Feasibility Analysis.

In addition, the concept of generating and using recycled water from the Central Kitsap WWTP was included in a watershed planning effort facilitated by Ecology for Water Resource Inventory Area (WRIA) 15, as directed by the Streamflow Restoration Act (RCW 90.94). This activity is documented in the *WRIA 15 Watershed Restoration and Enhancement Plan* (March 1, 2022). The evaluation presented in that document is based on the technical work conducted by the County and builds upon the broader water resource management benefits that a recycled water program could provide in this geographic area.

9.2.2 Plant Improvements

Over the past decade, recycled water related improvements have been made to the Central Kitsap WWTP, per the 2011 Basis of Design. Most of the improvements needed to generate recycled water have been put in place, including:

- Tertiary filtration system, initially sized to produce 3.5 MGD of recycled water.
- Pumps to convey secondary effluent from the UV disinfection system to the filters.
- Coagulant feed system.
- Chlorination and dechlorination systems.

These systems are used periodically, for operational and maintenance purposes to keep the equipment in sound working order, but no recycled water is being produced. Additional improvements needed to fully produce recycled water and convey the resource offsite are discussed in **Section 9.6**.

A schematic of the existing recycled water system, including flow and analysis elements and piping for recycled water not meeting specifications, is provided in **Figure 9-1**. A magnetic flow meter is present upstream of the filter influent channel and a second flow meter is present downstream of the filters. A sample tap for turbidity measurement is also present downstream of the filter effluent channel. This turbidity meter will aid in the identification of recycled water that does not meet permit requirements (i.e., "off-spec" water).

Two existing chlorine residual meters are present. The first is located upstream of the ascorbic acid dechlorination dosing point and the second is upstream of the slide gate to the 72-inch secondary effluent outfall pipe. These chlorine residual meters will be used to monitor residual chlorine to confirm that any residual chlorine is ultimately neutralized in any portion of recycled water that is routed to the secondary effluent outfall, such as "off-spec" water that must be diverted from conveyance to the recycled water transmission system. This is important because Ecology currently does not permit any residual chlorine in the secondary outfall per NPDES WA0030520.

Figure 9-1 also shows elements required in the future, such as connection to the existing 18-inch HDPE pipeline that is envisioned for use as a recycled water transmission line and a motorized control valve that would be used to automatically divert "off-spec" recycled water to the outfall under prescribed conditions (see **Section 9.4.1** for more detail regarding these future improvements).

9.3 Benefits and Potential Uses

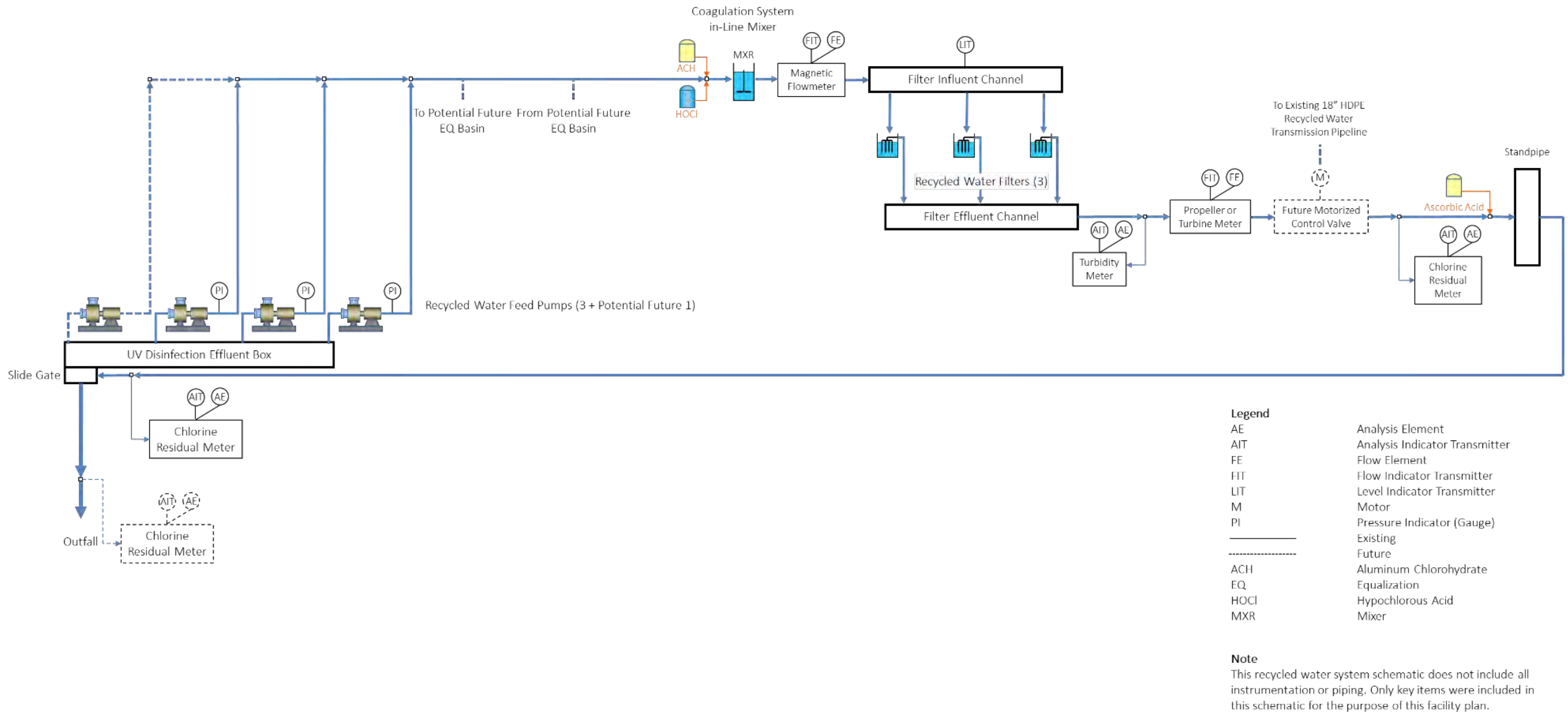
This section describes the general benefits of recycled water and identifies specific potential uses and their associated quantities.

9.3.1 General Benefits of Recycled Water

Recycled water can provide numerous benefits. Specific environmental benefits associated with the envisioned recycled water program at the Central Kitsap WWTP are summarized below.

- **Conserve limited groundwater resources**. Water use in the area is sourced from groundwater pumped primarily from the sea-level aquifer. This is a limited resource, with aquifer levels susceptible to decline as local water demand increases. In addition, saltwater intrusion can occur if groundwater levels are withdrawn below certain thresholds. Use of recycled water to replace the use of potable water for nonpotable purposes, especially during peak use times (i.e., summer irrigation season), reduces the stress on area groundwater and supports sustainable management of that limited resource.

Figure 9-1 | Schematic of Existing Recycled Water System



- **Reduce marine water discharge**. Recycled water is being increasingly explored around Puget Sound as a means to reduce wastewater discharge (and therefore reduce nitrogen loading) to marine waters and comply with more restrictive wastewater discharge permit requirements, such as those established by the recently enacted PSNGP. Such actions serve to protect and improve marine water quality, which in turn improves fish and shellfish habitat by reducing the overpopulation of phytoplankton and zooplankton and avoiding development of algal blooms.

- **Restore and replenish streams and fish habitats**. Recycled water can be used to directly augment streams and wetlands and can be used to indirectly influence them through recharge of groundwater that supports such features.

9.3.2 Silverdale Water District

Prior planning by the County and partnering entities identified the District as a primary potential distributor of recycled water produced at the Central Kitsap WWTP. For more than 15 years the District has incorporated the concept of recycled water in its water system plan and has been installing recycled water distribution piping to utilize the resource for applications such as irrigation, toilet flushing, and groundwater recharge when it becomes available from the WWTP. Some existing customers are currently connected to this distribution system (which is currently conveying potable water), while others have stub-outs from the recycled water mains on their property to support service line extensions and meters in the near future (i.e., when the recycled water is available). In both cases, some connections are for irrigation solely, while other connections are for dual-plumbed facilities that will ultimately make use of recycled water for both irrigation and approved indoor uses (such as toilet and urinal flushing). As part of its 2023 Water Comprehensive Plan Update process, the District has updated the estimate of demands associated with these connections, based on 2019-2021 water use billing data. In total, these customers represent approximately 433,000 gpd of use during the irrigation season.

The District has not developed specific longer-term recycled water projections for these types of uses. However, analysis conducted for the District's 20-year potable water demand forecast in the context of its 2023 Water Comprehensive Plan Update[2] projects a 40 percent increase in overall water demand between 2022 and 2042. Given the ability to expand the recycled water distribution network to other parts of the service area, it is reasonable to assume half of this rate of growth in recycled water usage (i.e., it is unlikely that the same amount of large irrigated turf and landscape areas will continue to develop as currently exist). Therefore, a long-term (i.e., 20-year) forecast of District demands for these uses is approximately 520,000 gpd during peak irrigation season (433,000 gpd with 20 percent increase).

The District has plans to further explore a wider range of recycled water uses, including groundwater recharge, to sustain the utility's underlying source of water supply. Any specific investigations conducted to-date have been in the context of larger, regional efforts, which are described in **Section 9.3.3**. In addition to those specific projects, the District will continue to analyze other potential uses (such as groundwater infiltration other than the specific efforts noted in **Section 9.3.3**, streamflow augmentation, and wetlands enhancement), and is planning on constructing its recycled water transmission infrastructure to accommodate up to 3.5 MGD. This is reflected in the demand summary presented in **Section 9.3.5**.

[2] The District's 2023 Water Comprehensive Plan Update is under development, as of the writing of this section. Therefore, the information presented here that is based on that effort is subject to change during finalization of that plan. However, it is unlikely that any changes will be significant.

9.3.3 Aquifer Recharge and Streamflow Augmentation

A potential year-round application of recycled water is groundwater infiltration. The potential for this has been evaluated in the vicinity of the Central Kitsap WWTP at a conceptual level most recently as a part of watershed planning activities. In January 2018, the State legislature passed the Streamflow Restoration Act (RCW 90.94) to help maintain streamflow levels and associated environmental conditions while also ensuring rural communities have access to water. Amongst other things, this legislation required Ecology to develop a Watershed Restoration and Enhancement Plan for select WRIAs to identify projects that would mitigate or offset the consumptive impacts of new water right permit-exempt domestic groundwater withdrawals. WRIA 15, within which the Central Kitsap WWTP is located, is one such WRIA.

Ecology published the "WRIA 15 – Kitsap Watershed Final Draft Plan" in March 2022. One of the mitigation strategies discussed in this plan is the use of groundwater infiltration (also called managed aquifer recharge), wherein water such as seasonal high flow surface water, stormwater, or recycled water is intentionally introduced into the shallow aquifer setting for the purpose of bolstering groundwater levels, and thereby benefiting streamflows.

One such project identified in the WRIA 15 plan is the use of Central Kitsap WWTP-produced recycled water, conveyed through District recycled water transmission piping, for recharge and potentially direct streamflow augmentation at multiple sites to the west and south of the Central Kitsap WWTP. These end use locations include the sand and gravel facilities at Dickey Road, the Asbury Soils site, and a stormwater retention pond along Newberry Hill Road near the terminus of the District's planned pipeline. In total, the WRIA 15 plan estimates a flow of 0.5 MGD could be used to provide 560 acre-feet per year of streamflow benefit to multiple creeks.

9.3.4 Other Uses

Other potential recycled water uses that have been considered are:

- Irrigation of turf/landscaped areas managed by the County. The Plan project team discussed with staff from the County Parks Department (during a meeting held on January 21, 2022, and through subsequent email communications) the possibility of irrigating County facilities with recycled water from the Central Kitsap WWTP. Upon review of applicable facilities, their associated water usage and location relative to the Central Kitsap WWTP and planned recycled water transmission infrastructure, County staff indicated there were no sites where such use would be cost-effective other than the small areas already included in the District's plans for delivery of recycled water.

- Other Water Purveyors. The project team discussed with the District and other water purveyors, during various meetings held in early 2022 and 2023, the potential for delivery of recycled water to other nearby potable water purveyors. While this is a possibility, no other purveyors had identified significant uses and therefore had no plans to connect to the envisioned transmission system to come from the Central Kitsap WWTP. This could change in the future once North Perry Water District completes a recycled water feasibility study of its own.

- Wetlands Enhancement. While wetlands enhancement is a possible use of recycled water, it is more limited to seasonal (summer) application in western Washington than other environmental uses such as groundwater infiltration and streamflow augmentation, which are described in **Section 9.3.3**. Based on the analysis conducted in the above sections, and as summarized in **Section 9.3.5**, it appears the potential for irrigation, groundwater recharge, and streamflow augmentation will likely add up to the total amount of summer-time flow that the Central Kitsap WWTP recycled water facilities have thus far been designed for (3.5-4.0 MGD). Wetland enhancement may therefore not be required to utilize a substantial amount of recycled water during the dry season. However, this could be investigated more closely, particularly in wetland areas in proximity to recycled water facilities, such as the wetland complex directly to the south of the Central Kitsap WWTP, if irrigation demands are not realized to the level anticipated.

9.3.5 Summary of Estimated Recycled Water Demands

Table 9-1 presents a summary of potential near-term (5-year) and longer-term (beyond 20-year) demands for recycled water produced at the Central Kitsap WWTP. The volume of near-term uses is expected to be on the order of 0.4 MGD (District-related uses only) to 0.9 MGD (including groundwater recharge associated with the WRIA 15 plan). By contrast, it is reasonable for the long-term demand to approach 3.5 MGD, based on the growth of District-customer irrigation and approved indoor usage and additional use for groundwater infiltration and other environmental enhancement uses.

Table 9-1 | Summary of Estimated Recycled Water Demands

Recycled Water Use	Near-Term (5-years)		Long-Term (>20-years)	
	Annual (gallons)	Max Daily (gpd)	Annual (gallons)	Max Daily (gpd)
Silverdale Water District Irrigation-Only Customers	19,700,000	313,000	23,640,000	375,600
Silverdale Water District Dual-Plumbed Customers	10,900,000	120,000	13,080,000	144,000
Groundwater Infiltration (WRIA 15 Plan)[1]	182,500,000	500,000	182,500,000	500,000
Other Uses[2]	0	0	452,673,000	2,480,400
TOTAL[3]	**213,100,000**	**933,000**	**671,893,000**	**3,500,000**

Notes:

1. Groundwater infiltration at these sites is assumed to be operational all year.
2. Other uses to be identified include additional groundwater recharge and environmental enhancement, up to the planned recycled water treatment and transmission capacity of approximately 3.5 MGD. Annual amount assumes that these uses are operational half of the year, to account for seasonal limitations associated with some environmental enhancement options.
3. Near-term max daily total is consistent with the District's recycled water planning in development of its 2023 Water Comprehensive Plan Update. Long-term max daily total is established at current design capacity of the Central Kitsap WWTP recycled water treatment unit processes.

9.4 Recycled Water Disinfection Process Evaluation

As part of the 2011 Basis of Design, the preliminary plan for disinfection of recycled water was to chlorinate. With the adoption by Washington State of the Reclaimed Water Rule in 2018, the County re-evaluated this planned approach in this Plan by further exploring the potential for using UV disinfection and comparing that to chlorination. This section summarizes this re-evaluation of chlorination and UV disinfection options to meet Class A recycled water performance standards including those identified for total coliform per WAC 173-219 (i.e., a 7-day median of 2.2 most probable number (MPN)/100 mL or CFU/100 mL, and a sample maximum of 23 MPN/100 mL or CFU/100 mL). Though these disinfection evaluation options might be sufficient in meeting those performance standards, it is important to highlight that recycled water would also need to meet specific nitrogen limits for certain uses as discussed in **Section 9.3.3**. If those limits are not met, the recycled water effluent would be redirected to the plant's outfall as described in **Section 9.2.2**.

9.4.1 Option 1: Chlorination

As previously discussed, a chlorination system has already been installed to provide the additional disinfection needed to produce Class A recycled water from Central Kitsap WWTP's secondary effluent.

Chlorine contact time requirements can be met by connecting the piping from the recycled water filter effluent to an existing unused 18-inch HDPE pipeline that extends south from the plant. There is approximately 4,500 feet in distance along this pipeline alignment, from the existing recycled water treatment facilities to the approximate proposed location of a recycled water distribution reservoir that the District tentatively envisions constructing in the vicinity of Madison Road, prior to any end uses of the water. See **Figure 9-2** for locations of these features. Given this length of pipe, a 30-minute chlorine contact time could be provided for flows up to approximately 1.5 MGD, which is more than sufficient to meet the projected near-term (5 year) recycled water demands.

In the event that the recycled water post-filtration is determined to not meet specifications (e.g., turbidity thresholds have been exceeded), the water would be diverted from conveyance to the recycled water transmission system and the existing dechlorination system using ascorbic acid would be used to neutralize any residual chlorine before the "off-spec" recycled water reaches the secondary effluent outfall. After the addition of ascorbic acid, the existing "off-spec" piping system will allow for a residence time of approximately three to six minutes (associated with a flow range of 0.4 – 0.9 MGD, per the potential near-term recycled water demand discussed in **Section 9.3**), which is sufficient for the removal of any free residual chlorine. However, this length of time may not be sufficient for complete neutralization of combined chlorine (e.g., chloramines), which could require up to approximately eight minutes of contact time. The exact timeline required is unknown as it will be dependent on water quality, including the concentration of ammonia, which will likely be variable. To account for this and provide for a more robust dechlorination approach, the additional mixing and dilution that will occur once this flow of water enters the 72-inch secondary effluent pipe that leads to the outfall can provide for additional ascorbic acid contact time. Preliminary analysis indicates that additional contact time provided in this pipe segment, prior to the manhole transition to the 36-inch outfall pipeline, would be three to four minutes. Therefore, the total contact time of six to ten minutes should be sufficient to achieve dechlorination to levels below detection. To fully implement this approach an additional chlorine residual meter would be needed in the 72-inch pipeline, prior to the manhole leading to the 36-inch outfall pipeline. The exact location of this additional feature would be determined during design.

To divert "off-spec" water when needed, a motorized control valve at the junction of the transmission pipeline and the "off-spec" pipe (see **Figure 9-1**) is needed to automate recycled water flow routing. This addition will also include associated control and power to the control valve. These features would be designed in accordance with the Reclaimed Water Facilities Manual reliability criteria.

Figure 9-2 | Near-Term Recycled Water Treatment/Distribution Components

While the use solely of chlorine for recycled water disinfection is feasible, it may be challenging for the Central Kitsap WWTP in the long term. These specific site conditions must be considered when employing chlorine for recycled water disinfection:

- The plant's biosolids process returns centrate to the treatment processes, resulting in tertiary effluent containing ammonia. The introduction of chlorine leads to the formation of combined chlorine or chloramines, which become the dominant disinfectant in the presence of ammonia. Chloramines are weaker disinfectants, requiring higher doses and longer contact times compared to free chlorine to achieve the Class A disinfection target for total coliform. The recycled water disinfection criteria, based on chloramination, entail a modal contact time of 90 minutes and a CT value of 450 mg/L-min (based on the Pomona Virus Study of 1977). The modal contact time of 90 minutes translates to a theoretical contact time of 120 minutes. To meet the Class A disinfection target based on these design criteria, a chlorine contact tank with a volume of approximately 300,000 gallons should be provided for a 3.5 MGD recycled water flow (long-term demands). Consequently, the recycled water system necessitates a substantial contact basin to provide sufficient contact time for chloramination. This is larger than was previously considered in the 2011 Basis of Design to achieve a 30-minute contact time for chlorination, and greater than what can be provided in the 18-inch pipeline. To minimize the chloramination effect, it may be advisable to produce recycled water primarily on non-dewatering days and/or when the facility is operating in BNR mode, to maintain low ammonia levels.

- Dechlorination might be necessary to reduce excess chlorine residual levels before distributing recycled water, or for routing of water that does not meet treatment requirements to the secondary effluent outfall for discharge. It is worth noting that Ecology identifies that the Central Kitsap WWTP uses UV for secondary effluent disinfection and thus no chlorine residual is permitted in the secondary effluent outfall above the quantitation level of 50 µg/L. Therefore, as noted previously, dechlorination would be required for any “off-spec” water that needed to be routed to the outfall. This would be accomplished by the existing dechlorination facilities, with the previously-mentioned additional control features to automate such a diversion. Regarding chlorine residual levels in the recycled water distribution system, high residuals may be undesirable for various end uses such as golf course irrigation or park irrigation. Thus, a dechlorination system may be required to decrease the excess chlorine residual closer to points of use. Such infrastructure will be identified during the planning and design of the recycled water distribution system, outside the scope of treatment facility planning.

- The region's water is characterized by very low alkalinity or low buffering capacity, making it susceptible to significant pH drops when chemicals are added for disinfection. Recycled water has a pH requirement within the range of 6 to 9. Chemical addition could challenge the pH limits of recycled water.

Maintaining a reliable chemical supply and mitigating rapidly escalating chemical prices are other concerns in the region regarding the chlorination approach. An incident at a major regional chemical supplier could significantly affect the chemical supply, resulting in a chemical shortage for all water and wastewater treatment facilities in the area. In addition, sodium hypochlorite prices have increased by over 100 percent since 2019. These could lead to chlorination being a low-reliability option for the long-term.

9.4.2 Option 2: UV Disinfection

An alternative to chlorination would be UV disinfection. The regulatory requirements and a preliminary assessment of an adequately-sized system at the Central Kitsap WWTP are provided in this sub-section.

9.4.2.1 Regulatory Requirements

For a recycled water UV system, the capacity would be based on Class A recycled water requirements, which demand a total coliform 7-day median of 2.2 MPN/100mL and a sample maximum of 23 MPN/100mL. Additionally, a UV system to produce Class A water needs to provide sufficient capacity for a 5-log reduction of poliovirus. The typical UV design criteria, based on the NWRI Guidelines for Water Recycling, to achieve these Class A water recycling requirements include a UV dose of 100 mJ/cm2 and a UVT of 55 percent when combined with upstream media filtration.

By contrast, the existing Central Kitsap WWTP UV system's capacity is designed to meet the NPDES discharge requirements, which specify a monthly geometric mean of fecal coliform at 200 cfu/100mL and a weekly geometric mean of fecal coliform at 400 cfu/100mL. The typical UV design parameters used to achieve these discharge requirements, following standards such as the Ten States Standards, include a UV dose of 30 mJ/cm2 and a UVT of 55 percent when combined with upstream media filtration.

Based on the above, the UV dose required for achieving the disinfection requirements in Class A recycled water is approximately four times higher than the current UV dose for secondary discharge. This reflects the more stringent microbial reduction targets and the higher level of treatment needed to increase the safety and quality of the recycled water. The increase in UV dose aims to provide the necessary level of disinfection to meet the Class A requirements, including the reduction of total coliform and the additional 5-log reduction of poliovirus.

9.4.2.2 Preliminary UV Analysis

A preliminary conceptual design of a UV system to provide the dedicated treatment needs of future recycled water disinfection was developed. The design basis of this system is summarized by the following:

- Xylem Duron system (600 watt/lamp)
- 24 lamps per bank
- Design UVT 55 percent (NWRI Guidelines with media filtration)
- Design Dose 100 mJ/cm^2 (NWRI Guidelines for non-potable reuse criteria with media filtration upstream)

A new system sizing summary is provided in **Table 9-2**, featuring low-pressure, high-output lamps in an open channel configuration. Open channel UV systems are commonly employed for recycled water disinfection when combined with upstream media filtration.

Table 9-2 | Preliminary UV System Sizing

Operational Period	Design Flow (MGD)	Number of Duty Channels	Redundancy Requirement	Number of Duty Banks in Each Channel	Number of Duty Lamps	Duty Power Output (kW)	Disinfection Power Requirement (kW/MGD)
Recycled Water System short term	1	2	1 bank in each channel	2	96	72	27.0
Recycled Water System long term	3.5	2	1 bank in each channel	4	192	144	41.1

The new UV system designed for recycled water disinfection would consist of two parallel channels. Each channel would have four duty banks and one standby bank. When both channels and four duty banks per channel are operational, the system would be capable of handling a recycled water disinfection flow rate of 3.5 MGD. Initially, for a short-term recycled flow of 1.0 MGD, two banks can be installed in each channel. The installation of the additional banks can be postponed until the recycled flow increases beyond 1.0 MGD.

UV technology is most effective for disinfection in recycled water applications when the solids content is low. Achieving a total coliform level of 2.2 MPN/100mL is a more stringent and challenging target compared to the discharge requirement of fecal coliform at 200 cfu/100mL. Therefore, it is desirable to have a low TSS level in the filter effluent for effective UV disinfection in recycled water. If the TSS level is high in the filter effluent, typically the UV system needs to be upsized to increase its disinfection capacity in order to compensate for the high solids content until a point called the "tailing effect" is reached. Beyond this point, increasing the UV dose does not lead to further pathogen reduction. It is recommended to conduct UV dose response testing, or collimated beam test, during the UV system design phase, using representative filter effluent samples, to establish the design UV dose. If the facility aims to improve solids reduction for UV treatment, enhancing the filters is recommended when considering water recycling.

9.4.3 Disinfection Residual

A recycling system comprises both a disinfection process and a residual control process. In the recycled water distribution system, chlorine is commonly employed for residual control. However, when utilizing UV treatment to achieve a total coliform level of 2.2 MPN/100mL, a small amount of chlorine is added after UV treatment for the purpose of recycled water distribution. Consequently, the disinfection system for recycled water incorporates a UV system along with a small chlorine storage and feed facility, typically utilizing sodium hypochlorite.

9.4.4 Recommended Disinfection Approach

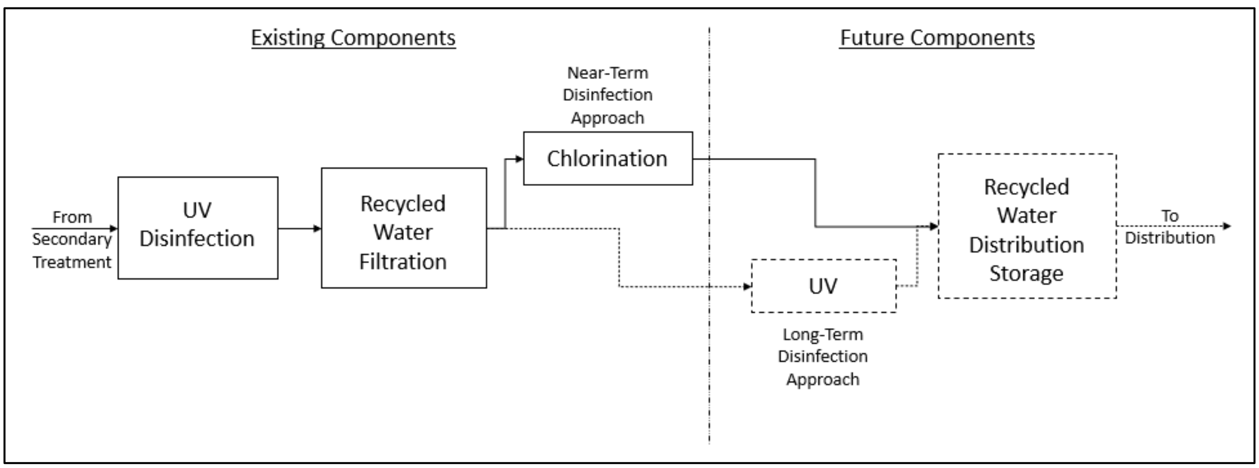
Based on the discussion above, it is recommended that the County consider employing UV disinfection to meet long-term recycled water objectives, with the District then providing booster chlorination at distribution system facilities to meet residual chlorine requirements. That said, to support near-term production of small-scale volumes of recycled water with minimal investment at the Central Kitsap WWTP over the next five years, it would be feasible to implement the previously-planned chlorination approach by introducing chlorine at the filters and utilizing the volume of the 18-inch HDPE transmission pipe that extends south to achieve contact time. This is most achievable if the County continues implementing steps to operate in BNR mode, at least when most feasible, so as to maintain ammonia levels less than approximately 1.0 mg/L, which would minimize chloramine formation and support using a 30-minute contact time.

Therefore, a phased approach is recommended for implementation, comprised of:

- **Near-term (to meet demands in approximately five years)**. Use of chlorination, with recycled water generated when the Central Kitsap WWTP is operating in BNR mode and potentially only on non-dewatering days (so as to avoid significant increases in ammonia concentration, and support a 30-minute contact time). Storage located throughout the distribution system would be used to equalize the recycled water flow to the distribution system during times when recycled water is not being generated.
- **Longer-term (to meet demands beyond five years)**. Implementation of UV disinfection to avoid the need for dechlorination and the need for additional contact time storage beyond that which can be provided by the existing transmission piping. It is recommended that this not be pursued until the magnitude and timing of future demands are more fully defined.

Figure 9-3 summarizes this approach. These concepts, and their sizing and timing, will be further refined in the context of a Recycled Water Master Plan that is currently under development by the County and the District (see **Section 9.6** for more detail).

Figure 9-3 | Key Recycled Water System Components



9.5 Treatment Process Reliability

WAC 173-219-350 describes the general treatment reliability standards for recycled water facilities. In summary, the treatment capacity of a recycled water facility must not be limited by the failure of one or more treatment trains but must be maintained at all times. This is in accordance with the reliability requirements assessed in **Section 6.5.2** of this Plan. That analysis indicates that the secondary clarification unit process is projected to be deficient in meeting reliability requirements by 2028, based on the hydraulic and capacity analysis presented in **Section 6**. That is, neither one of the two existing secondary clarifiers will have the hydraulic capacity to handle 75 percent of the predicted PHF within the next 20-year design period. To address this deficiency, the County has included a third secondary clarifier in the CIP. This improvement will address the reliability standards associated with recycled water requirements. The analysis also indicated that the existing aeration basins and UV disinfection channels will be sufficient to meet the hydraulic and process capacity throughout the next design period.

In addition, WAC 173-219-350 requires that treatment facilities store inadequately treated water or discharge such water through an NPDES outfall. At the Central Kitsap WWTP, this requirement will be met by routing water that does not meet Class A recycled water to the facility's secondary effluent outfall. During near-term operation, while chlorination is used to achieve the recycled water disinfection requirement, the presently installed dechlorination system will be used to dechlorinate the water prior to routing to the outfall. During the long-term operation with UV disinfection in place, no additional step will be required prior to routing the water from the treatment process to the outfall.

9.6 Capital Improvements

This section summarizes future planning the County is implementing with the District and identifies capital improvements related to further development of the recycled water system.

9.6.1 Recycled Water Master Planning with Silverdale Water District

As noted previously, the County has been coordinating with the District for over a decade on the early phases of recycled water program development. With both entities having implemented related infrastructure and advanced the planning of recycled water in their respective utilities, the County and the District are now coordinating closely to prepare a joint Recycled Water Master Plan. In scoping as of the writing of this Plan, the Recycled Water Master Plan will provide the additional analysis needed to finalize the plan forward for remaining infrastructure needed to be developed by both the County and the District to complete the production of recycled water and delivery of that resource to a point where the District can then receive and distribute it. As such, final decisions on future County capital improvements related to recycled water generation will be made as part of that effort, building upon the information that is provided and capital projects that are suggested in this plan.

9.6.2 Capital Improvement Projects

Two phases of capital improvements are planned relating to production of recycled water, as summarized below.

- **Near-Term Improvements**. Improvements are needed to connect the effluent piping from the recycled water filters to the existing, unused 18-inch HDPE pipeline that then runs from the filter location south through the plant site. These improvements include a small piping connection and associated appurtenances to connect pipelines that are currently less than 20 feet apart, insertion of a motorized control valve and associated control and power wiring (for diversion of "off-spec" water), an additional chlorine residual meter (sampling from the 72-inch secondary effluent pipeline, to make sure of chlorine-free discharge of "off-spec" water), and system control programming to integrate water quality monitoring data (e.g., filter effluent turbidity) into valve control logic.

- **Long-Term Improvements**. To support long-term recycled water demands (i.e., beyond five years and up 3.5 MGD in flow), it is recommended that the County construct an additional UV system to achieve the disinfection requirements associated with recycled water, based on the design assumptions described in **Section 9.4.2**.

Table 9-3 presents the OPPC for these recycled water related improvements. These OPPCs are based on a Class 5 estimate (-50 percent to +100 percent) as defined by the AACE. The estimates include these key assumptions: electrical, instrumentation, and controls costs at 25 percent of the direct construction cost;

engineering design and project administration at 25 percent of total project cost; and, construction services and allied costs at 25 percent of total project cost.

Table 9-3 | Recycled Water System Capital Improvements

Project	Project Cost
Near-Term Improvements (piping connections, control valve, chlorine residual meter, control logic programming)	$521,000
Long-Term Improvements (UV disinfection)	$4,667,000
TOTAL	**$5,188,000**

9.7 Future Steps

The key next step the County is taking regarding implementing the Central Kitsap WWTP recycled water program is a joint Recycled Water Master Plan with the District. That plan will finalize decisions on the additional capital improvements needed at the Central Kitsap WWTP to produce Class A recycled water, as well as improvements required offsite for distribution of the resource, and will address policy and programmatic elements required for operation and maintenance of the system.

Key implementation considerations that will be taken into account in that effort, beyond technical feasibility, costs, and water quantity/quality benefits, include those described briefly below. These items will be explored in greater depth as the County and the District advances in its planning process.

- Regulatory Requirements. One of the more rapidly changing elements that will shape future recycled water programs are water quality requirements related to currently unregulated chemicals. In particular, the water industry's current focus on per- and polyfluoroalkyl substances (PFAS) will likely yield State or federal drinking water limits that are lower than the State Action Levels established for five PFAS compounds in 2021. This may lead to certain additional forms of treatment being required to produce recycled water suitable for purposes such as groundwater recharge or streamflow augmentation. The County and its recycled water program partners will consider these factors when deciding which recycled water applications to place into use first.

- Funding. The capital investment to implement reuse can be significant and is greater than what can be realistically recouped through recycled water rates. Most utilities seek low-interest loans or grant money from the State or federal government to support reuse implementation. At the State level, this includes funding through the Centennial Clean Water Fund, while at the federal level this can include funding through the WaterSMART Title XVI program.

- Stakeholder and Public Outreach. The County has had extensive coordination with the Suquamish Tribe during development of the proposed recycled water project. Continued collaboration with the Tribe, along with general public involvement, is critical to the success of this effort, largely in relation to the above two topics of water quality and funding. The public will want assurance that proposed reuse practices are protective of public and environmental health. In addition, the full range of benefits must be articulated so that the community can truly assess costs versus benefits, and understand how investment in reuse relates or compares to other priorities the County is facing.

- Implementation Policies and Procedures. Recycled water programs require much more than the upfront capital infrastructure. County policies will be needed to establish when, where, and how recycled water can be used and what the applicable rates are for customers who would use the resource. Depending on the extent of infrastructure that may be needed in the future, development standards may be required, including maintenance procedures specific to purple pipe distribution systems, water quality monitoring/reporting, and backflow prevention. These elements, along with other considerations such as development of end user agreements, will be addressed in more detail in the Recycled Water Master Plan.

SECTION 10

Operations and Maintenance

10.1 Introduction

The County's Central Kitsap sewer collection and conveyance system, WWTP O&M program, and review of State and Federal requirements that impact the County's O&M program are summarized in this section. Current department organization and staffing is presented, and future staffing needs are also discussed. Comments, observations, and recommendations to improve the efficiency and effectiveness of the County's O&M program are provided at the end of this section. Key O&M elements that have the potential to impact the CIP are carried forward and further discussed in the following sections.

10.2 Utility Management and Structure

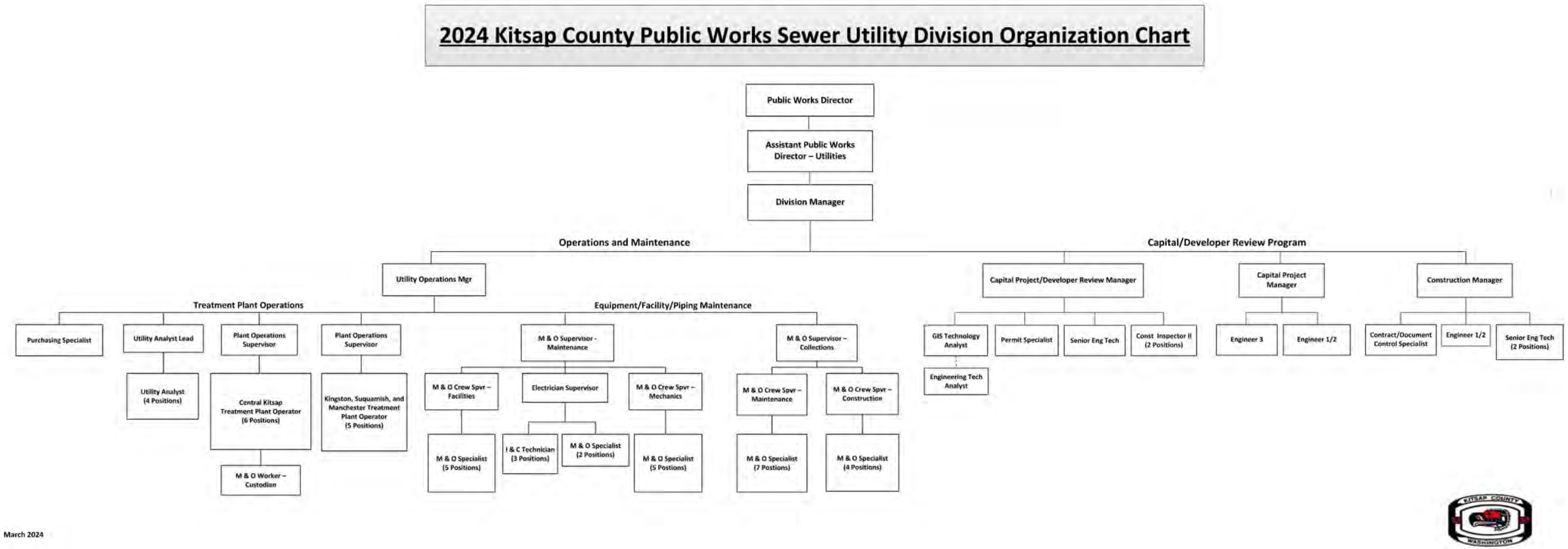
The County is managed by a three-person Board of County Commissioners, who are elected officials that represent one of three geographical districts. The Kitsap County Department of Public Works is responsible for management of County roads, recycling and solid waste, sewer, and stormwater, with separate Divisions for each. The Sewer Utility Division is responsible for O&M of both the sewer collection system and the County's four WWTPs. The organizational chart for the Sewer Utility Division is shown as **Figure 10-1**.

The Sewer Utility is led by the Sewer Utility Senior O&M Manager, who reports to the Public Works Assistant Director. A total of 72 staff currently work in the Sewer Utility Division. The Sewer Utility Division consists of four main work groups: Utilities (Plant and Pump Station) O&M, Field (Collection) Operations, Engineering and Administration, and Construction Management.

The Utilities (Plant and Pump Station) O&M is led by the Utilities Operations Manager. The pump station O&M of the plants and pump stations is run by the Sewer Utility O&M Supervisor who oversees two Maintenance Crew Supervisors, each with a five-person crew, and an Electrical Supervisor with a 5-person crew. The four WWTPs are managed by the two Plant Operations Supervisors: Outlying Plant Supervisor and Central Kitsap Treatment Plant Supervisor. The three smaller WWTPs, Kingston, Suquamish, and Manchester, each have a lead operator and share two additional operators who work on all plants as needed. Central Kitsap WWTP is run with six plant operators, and one worker. The County cross-trains operations staff so that they can fill in for other staff during absences or emergencies.

The Field (Collection) Operations is responsible to maintain, repair, replace, clean, and inspect the sewer utilities collection systems. It is managed by the Sewer Collections O&M Supervisor who oversees two O&M Crew Supervisors. Engineering efforts are managed by both the Sewer Utility Engineering and Construction Management Groups. The Construction Management Group manages the delivery of capital work while the Engineering Group manages the design, both groups consult the Facilities and Conveyance operation groups for project specific challenges that will impact day-to-day or future operations. The Administration portion of the Engineering Group manages the GIS database utilized by the Operations groups and provides review efforts for Developer proposed projects.

Figure 10-1 | Kitsap County Public Works Sewer Utility Organizational Chart



10.3 Operation and Maintenance Requirements

10.3.1 Regulatory Compliance

Ecology has the authority to permit WWTPs through the NPDES program, which includes Central Kitsap WWTP. Ecology has issued NPDES Permit WA0030520 to the County for Central Kitsap WWTP, which includes operator certification and O&M requirements for both the WWTP and the collection system.

10.3.2 Operation and Maintenance Program

As required by the NPDES permit, the County has instituted an O&M program which consists of maintenance records for all major mechanical and electrical components for the WWTP, collection system, pump stations, and any other major facilities. The County uses a computerized maintenance management system (CMMS) to schedule and record all maintenance activities for plants and pump stations. The system identifies the frequency and type of maintenance recommended by the manufacturer and records the frequency and types of maintenance performed. The CMMS is available to all relevant County staff for review, update, and inspection. The County also uses a GIS system to inventory and record all maintenance and inspections of the conveyance pipe systems and is also used to populate downloadable asset layers accessible to the public.

10.3.3 Operation and Maintenance Manual

The Central Kitsap WWTP O&M Manual provides basic information for the plant in accordance with the NPDES permit, WAC 173-240-080, and Ecology's Orange Book. It describes the treatment process in sufficient detail to familiarize personnel with both the normal operation of the plant as well as the alternate methods of operation that are available. In addition, it provides an overview of all miscellaneous components and management systems in use at the plant. The intent of the manual is to assist operators and other personnel with learning the overall operation of the plant, to serve as a basic reference for operating any of the system's components and provide emergency response and safety guidelines.

Pump station specific O&M information is located on the County's Electronic Operations and Maintenance website. This includes information on critical pieces of equipment such as pumps, electrical, instrumentation, controls equipment, valves, and odor control systems. Newer stations have more complete O&M data than older stations.

10.4 Supervisory Control and Data Acquisition

The County employs a SCADA system to monitor and record the status of the pump stations and treatment plants. The SCADA system uses Aveva (previously known as Wonderware) software. The County recently completed a Sewer Utility SCADA Master Plan that evaluated the existing SCADA system, identified operational needs, determined preferred hardware and software, and presented recommended improvement projects. The Scada Master Plan TM is included as **Appendix D**. All the County pump stations are connected to the SCADA system, and new pump stations include force main pressure monitoring to provide greater remote insight into operating conditions.

The pump stations and treatment plants have a number of alarms that are linked to the County SCADA system that alert staff if a problem is occurring via either very high frequency (VHF) licensed radio network or 4G cellular network. These alarms include high wet well level alarms, intrusion alarms, pump fail alarms, and others. The alarm functionality at pump stations designated as 'critical' is checked weekly to test that they are operational.

10.5 Collection System Operation and Maintenance Activities

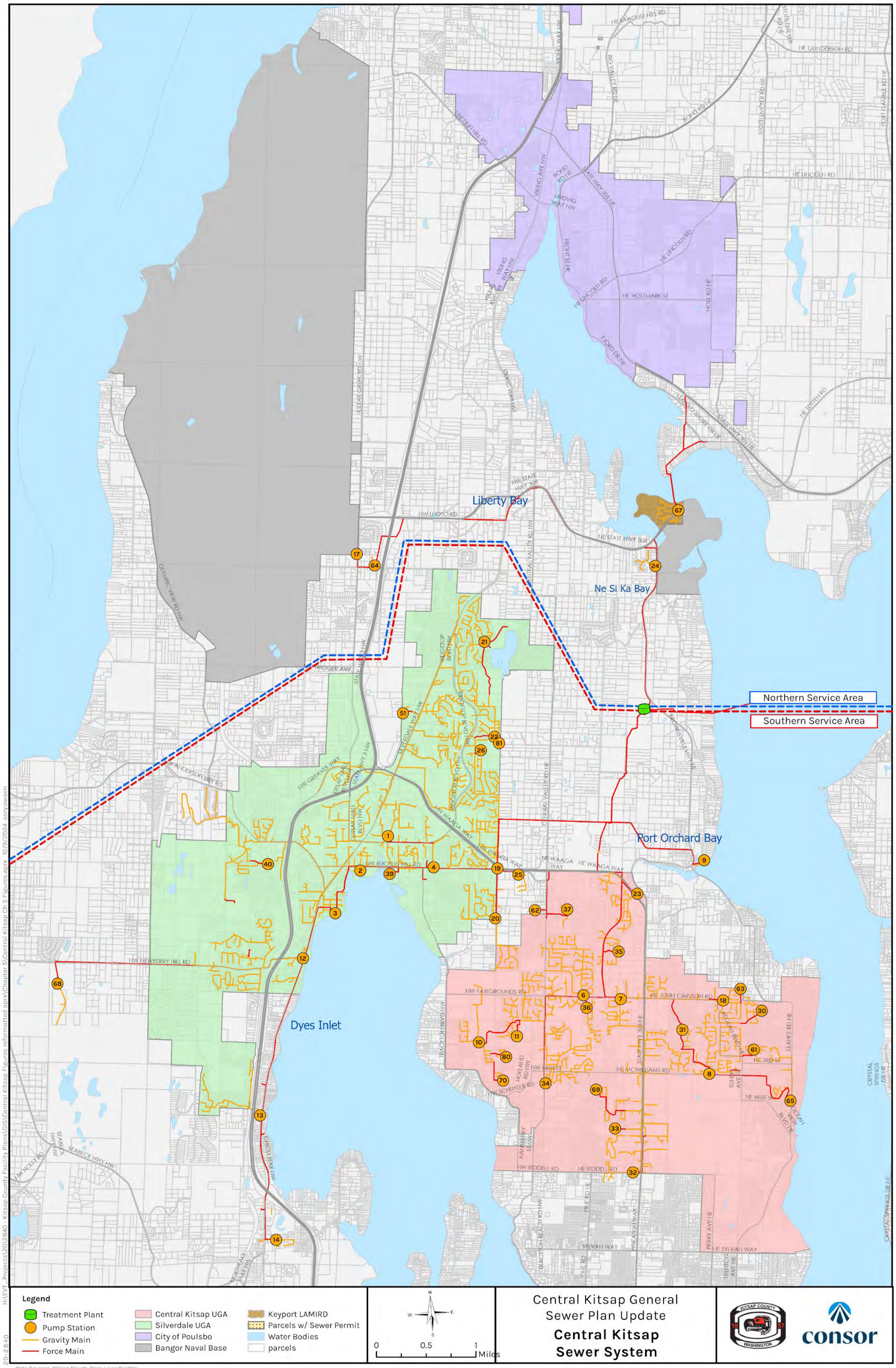
10.5.1 Collection System Overview

The Central Kitsap collection and conveyance system is comprised of two service areas defined as the Northern and Southern Service Areas. Figure 10-2 presents an overview of the Central Kitsap sewer system.

The Northern Service Area consists of the Keyport Naval Base and Bangor Trident Base, and Poulsbo communities. The Northern Service Area's flows are routed through PS-17, PS-64, PS-67, and PS-24. Flows from all pump stations combine at the intersection of NE Tagholm Road and Brownsville Highway NE into a 24-inch diameter force main that runs south along Brownsville Highway NE and discharges at the influent channel of the Central Kitsap WWTP Headworks. The Navy owns and operates the sewer system upstream of PS-17 within Bangor Naval Base, as well as the sewer system within the boundaries of Keyport Naval Base. The County owns and maintains the sewer system within the residential areas of the Keyport community and performs routine sampling of flows on-site at Keyport Naval Base on a restricted access basis. The City of Poulsbo owns and operates the sewer system upstream of Johnson Way NE and State Highway 305.

The Central Kitsap collection and conveyance system's Southern Service Area is divided into two primary basins, each defined by the UGA for which they serve. The Silverdale basin includes 14 pump stations encompassed within the District UGA boundary as well as the outlying PS-13, PS-14, and PS-68. The Central Kitsap basin is defined by the Central Kitsap UGA boundary and includes 22 pump stations. Flows from all pump stations within the Southern Service Area ultimately combine at the intersection of NE Paulson Road and Kelly Court NE into a 30-inch diameter pipe running north to the Central Kitsap WWTP.

Figure 10-2 | Central Kitsap Sewer System



Data Sources: Kitsap County Base Layer Credits:
Disclaimer: Consor Engineers & Kitsap County make no representations, express or implied, as to the accuracy, completeness and timeliness of the information displayed. This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.

10.5.2 Pump Stations

County crews visit and inspect each pump station regularly to check on equipment, test alarms, and perform maintenance as needed. The inspection and testing frequency is determined by the criticality of the pump station and is completed as shown in **Table 10-1**. Criticality is determined by how many drainage basins (or upstream pump stations) discharge to the pump stations. A schematic of the conveyance system showing the pump station criticality is shown in **Figure 10-3**. Physical location of a pump station in relation to a water body or location that is difficult to access, may drive a higher criticality definition independent of number of contributing basins. Generator load exercise is completed with the pump station load at all critical stations and regional stations with loads greater than 200 kW. Stations with loads less than 200 kW are exercised with mobile load banks. Stations will be checked if alarms are indicated.

Table 10-1 | Pump Station Inspection & Testing Frequency

Pump Station Type[1]	Threshold for Designation	Inspection Frequency	Alarm Check Frequency	Generator Load Exercise[2]
Critical	5+ Basins Served, or if specifically identified	1 x per week	bi-weekly	Annually
Regional	3-4 Basins Served	1x per week	bi-weekly	Annually
Relay	2 Basins Served	1 x per week	bi-weekly	Annually
Satellite	1 Basin Served	1x per week	bi-weekly	Annually

Notes:

1. Certain pump stations may serve fewer basins, yet the selection of type is driven by location.
2. Generators are run monthly, however load tested annually.

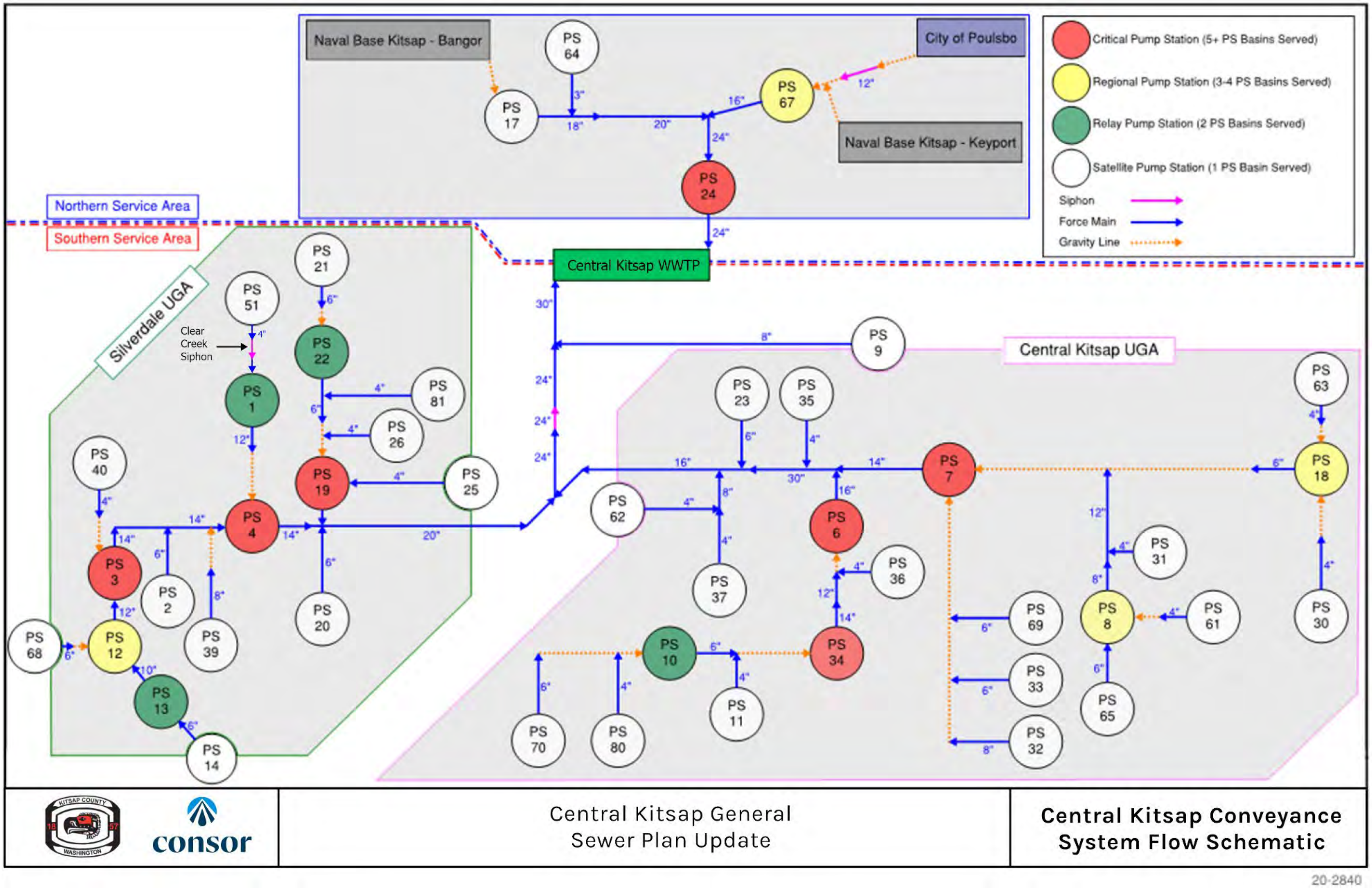
10.5.3 Sanitary Sewers

Gravity sanitary sewer pipes and manholes are regularly cleaned to clear them of debris, settled solids, and grease buildup and inspected with video equipment to evaluate pipe condition and identify any condition issues. Sewer cleaning and inspection are vital to maintaining a well working sewer collection system. Over time, deterioration, solids build-up, and blockages can cause collapse and other pre-mature failures. Proactive maintenance through cleaning and inspection keeps the sewer collection system working efficiently and avoids many serious service disruptions from occurring.

The County performs pipe cleaning/jetting and CCTV inspection in-house. Reasons for inspection include routinely scheduled inspections, warranty inspections, new construction inspections and other special projects inspection. The system is jetted prior to inspections to improve visibility by removing grease, roots by foaming, sand, grit, and debris, helping reduce blockages and odor issues.

The County process consists of inspecting pipe via CCTV, storing the video in a database, reviewing the video, and assigning an OCI score based on the observations. Pipe condition is evaluated based on operator experience and flagged for further investigation if needed. The County does not currently use a condition rating system such as the National Association of Sewer Service Companies (NASSCO) standards to evaluate and record observed conditions. It is recommended that the County consider having CCTV operators trained and certified in NASCCO assessment to improve the consistency of sewer inspecting rating.

Figure 10-3 | Central Kitsap Conveyance System Flow Schematic



The results of these assessments have been stored in their asset management database software Cartegraph since 2017. The County has a target metric to complete inspection of all pipes in the system on a five-year cycle (approximately 20 percent of the pipes inspected each year). According to Standard Operating Procedure (SOP), in addition to CCTV every five-year, flushing is performed annually unless identified as a hot spot and frequency is then location dependent. At the time of this writing, all of the pipes have been inspected and an evaluation has been stored in Cartegraph.

The force mains and siphons are cleaned when needed. The County's force mains are designed to achieve scouring velocities that self-clean under normal system operation. If pipe conditions allow, pigging is performed annually. Destructive testing is only performed when lines are suspected of failure.

The Central Kitsap WWTP outfall is inspected by divers following the procedures required by the NPDES permit.

10.5.4 Pretreatment Program

The County is required by the NPDES permit to enact a pretreatment program to ensure all commercial and industrial customers comply with the pretreatment regulations in 40 CFR Part 403 through 471. The program is required to take continuous and routine measures to identify all existing, new, and proposed SIUs. Pretreatment by industrial users that contribute to the County system is managed by Ecology. Refer to Section 4 for a list of current industrial users.

10.5.5 Odor and Corrosion Control Program

The County has several calcium nitrate (Bioxide™) solution dosing systems in the collection system to remove and prevent formation of H_2S. The systems are located upstream of areas where odor complaints are common. These systems are set to dose automatically and are not connected to SCADA. Operators visit each system regularly to check on operation and refill on-site solution containers.

The County also utilizes hypochlorite dosing, charcoal filters, and organic biofilters at specific stations. Uses are prescribed based upon individual pump station characteristics.

10.5.6 Fats, Oils, and Grease Program

Kitsap County Code 13.12.160 prohibits discharge of pollutants that will cause obstructions in the County sewer system. Improper discharge of FOG or failure to maintain oil/water separators can cause operational problems in the collection system. Businesses producing FOG are required to have and maintain a grease removal system. Depending on the type and size of business, this may be a small grease trap maintained by employees or a large oil/water interceptor that is pumped out regularly by a permitted waste hauler. The County accepts hauled FOG waste at the Central Kitsap WWTP and is currently designing a dedicated FOG receiving station to improve ease of disposal for FOG haulers.

The County is considering implementing code through the use of inspection, enforcement, or other financial penalties to ensure FOG compliance.

10.6 WWTP Operations and Maintenance Activities

10.6.1 Preventative Maintenance

The County maintains the Central Kitsap WWTP to keep critical components in good operating condition. This includes inspecting machinery, cleaning tanks, and maintaining equipment. Maintenance is performed in accordance with the manufacturer's recommendations during the warranty period for equipment and maintenance intervals are adjusted based on operator experience after the warranty period expires. Spare parts for all equipment are tracked in the CMMS with critical spare parts identified. Key parts are kept on hand in instances where the part cannot be readily obtained from local suppliers.

It is recommended that the County develop a valve exercise program to minimize issues with infrequently used valves seizing as they age, and also review spare parts inventories and assess the need for additional spare parts due to supply chain challenges.

10.6.2 Laboratory Operation and Accreditation

The County maintains an accredited laboratory at the Central Kitsap WWTP (W660-21A) to provide analysis of a broad range of water quality parameters including those for reporting or permit monitoring data. The laboratories at the smaller WWTPs are not certified, so samples from the smaller WWTPs are analyzed at the Central Kitsap WWTP lab for reporting purposes. The County must maintain accreditation in accordance with WAC 173-50. Ecology's *Procedural Manual for the Environmental Laboratory Accreditation Program* provides details on requirements, fees, recommended practices, proficiency testing, and audit procedures.

In addition to completing water quality testing, the laboratory is responsible for recalibrating and maintaining process probes and mobile testing instruments.

10.7 Sewer Collection System Staffing Needs

The County operates and maintains all four basins as a single utility, and all sewer collection staff work in all the basins. A comparison of County sewer collection operations staff with similar utilities in the area is shown in **Table 10-2**. The County numbers reflect all County owned sewer collection and conveyance facilities from all County basins. The County has slightly more staff per mile of pipe, but fewer staff per pump station than the average of the other utilities.

Table 10-2 | Sewer System Staffing Comparison

Agency	Personnel (FTE)	Miles of Pipe	Personnel per Mile of Pipe	No. of Pump Stations	Personnel per Pump Station
Kitsap County	18	215[1]	0.09	64[2]	0.3
City of Bellevue	25	520	0.05	36	0.7
City of Enumclaw	4	142	0.03	7	0.6
City of Kent	13	211	0.06	7	1.8
City of Kirkland	24	123	0.19	6	4.0
City of Lacey	14	236	0.06	48	0.3
City of Port Orchard	6.5	75	0.09	21	0.3
Silver Lake Water and Sewer District	33	207	0.16	22	1.5
West Sound Utility District	15	45	0.33	12	1.3
Alderwood Water and Wastewater District	11	440	0.03	12	0.9
Average			**0.11**		**1.25**

Notes:

FTE: Full-time equivalent

1. Total miles of gravity sewer pipe and force main pipe in Central Kitsap, Kingston, Manchester, Suquamish, and Navy Yard City, provided by the County's sewer asset count in 2024.
2. Number of pump stations in Central Kitsap, Kingston, Manchester, Suquamish, and Navy Yard City.

10.8 WWTP Staffing Needs

Central Kitsap WWTP is classified by Ecology as a Class IV facility, therefore, the operator in responsible charge must have a Group IV operator certification. Additionally, a Group III operator must be in charge during all regularly scheduled shifts. Operator certification of all four WWTPs is shown in **Table 10-3**. In addition to the plant operators, there are 5 laboratory staff who are required to obtain an operator certification within two years of being hired.

Table 10-3 | Operator Certifications

Operations Certification	Number of Staff
Operator in Training	0
Group I	4
Group II	5
Group III	3
Group IV	4
TOTAL	**16**

Current staffing at Central Kitsap WWTP facility consists of one Plant Operations Supervisor, six plant operators, and one worker. Thus, the total FTE for Central Kitsap is approximately 8.0 FTE. During off hours, critical SCADA alarms from the plant are configured to ring through to an on-call operator. Maintenance at Central Kitsap WWTP is conducted by the Sewer Utility O&M group which is shared across all of the County's WWTPs and collection and conveyance systems.

As flows and loads increase at the facility and as improvements are undertaken, staffing levels may change. **Table 10-4** identifies potential staffing needs at existing and future planning horizon based on *Estimating Staffing for Municipal Wastewater Treatment Facilities* (EPA, 1973) and *The Northeast Guide for Estimating Staffing at Publicly and Privately-Owned Wastewater Treatment Plants* (New England Interstate Water Pollution Control Commission, Nov 2008). These estimates include supervisory, administrative, clerical, laboratory, yard work, site maintenance, and unit process O&M. All methods assume 1,500 working hours per employee after holidays, time off, training, etc. These estimates are intended to be guidelines only; specific staffing levels must be determined by the County and reviewed regularly to adequately operate and maintain the facility.

Table 10-4 | Central Kitsap WWTP Staffing Comparison and Projection

Condition	Average Annual Flow (MGD)	Current Staffing	EPA Method Staffing	Northeast Guide Method Staffing
Staff at 2020 *(additional staff needed)*	3.5	8.00	7.04 *(0)*	9.13 *(1.13)*
Staff at 2042[1] *(additional staff needed)*	5.4	-	8.25 *(0.25)*	9.28 *(1.28)*

Note:
MGD: Million gallons per day
1. Staff required in 2042 is higher for both methods due to the upsized unit processes.

Based on both the EPA and Northeast Guide methods, the County's current approach of having eight dedicated staff for Central Kitsap WWTP appears to be appropriate and adequate for current operations. There is a deficiency in staff using the Northeast Guide method. Increase in flows and improvements at the plant are expected, so additional staff is expected to be required though the 20-year planning period. It is recommended that the County continue executing the Sewer Utility Plant Operator Qualification Program and additional external classroom training to accelerate employees into Operator Certification Group III and prepare for anticipated Puget Sound Nutrient Reduction Goals and facility upgrades.

10.9 Conclusions and Recommendations

Conclusions and recommendations based on a review of the County O&M practices are:

- Consider having CCTV operators trained and certified in NASCCO assessment to improve the consistency of sewer inspecting rating.
- Consider reviewing spare parts inventories and assessing the need for additional spare parts due to supply chain challenges.
- Institute and annual valve exercise and maintenance program.
- Consider developing additional classroom training to accelerate employees into Operator Certification Group III and prepare for anticipated Puget Sound Nutrient Reduction Goals and facility upgrades.
- Institute an Arc Flash Analysis and Protection program to identify deficiencies that can be mitigated through coordinated CIP projects.

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SECTION 11

Capital Improvement Plan

11.1 Introduction

This section identifies CIP projects and O&M projects for the Central Kitsap collection system and WWTP. These improvements are required to remedy deficiencies identified in **Section 7** and **Section 8**, and to implement a recycled water program as described in **Section 9**.

11.2 Capital Improvement Plan Criteria

The CIP projects are presented for recently completed and ongoing planned projects, 6-year basis from 2023 to 2028 for immediate and imminent needs and for the 20-year planning horizon (from 2029 to 2042) for improvements that are anticipated but not pressing. A planning level cost opinion and a preliminary timeline of CIP project implementation is provided. It is assumed that minor projects will be completed with O&M budget and are listed separately. The methodologies for funding the CIP projects will be discussed in **Section 12**.

The Asset Health Scores developed in **Section 5** and **Section 6** were used to identify the most critical projects across the County's system based on the condition and the CoF. The CIP projects were prioritized based on the Asset Health Scores and several factors including the extent and type of deficiency, customers impacted, environmental impacts, and capital and O&M costs.

In conjunction with the facility planning effort, the County has been working on a series of SCADA Master Plan TMs which include project identification, estimates, and capital improvement planning in TM No. 5. SCADA system improvements are not incorporated into this CIP because they are generally implemented across the entire sewer division, and not specifically to process improvements at the Central Kitsap WWTP. SCADA improvements were also included in a separate CIP.

Drivers of improvements are considered for five categories:

1. Capacity: An asset no longer has sufficient capacity when it cannot or is modeled in the future to not be able to meet the equipment, hydraulic, or process capacity requirements, as detailed in **Section 6** for the WWTP and **Section 7** for the collection and conveyance system. The proposed firm capacity is determined through hydraulic and hydrologic (H/H) model simulations considering increased population for the 2042 planning horizon and a 25-year storm event. Capacity driven improvements are assigned the maximum asset health score of 25 as these projects are considered the most critical. Capacities are defined as follows:

    a. A gravity sewer pipe no longer has sufficient capacity when the flow in the pipe is greater than or equal to 80 percent of pipe flowing full ($d/D \geq 0.8$).

    b. A force main no longer has sufficient capacity when the velocity in the pipe is greater than 7 fps.

    c. A pump station is over capacity if the largest pump is out of service and the remaining pump(s) is (are) unable keep up with the inflow.

   d. An equipment/treatment process no longer meets the equipment, hydraulic, or process capacity requirements, discussed in detail in **Section 6**.

2. O&M: County staff indicate the asset requires too frequent and/or too time or money-consuming visits. O&M issues are primarily driven by condition. The project goal will be to improve reliability and reduce maintenance call outs.

3. Obsolescence: The asset is reaching the end of its service life. Life expectancy of piping, structures, and mechanical/electrical equipment varies depending on the treatment processes and is discussed in **Section 6**. For the collection system, life expectancy of pipes are 100 years, structures are 50 years, and mechanical/electrical equipment is 25 years.

4. Developer: A new development in the County necessitates new or upgraded infrastructure that would not be needed by the existing customers and would be funded and constructed by a developer.

5. Regulatory: Regulatory projects will address facilities that are currently out of compliance or expected to become incompliant with existing, pending, or anticipated regulations set by the State and Federal agencies, such as Ecology or the EPA.

Projects for the County's sewer systems are identified with a code that identifies the basin, system, driver of improvements, and a project number using the following identifiers (note that basin identifiers are used as General Sewer Plan Updates for the three other service areas are being completed concurrent to this plan):

- Project Category:
    - Capital Improvement Plan = CIP
    - Operation and Maintenance = O&M
- Basin Abbreviations:
    - Central = CK
    - Kingston = K
    - Suquamish = S
    - Manchester = M
- System:
    - Collection and Conveyance = CC
    - Wastewater Treatment Plant = WWTP
- Driver:
    - Capacity = CAP
    - Operation and Maintenance = OM
    - Obsolescence = OB
    - Developer = DEV
    - Regulatory = REG

AACE International Class 5 OPPCs with an anticipated accuracy range of -50 percent to +100 percent were developed using RSMeans Heavy Construction Cost Data, recent County project bid tabs, County input, industry experience, and local contractor and supplier costs. The total project costs include construction costs for work and materials plus markups for mobilization, general contractor markups, overhead and profit, taxes, and a construction contingency of 50 percent plus an additional markup of 50 percent for engineering, legal, administration costs, and construction management associated with project delivery. The OPPCs were developed in 2023 dollars.

There is a five-year moratorium on pavement excavation and trenching following the completion of a new road or road overlay. This requirement restricts all road trenching except in the event of an emergency repair or if all trenching is outside of the paved area. Projects should be coordinated with road paving projects to avoid this moratorium and reduce paving costs.

11.3 Central Kitsap Collection and Conveyance System Improvements

The collection and conveyance system includes pump stations, force mains, and gravity sewers. Proposed CIP projects address identified deficiencies for these assets. Projects are frequently combined for efficient project delivery. The projects components are broken down into pump stations and pipeline projects which include force mains and gravity sewers.

11.3.1 Recently Completed and Ongoing Central Kitsap Collection and Conveyance CIP

Several of the projects that have been identified for the Central Kitsap collection and conveyance system have been completed during the facility planning process or are already in the construction phase. These projects are identified below and are not included in the CIP:

- Bangor-Keyport Force Main Replacement
- PS-19
- PS-21
- PS-31

Projects that are in currently in design will require significant financial commitment to finish design and construction, and are included in the 6-year CIP.

11.3.2 6-Year Collection and Conveyance CIP (2023 to 2028)

Each of the projects identified for the Central Kitsap collection and conveyance system 6-year CIP are summarized in **Table 11-1** and described in greater detail below. The location of the 6-year CIPs are shown in **Figure 11-1**. Capacities were determined from hydraulic modeling performed by BHC Consultants, as documented in their PER which is included as **Appendix A**, and described in **Section 7**. See OPPCs for individual projects in **Appendix Q** for more detail.

11.3.2.1 Project Descriptions

11.3.2.1.1 CIP-CK-CC-CAP-2 – Replace PS-4 and Forcemain

This project will replace the existing PS-4 and forcemain, and 640 feet of new 15-inch diameter gravity sewer main. The existing pump station is near the northeast corner of the intersection of Fredrickson Road

NW and NW Bucklin Hill Road and is proposed to remain in this location. The pump station was originally constructed in 1980 and upgraded in 2005. This CIP is primarily driven by capacity. An assessment at this pump station was not performed as it was already planned for replacement. The proposed firm capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event and will need to be increased to 4,650 gpm.

The existing 14-inch diameter force main should be upsized to 1,570 LF of 20-inch diameter pipe concurrent with the pump station upgrades, resulting in velocities in the force main of 2.8 fps (one pump operating) and 4.7 fps (two pumps operating). SSMH J18-3048 has been converted to an air-vacuum station by plating over the existing manhole channel and then filling the remaining structure with sand. Vent piping, an air/vacuum assembly, and a carbon canister were then installed to provide venting of the force main at this location. The manhole should be replaced with an air-vacuum valve station as part of the force main upgrades to bring the system into compliance with the County's current standards.

This project will also install 700 feet of new 15-inch diameter gravity sewer to intercept the flows at SSMH L17-1079 near the intersection of Pacific Avenue NW and NW Carlton Street and convey them east along NW Carlton Street to the new gravity sewers installed in Washington Avenue NW as part of the recently completed Bayshore and Washington Improvements.

11.3.2.1.2 CIP-CK-CC-CAP-3 – Upgrade PS-24

This project will upgrade the existing PS-24. The existing pump station is on the west side of Brownsville Highway NE approximately 1,400 feet south of SR-304 and is proposed to remain in this location. The pump station was originally constructed in 2000. This CIP is primarily driven by capacity and obsolescence of the pumps and electrical equipment. The proposed firm capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event and will need to be increased beyond current capacities.

11.3.2.1.3 CIP-CK-CC-CAP-8 – Lemolo Inverted Siphon Improvements

This project will install 2,200 LF of 24-inch diameter inverted siphon parallel to the two existing 12-inch diameter inverted siphons to increase capacity and redundancy for increasing flows coming from the City of Poulsbo.

11.3.2.1.4 CIP-CK-CC-CAP-9 – Johnson to Norum Pipeline

This project will install 4,200 LF of 24-inch diameter pipe to increase capacity for increasing flows coming from the City of Poulsbo, and to reduce backwater effects that have caused flooding upstream. This project is currently under design.

Table 11-1 | 6-Year Collection System Capital Improvement Projects

CIP No	Asset Health Score	Project Name	Replacement[1]	Upgrade[2]	Capacity Increase[3]	Total Project Cost (2023 Dollars)	Project Description
CIP-CK-CC-CAP-2	25[4]	Replace PS-4 and Forcemain	X		X	$13,200,000	➢ Replace the pump station ➢ Increase capacity to 4,650 gpm ➢ Replace forcemain with 1,590 LF of 20-inch diameter pipe with air-vacuum station at SSMH J18-3048 ➢ Install 640 LF of new 15-inch diameter gravity sewer to intercept flows from NW Carlton Street and Pacific Ave NW and divert to PS-3 ➢ Install 500 LF of 12-inch diameter force main ➢ Project was awarded in 2023
CIP-CK-CC-CAP-3	15.5	Upgrade PS-24		X	X	$7,300,000	➢ Upgrade the pump station ➢ Increase capacity to 6,800 gpm ➢ Replace pumps ➢ Replace valves ➢ Replace electrical, instrumentation, and control equipment in existing building ➢ Replace generator set
CIP-CK-CC-CAP-8	25[4]	Lemolo Inverted Siphon Upgrades	X		X	$0[5]	➢ Install 2,200 LF of 24-inch diameter inverted siphon pipe using HDD
CIP-CK-CC-CAP-9	25[4]	Johnson to Norum Pipeline	X		X	$0[5,6]	➢ Replace 4,200 LF of pipe with 24-inch diameter pipe from Johnson Road to the Lemolo Siphon
					Total	$20,500,000[5]	

Notes:

1. Replacement projects will construct a new facility.
2. Upgrade projects will replace components of the facility.
3. Capacity Increase projects will increase hydraulic capacity and can include system expansion.
4. Project was previously included in the CIP and a condition assessment was not performed. An Asset Health Score of 25 has been assigned to these projects.
5. The Lemolo Peninsula Sewer and Inverted Siphon Improvements and Johnson to Norum Pipeline projects will be funded entirely by the City of Poulsbo but is a County owned project. Because they will be paid for by the City of Poulsbo, they are not included in the total cost.
6. The Johnson to Norum Pipeline Project cost is for construction only. Design costs are currently being paid for by the City of Poulsbo.

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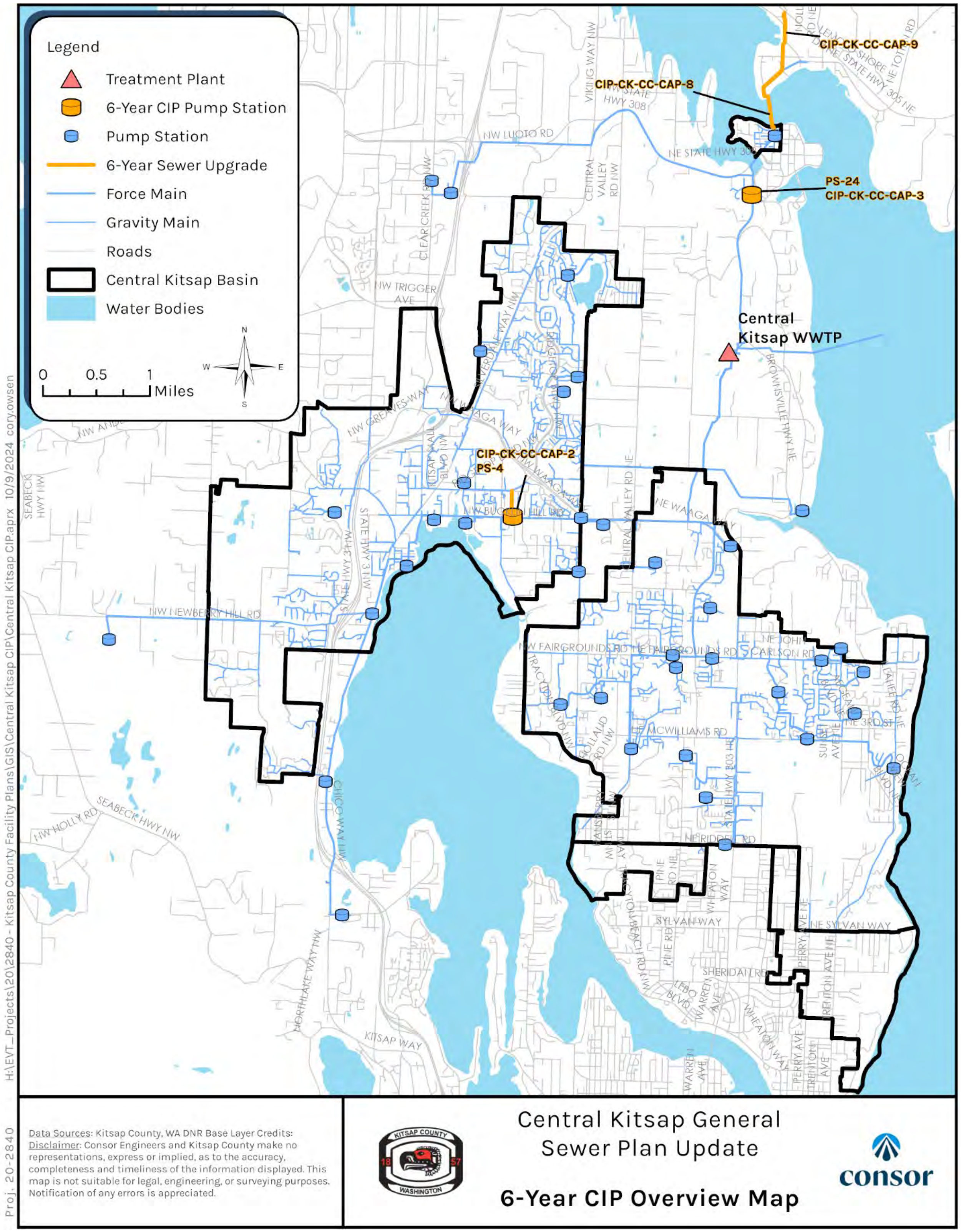
Figure 11-1 | 6-Year Collection and Conveyance CIP (2023-2028)



11.3.3 20-Year Collection and Conveyance Capital Improvement Plan (2029-2042)

Each of the projects identified for the Central Kitsap collection and conveyance system 20-year CIP are summarized in **Table 11-2** and described in greater detail below. See OPPCs for individual projects in **Appendix Q** for more detail.

11.3.3.1 Project Descriptions

11.3.3.1.1 CIP-CK-CC-CAP-1 – Replace PS-3

This project will replace the existing PS-3. The existing pump station is near Washington Avenue NW, south of NW Byron Street and is proposed to remain in this location. The pump station was originally constructed in 1980 and upgraded in 2005. This CIP is primarily driven by obsolescence. The proposed firm capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event. Pump runtimes should be evaluated prior to finalizing required firm capacity of the replacement station.

*If funding becomes available, this project should be considered in the 6-year CIP.

11.3.3.1.2 CK-CC-OM-4 – Replace PS-36

This project will replace the existing PS-36. The existing pump station is near the intersection of Auklet Place NE and Blackbird Drive NE and is proposed to remain in this location. The pump station was originally constructed in 1979 with upgrades in 1999. This CIP is primarily driven by O&M considerations. The wet well is steel and has significant corrosion. The proposed firm capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event.

*If funding becomes available, this project should be considered in the 6-year CIP.

11.3.3.1.3 CIP-CK-CC-OM-5 – Upgrade PS-11

This project will upgrade the existing PS-11. The existing pump station is near NW Firglade Drive and is proposed to remain in this location. The pump station was originally constructed in 1979 with upgrades in 1985. This CIP is primarily driven by O&M considerations. The proposed firm capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event.

*If funding becomes available, this project should be considered in the 6-year CIP.

11.3.3.1.4 CIP-CK-CC-OM-6 – Upgrade PS-33

This project will upgrade the existing PS-33. The existing pump station is on NE Franklin Avenue west of SR-303 and is proposed to remain in this location. The pump station was originally constructed in 1983 with new pumps installed in 1993. This CIP is primarily driven by O&M considerations. The proposed firm capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event.

*If funding becomes available, this project should be considered in the 6-year CIP.

11.3.3.1.5 CIP-CK-CC-CAP-7 – Northern Old Military Road Sewer Upgrades

This project will replace 6,180 LF of 14- and 24-inch diameter pipe with 30-inch diameter pipe from Old Military Road NE to NE Paulson Road to alleviate excessive surcharging and reduce backwater effects in the surrounding conveyance system. The proposed firm capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event.

*If funding becomes available, this project should be considered in the 6-year CIP.

11.3.3.1.6 CIP-CK-CC-OM-11 – Replace PS-13

This project will replace the existing PS-13. The existing pump station is near the intersection of NW Eldorado Boulevard and Chico Way NW and is proposed to remain in this location. The pump station was originally constructed in 1980 with electrical upgrades in 2020. This CIP is primarily driven by O&M considerations. The proposed firm capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event.

11.3.3.1.7 CIP-CK-CC-CAP-12 – Replace PS-12

This project will replace the existing PS-12. The existing pump station is near NW Newberry Hill Road and Chico Way NW and is proposed to remain in this location. The pump station was originally constructed in 1980 with electrical upgrades in 2020. This CIP is primarily driven by capacity. The proposed firm capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event.

11.3.3.1.8 CIP-CK-CC-CAP-13 – Replace PS-34

This project will replace the existing PS-34. The existing pump station is at 6252 Central Valley Road NE. The pump station was originally constructed in 1989. This CIP is primarily driven by obsolescence. The proposed firm capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event and will need to be increased to 1,790 gpm.

11.3.3.1.9 CIP-CK-CC-OM-14 – Upgrade PS-22

This project will upgrade the existing PS-22 with a new generator, electrical improvements, and replacing one of the pumps. The existing pump station is at 11503 Quail Run Drive NW and is proposed to remain in this location. The pump station was originally constructed in 1986. This CIP is primarily driven by obsolescence. The proposed firm capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event.

11.3.3.1.10 CIP-CK-CC-OM-15 – Replace PS-32

This project will replace the existing PS-32. The existing pump station is at 1550 NE Riddell Road and is proposed to remain in this location. The pump station was originally constructed in 1983. This CIP is primarily driven by obsolescence. The proposed firm capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event.

11.3.3.1.11 CIP-CK-CC-OM-16 – Replace PS-2

This project will replace the existing PS-2. The existing pump station is at 3073 NW Bucklin Hill Road and is proposed to remain in this location. The pump station was originally constructed in 1980. This CIP is primarily driven by obsolescence. The proposed firm capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event.

11.3.3.1.12 CIP-CK-CC-OM-17 – Replace PS-37

This project will replace the existing PS-37. The existing pump station is at 289 NE Watson Court and is proposed to remain in this location. The pump station was originally constructed in 1983. This CIP is primarily driven by obsolescence. The proposed firm capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event.

11.3.3.1.13 CIP-CK-CC-OM-18 – Upgrade PS-40

This project will upgrade the existing PS-40 with a new generator set and canopy over the electrical equipment. The existing pump station is at 4900 NW Discovery Ridge Court and is proposed to remain in this location. The pump station was originally constructed in 1993. This CIP is primarily driven by obsolescence. The proposed firm capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event.

11.3.3.1.14 CIP-CK-CC-OM-19 – Upgrade PS-35

This project will upgrade the existing PS-35 with a new generator set, electrical equipment, and a canopy over the electrical equipment. The existing pump station is at 1099 NE Coco Court and is proposed to remain in this location. The pump station was originally constructed in 1983. This CIP is primarily driven by obsolescence. The proposed firm capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event.

11.3.3.1.15 CIP-CK-CC-OM-20 – Upgrade PS-9

This project will replace the existing PS-9 with a new generator set and replacement of check valves. The existing pump station is at 9816 Ogle Road NE and is proposed to remain in this location. The pump station was originally constructed in 1980. This CIP is primarily driven by obsolescence. The proposed firm capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event.

11.3.3.1.16 CIP-CK-CC-OM-21 – Replace PS-65

This project will replace the existing PS-65. The existing pump station is at 6001 Illahee Road NE and is proposed to remain in this location. The pump station was originally constructed in 1994. This CIP is primarily driven by obsolescence. The proposed firm capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event.

11.3.3.1.17 CIP-CK-CC-OM-22 – Upgrade PS-26

This project will upgrade the existing PS-26 with a new generator set and improvements to the hatches. The existing pump station is at 1187 NW Gooseberry Court and is proposed to remain in this location. The pump station was originally constructed in 1990. This CIP is primarily driven by obsolescence. The proposed firm capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event.

11.3.3.1.18 CIP-CK-CC-OM-23 – Upgrade PS-30

This project will upgrade the existing PS-30 with new pumps, electrical equipment, canopy, and generator set. The existing pump station is at 7278 Sunset Avenue NE and is proposed to remain in this location. The pump station was originally constructed in 1993. This CIP is primarily driven by condition. The proposed firm capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event.

11.3.3.1.19 CIP-CK-CC-OM-24 – Upgrade PS-20

This project will upgrade the existing PS-20 with new CMU control building and conversion to submersible pump station. The existing pump station is at 9000 Nels Nelson Road NW and is proposed to remain in this location. The pump station was originally constructed in 1981. This CIP is primarily driven by condition. The proposed firm capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event.

11.3.3.1.20 CIP-CK-CC-OM-25 – Upgrade PS-61

This project will upgrade the existing PS-61 with new pumps. The existing pump station is at 122 NW Glade Court and is proposed to remain in this location. The pump station was originally constructed in 2008. This CIP is primarily driven by obsolescence. The proposed firm capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event.

11.3.3.1.21 CIP-CK-CC-CAP-26 – Replace PS-69

This project will replace the existing PS-69. The existing pump station is at 882 NE Beaumont Lane and is proposed to remain in this location. The pump station was originally constructed in 1998. This CIP is primarily driven by capacity. The proposed firm capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event.

11.3.3.1.22 CIP-CK-CC-DEV-27 – Anderson Hill Sewer Upgrades

This project will install 3,900 LF of 12-inch diameter pipe to provide capacity through build-out. The proposed capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event. The pipe to be replaced is in NW Anderson Hill Road between Old Frontier Road NW and Silverdale Way NW, as shown on **Figure 11-2**.

11.3.3.1.23 CIP-CK-CC-DEV-28 – Dickey Road Sewer Upgrades

This project will install 2,420 LF of 12-inch diameter pipe to provide capacity through build-out. The proposed capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event. The pipe to be replaced is along NW Anderson Hill Road from Enchantment Avenue NW and Old Frontier Road NW, as shown on **Figure 11-2**.

11.3.3.1.24 CIP-CK-CC-CAP-29 – Myhre Road Sewer Upgrades

This project will install 2,260 LF of 21-inch diameter pipe to provide capacity through build-out. The proposed capacity is determined through H/H model simulations from the PER for the 2038 planning horizon and a 25-year storm event. The pipe to be replaced is from the intersection of NW Myhre Road and Silverdale Way NW, east to Mickelberry Road NW, and south to PS-1, as shown on **Figure 11-2**.

11.3.3.1.25 CIP-CK-CC-OM-30 – Annual Pipe Replacement

This project will be an annual program to replace aging and deficient pipes not identified in other capital improvement projects. These pipes may include deficiencies related to root intrusion, high rates of I&I, deflected joints, cracked pipes, insufficient slopes, and high rates of O&M call outs. It assumes that half of one percent of the pipes in the Central Kitsap basin would be replaced each year. See **Table 11-2** for project details.

Table 11-2 | 20-Year Collection System Capital Improvement Projects

CIP No	Asset Health Score	Item	Replacement[1]	Upgrade[2]	Capacity[3]	Total Project Cost (2023 Dollars)	Project Description
CIP-CK-CC-CAP-1[6]	25[4]	Replace PS-3	X		X	$7,800,000	➢ Replace the pump station ➢ Inflows are not projected to exceed firm capacity until after 2038 ➢ Increase capacity to 2,315 gpm ➢ Rehabilitate wet well ➢ Replace pumps and piping ➢ Replace electrical equipment in existing building
CIP-CK-CC-OM-4[6]	7.4	Replace PS-36	X		X	$1,900,000	➢ Replace the pump station ➢ Increase capacity to 170 gpm ➢ Construct new wet well to replace corroding steel wet well ➢ Construct new valve vault ➢ Construct new electrical, instrumentation, and controls equipment under a new canopy ➢ Construct new diesel generator set with Level 2 sound attenuating enclosure
CIP-CK-CC-OM-5[6]	7.0	Upgrade PS-11		x		$760,000	➢ Replace the pump station ➢ Rehabilitate dry wet well can ➢ Install new generator set ➢ Install new electrical, instrumentation, and controls equipment under new canopy ➢ Install new fencing
CIP-CK-CC-OM-6[6]	7.0	Upgrade PS-33		X		$240,000	➢ Upgrade the pump station ➢ Install generator set ➢ Upgrade electrical to comply with NFPA 820 ➢ Construct canopy over electrical, instrumentation, and control equipment ➢ Replace fencing
CIP-CK-CC-CAP-7[6]	25[4]	Northern Old Military Road Sewer Upgrades	X		X	$12,200,000	➢ Replace 6,180 LF of pipe with 30-inch diameter pipe from Old Military Road NE to NE Paulson Road
CIP-CK-CC-OM-11	11.1	Replace PS-13	X			$3,200,000	➢ Replace the pump station ➢ Maintain capacity of 400 gpm ➢ Construct new wet well ➢ Construct new valve and meter vault

CIP No	Asset Health Score	Item	Replacement[1]	Upgrade[2]	Capacity[3]	Total Project Cost (2023 Dollars)	Project Description
							➢ Install new electrical, instrumentation, and controls in existing controls building ➢ Install new generator set
CIP-CK-CC-CAP-12	14.4	Replace PS-12	X		X	$7,600,000	➢ Replace the pump station ➢ Increase capacity to 1,520 gpm ➢ Construct new wet well ➢ Construct new valve and meter vault ➢ Construct new controls building ➢ Install new electrical, instrumentation, and controls ➢ Install new generator set
CIP-CK-CC-CAP-13	14.5	Replace PS-34	X		X	$7,600,000	➢ Replace pump station ➢ Increase capacity to 1,790 gpm ➢ Construct new wet well ➢ Construct new valve vault ➢ Construct new controls building ➢ Install new electrical, instrumentation, and controls equipment ➢ Install new generator set ➢ Replace fencing
CIP-CK-CC-OM-14	8.1	Upgrade PS-22		X		$360,000	➢ Upgrade pump station ➢ Maintain capacity of 450 gpm ➢ Replace generator ➢ Replace one pump with new Flygt pump
CIP-CK-CC-OM-15	6.8	Replace PS-32	X			$1,900,000	➢ Replace pump station ➢ Increase capacity to 175 gpm ➢ Construct new wet well ➢ Construct new valve vault ➢ Construct new electrical, instrumentation, and controls equipment under new canopy ➢ Install new generator set ➢ Install fencing

CIP No	Asset Health Score	Item	Replacement[1]	Upgrade[2]	Capacity[3]	Total Project Cost (2023 Dollars)	Project Description
CIP-CK-CC-OM-16	6.6	Replace PS-2	X			$2,800,000	➢ Replace pump station ➢ Maintain capacity of 320 gpm ➢ Construct new wet well ➢ Construct new valve vault ➢ Construct new electrical, instrumentation, and controls equipment under new canopy ➢ Install new generator set ➢ Install fencing
CIP-CK-CC-OM-17	6.6	Replace PS-37	X			$1,900,000	➢ Replace pump station ➢ Maintain capacity of 150 gpm ➢ Construct new wet well ➢ Construct new valve vault ➢ Construct new electrical, instrumentation, and controls equipment under new canopy ➢ Install new generator set ➢ Install fencing
CIP-CK-CC-OM-18	6.4	Upgrade PS-40		X		$240,000	➢ Install on-site generator set ➢ Install canopy over electrical equipment
CIP-CK-CC-OM-19	6.4	Upgrade PS-35		X		$1,200,000	➢ Install on-site generator set ➢ Replace electrical equipment ➢ Install canopy over electrical equipment
CIP-CK-CC-OM-20	6.2	Upgrade PS-9		X		$260,000	➢ Replace check valve ➢ Install on-site generator set
CIP-CK-CC-OM-21	6.2	Replace PS-65	X			$3,000,000	➢ Replace pump station ➢ Increase capacity to 675 gpm ➢ Construct new wet well ➢ Construct new valve vault ➢ Construct new electrical, instrumentation, and controls equipment under new canopy ➢ Install new generator set ➢ Install fencing
CIP-CK-CC-OM-22	6.0	Upgrade PS-26		X		$250,000	➢ Install on-site generator ➢ Replace hatch and raise up to avoid getting covered with dirt
CIP-CK-CC-OM-23	6.0	Upgrade PS-30		X		$1,200,000	➢ Replace pumps ➢ Maintain capacity of 165 gpm ➢ Replace electrical and controls ➢ Install on-site generator set ➢ Install canopy over electrical equipment

CIP No	Asset Health Score	Item	Replacement[1]	Upgrade[2]	Capacity[3]	Total Project Cost (2023 Dollars)	Project Description
CIP-CK-CC-OM-24	5.8	Upgrade PS-20		X		$660,000	➢ Replace building with CMU controls building ➢ Upgrade to submersible pumps ➢ Maintain capacity of 426 gpm
CIP-CK-CC-OM-25	3.2	Upgrade PS-61		X		$1,090,000	➢ Replace pumps
CIP-CK-CC-CAP-26	4.0	Replace PS-69	X		X	$1,900,000	➢ Replace pump station ➢ Increase capacity to 165 gpm ➢ Construct new wet well ➢ Construct new valve vault ➢ Construct new electrical, instrumentation, and controls equipment under new canopy ➢ Install new generator set ➢ Install fencing
CIP-CK-CC-DEV-27	15	Anderson Hill Sewer Upgrades	X		X	$5,500,000	➢ Install 3,900 LF of 12-inch diameter pipe
CIP-CK-CC-DEV-28	15	Dickey Road Sewer Upgrades	X		X	$3,800,000	➢ Install 2,420 LF of 12-inch diameter pipe
CIP-CK-CC-CAP-29	15	Myhre Road Sewer Upgrades	X		X	$3,700,000	➢ Install 2,260 LF of 21-inch diameter pipe
CIP-CK-CC-OM-30	20[5]	Annual Pipe Replacement	X			$56,000,000	➢ Replace deteriorated and aging pipe 15-inches in diameter and smaller ➢ Project costs assume $4,000,000 per year totaled over 14 years ➢ Replacement assumes 0.5 percent of total system (18,600 LF) is replaced per year
Total						**$127,060,000**	

Notes:
1. Replacement projects will construct a new facility.
2. Upgrade projects will replace components of the facility.
3. Capacity Increase projects will increase hydraulic capacity.
4. Project was previously included in the CIP and a condition assessment was not performed. An Asset Health Score of 25 has been assigned to these projects.
5. An asset health score of 20 was selected to prioritize projects on an annual basis.
6. If funding becomes available, this project should be considered in the 6-year CIP.

The location of the 20-year CIPs are shown in **Figure 11-2.**

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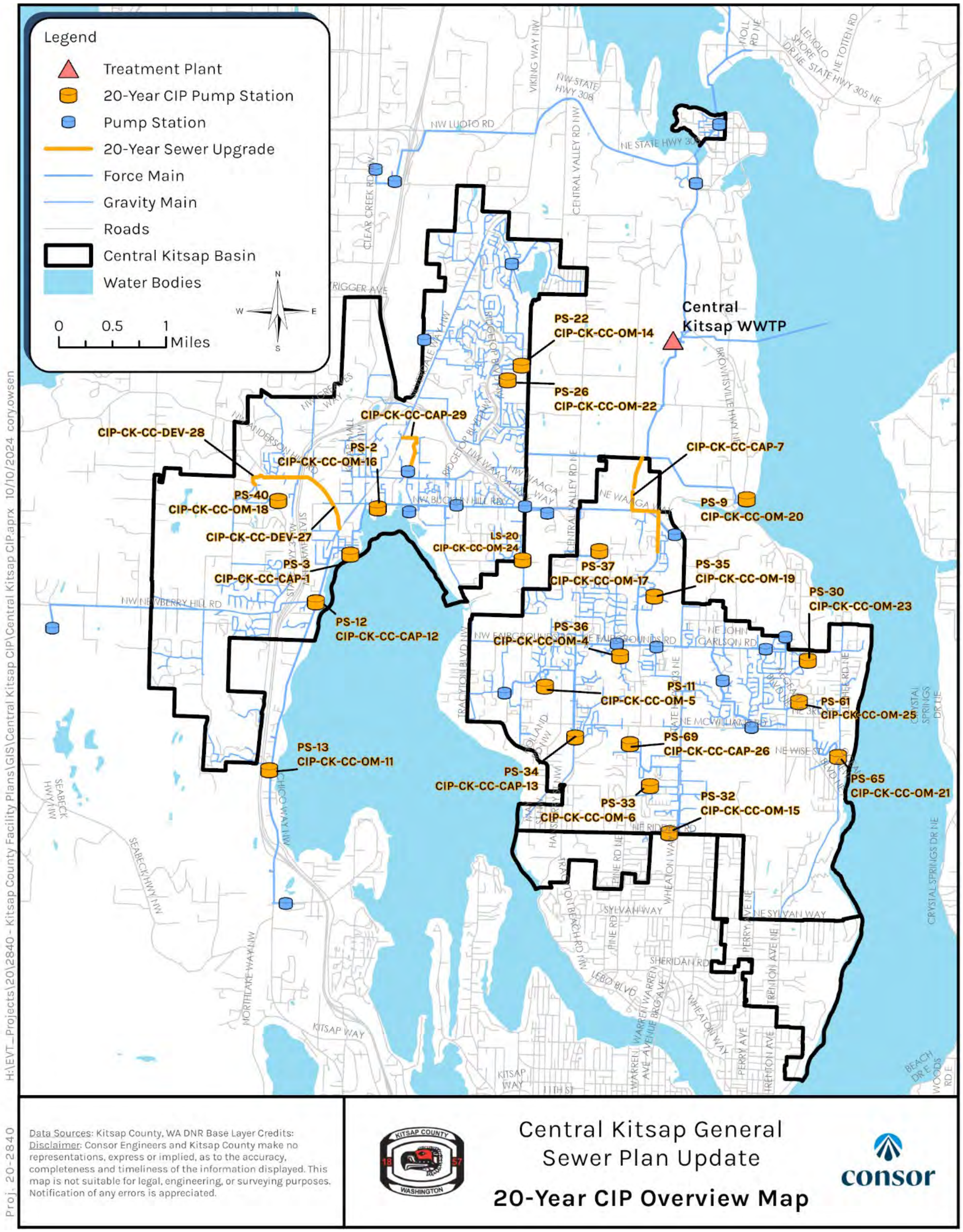
Figure 11-2 | 20-Year Collection and Conveyance CIP (2029-2042)



11.4 Central Kitsap WWTP Improvements

As summarized in **Section 6** and **Section 8**, Central Kitsap WWTP is an activated sludge plant that works well and can continue to provide treatment through the 20-year planning period. The plant was constructed in 1979 and has been upgraded and modified several times. Some additional repairs, replacements, and improvements will be required to facilitate continuing operation.

11.4.1 Central Kitsap WWTP Alternatives Analysis

The alternatives analysis in **Section 8** evaluated different treatment technologies for key processes and recommended secondary treatment, UV disinfection system, and odor control system upgrades. In addition, several minor maintenance, repairs, and direct replacements are identified in **Section 6** and will be required to keep the WWTP operating reliably over the next 20 years. Finally, the *Summary of Field Testing for Biological Nutrient Removal* (HDR, 2022) memorandum made recommendations for High, Medium, and Low Priority improvements to improve nutrient removal performance. The urgency of each of these projects has been assessed to develop a project list of recently completed/ongoing/planned/in-design projects, short-term CIP projects that should be addressed in the next 6-years and a long-term project list for those CIP projects that are not urgent but will need to be executed later in the 20-year planning period. High priority projects from *Summary of Field Testing for Biological Nutrient Removal* are included on the 6-year CIP, medium priority improvements are included on the 20-year CIP, and low priority projects (sidestream treatment and step-feed testing) are not included. The remaining projects that can be completed by the plant staff are categorized as O&M projects. These project lists, project descriptions, and costs are presented in the sections that follow.

11.4.2 Recently Completed and Ongoing Central Kitsap WWTP CIP

Several of the projects that have identified for the Central Kitsap WWTP have been completed during the facility planning process or are already in the construction phase. These projects are identified below and are not included in the CIP:

- Aeration Basin Diffuser Replacement
- Anaerobic Digester Annular Seal and PRV Rehabilitation
- Anaerobic Digester Bypass Piping

Projects that are in currently in design will require significant financial commitment to finish design and construction, so they are included in the 6-year CIP.

11.4.3 6-Year Central Kitsap WWTP CIP (2023 to 2028)

Each of the projects identified for the Central Kitsap WWTP 6-year CIP are summarized in **Table 11-3** and described in greater detail below. See OPPCs for individual projects in **Appendix Q** for more detail.

11.4.3.1 Project Descriptions

11.4.3.1.1 CIP-CK-WWTP-CAP-1: Solids and Liquid Hauled Waste Upgrades

Design is currently underway for replacement or expansion of several related components of the solids and LHW treatment processes. These items include:

- New Septage Receiving Station
- New FOG Receiving Station

- Septage Pump, Grit Cyclone, and Classifier Replacement
- Replacement of Gravity Thickeners with new mechanical thickening equipment
- New 1.3 MG Anaerobic Digester
- In-plant Pump Station Replacement
- Shop and Maintenance Building Relocation
- Anaerobic Digester Hot Water System Replacement

11.4.3.1.2 CIP-CK-WWTP-REG-2: Construct Third Secondary Clarifier and Replace RAS Pumps

The secondary clarifiers will not be capable of meeting Ecology redundancy requirements for the clarifiers to be capable of 75 percent of the peak flow with one clarifier out of service by 2028, as identified in **Section 6**. Installing an additional secondary clarifier will provide additional capacity and meet the redundancy requirements. Additionally, the existing secondary clarifiers’ walkways and drives and the RAS pumps should be replaced at the same time due to age and condition.

11.4.3.1.3 CIP-CK-WWTP-REG-3: Centrate Equalization

The plant experiences ammonia spikes and decreased effluent quality on centrate processing days relative to non-centrate days. Equalizing centrate flow to distribute the loads more evenly across the week would provide stability to BNR operation and improve overall average effluent TIN. This project is needed for Central Kitsap to consistently and reliably achieve effluent TIN less than 10 mg/L.

*After development of the CIP list, this project was added to the ongoing Solids and Liquid Hauled Waste Upgrades Project (CIP-CK-WWTP-CAP-1).

11.4.3.1.4 CIP-CK-WWTP-REG-5: Methanol Storage

Add a second methanol storage tank to provide flexibility for Central Kitsap WWTP staff to maintain consistent methanol dosing with flexibility in scheduling methanol deliveries. This project is needed for Central Kitsap to consistently and reliably achieve effluent TIN less than 10 mg/L.

*After development of the CIP list, this project was added to the ongoing Solids and Liquid Hauled Waste Upgrades Project (CIP-CK-WWTP-CAP-1).

11.4.3.1.5 CIP-CK-WWTP-OB-6: Existing Anerobic Digester Rehabilitation

The existing anaerobic digesters are in poor condition and will be rehabilitated after the new anaerobic digester currently in design is constructed and commissioned.

*After development of the CIP list, this project was added to the ongoing Solids and Liquid Hauled Waste Upgrades Project (CIP-CK-WWTP-CAP-1).

11.4.3.1.6 CIP-CK-WWTP-OB-7: Replace Main Switchgear

The main switchgear (SWBD-1) has exceeded its expected lifespan and will be replaced.

*After development of the CIP list, this project was added to the ongoing Solids and Liquid Hauled Waste Upgrades Project (CIP-CK-WWTP-CAP-1).

11.4.3.1.7 CIP-CK-WWTP-OB-8: Replace SWGR-2960 ATS-1

ATS-1 in SWGR-2960 is disconnected and staff report that it does not function, so it will be replaced.

*After development of the CIP list, this project was added to the ongoing Solids and Liquid Hauled Waste Upgrades Project (CIP-CK-WWTP-CAP-1).

11.4.3.1.8 CIP-CK-WWTP-CAP-9: Conduct Process Load Study and Assess Generator Needs

Complete a process and load study for the entire facility including future loads to determine whether GEN-2994 should be replaced in kind or if a different approach to providing the required standby power for the facility should be pursued.

*After development of the CIP list, this project was added to the ongoing Solids and Liquid Hauled Waste Upgrades Project (CIP-CK-WWTP-CAP-1).

11.4.3.1.9 CIP-CK-WWTP-OB-10: Replace Utilidor Panel 1990 and Septage Panel 5012

Utilidor power panel PNL-1990 has exceeded its expected lifespan and will be replaced. Septage panel PNL-5012 is in poor condition due to corrosion and will be replaced.

*After development of the CIP list, this project was added to the ongoing Solids and Liquid Hauled Waste Upgrades Project (CIP-CK-WWTP-CAP-1).

11.4.3.1.10 CIP-CK-WWTP-OM-11: Evaluate Headworks Building HVAC

Evaluate the HVAC system for the Headworks Building to determine if options such as positive room pressurization or some other means of keeping chemical gases from entering the room should be considered to reduce corrosion and provide additional cooling.

*The proposed evaluation was completed shortly after the development of the draft CIP list. Construction of the recommended HVAC improvements is included in the final CIP list with the costs provided by the County.

Table 11-3 | 6-Year Central Kitsap WWTP Capital Improvement Projects

CIP No	Asset Health Score	Project	Replacement[1]	Upgrade[2]	Capacity[3]	Total Project Cost (2023 Dollars)	Project Description
CIP-CK-WWTP-CAP-1[4]	17.5	Solids and LHW Upgrades	X	X		$ 140,000,000	➢ Project is currently in design ➢ New septage receiving station ➢ New FOG receiving station ➢ Replace septage pump, grit cyclone, and grit classifier ➢ Replace gravity thickeners with new mechanical thickening equipment ➢ New 1.3 MG anaerobic digester ➢ Replace in-plant pump station ➢ Replace digester hot water system ➢ Replace O&M building
CIP-CK-WWTP-REG-2	8.5	Construct Third Secondary Clarifier and Replace RAS Pumps			X	$ 9,900,000	➢ Construct a third primary clarifier to increase capacity. ➢ Replace the existing secondary clarifiers' walkways and drive mechanisms.

CIP No	Asset Health Score	Project	Replacement[1]	Upgrade[2]	Capacity[3]	Total Project Cost (2023 Dollars)	Project Description
							➢ Replace the RAS pumps.
CIP-CK-WWTP-REG-3[4]	9.0	Centrate Equalization		X		$ 0	➢ Construct a centrate equalization basin so that centrate flow can be evenly applied to the aeration basins. ➢ This project will contribute towards ensuring effluent TIN can be kept consistently below 10 mg/L. ➢ It may be feasible to make operational changes that improve centrate equalization without construction of a new basin.
CIP-CK-WWTP-REG-5[4]	8.5	Methanol Storage			X	$ 0	➢ Add additional methanol storage capacity. ➢ This project will contribute towards ensuring effluent TIN can be kept consistently below 10 mg/L
CIP-CK-WWTP-OB-6[4]	17.5	Existing Anaerobic Digester Rehabilitation		X		$0	➢ Rehabilitate the existing anaerobic digesters.
CIP-CK-WWTP-OB-7[4]	9.5	Replace Main Switchgear		X		$ 0	➢ Replace main plant switchgear SWBD-1
CIP-CK-WWTP-OB-8[4]	9.5	Replace SWGR-2960 ATS-1		X		$ 0	➢ Replace ATS 1 in switchgear 2960.
CIP-CK-WWTP-CAP-9[4]	9.5	Conduct Process Load Study and Assess Generator Needs		X		$ 0	➢ Conduct an engineering study to determine the entire facility loads and determine if generator 2994 should be replaced or if a different approach to providing standby power should be used.
CIP-CK-WWTP-OB-10[4]	9.5	Replace Utilidor Panel 1990 and Septage Panel 5012		X		$ 0	➢ Replace the electrical panels for the utilidor (PNL-1990) and septage receiving station (PNL-5012).
CIP-CK-WWTP-OM-11[5]	6.9	Evaluate Headworks Building HVAC		X		$ 2,200,000	➢ Investigate the headworks building HVAC system to evaluate how corrosion can be prevented and additional cooling can be provided.
					Total	$152,100,000	

Notes:

1. Replacement projects will construct a new facility.
2. Upgrade projects will replace components of the facility.
3. Capacity Increase projects will increase hydraulic capacity.
4. All costs for projects included in the Solids and Liquid Hauled Waste Project have been rolled up into CIP-CK-WWTP-CAP-1 and the cost has been updated to reflect the most recent estimate.
5. After the development of the CIP list, the County conducted the described HVAC study and determined improvements would cost approximately $2.2 million dollars. For planning and budgeting purposes, this value will be used.

11.4.4 20-Year Central Kitsap WWTP CIP (2029 to 2042)

Each of the projects for the 20-year CIP are summarized in **Table 11-4** and described in greater detail below. See OPPCs for individual projects in **Appendix Q** for more detail.

11.4.4.1 Project Descriptions

11.4.4.1.1 CIP-CK-WWTP-REG-4: RAS Distribution Box Hydraulic Study& Improvements

Conduct an engineering study (potentially with computational fluid dynamics modeling) of the influent hydraulic box to determine modifications necessary to allow efficient mixing of RAS and primary effluent and distribution to each basin. Correcting this imbalance, and the potential current arrangement in which primary effluent and RAS are not equally distributed between basins, is critical to maintaining consistent effluent performance as well as efficiently integrating other optimization strategies (i.e., centrate equalization is less effective if flow cannot be accurately distributed between basins).

Implement fully automated flow pacing of the RAS pumping system (within current constraints). This can be combined with an engineering study into the value of increasing RAS capacity and potentially modifying the secondary clarifiers to lower the minimum RAS rate required for clarifier mechanism operation. This project is needed for Central Kitsap to consistently and reliably achieve effluent TIN less than 10 mg/L.

*If funding becomes available, this project should be considered in the 6-year CIP.

11.4.4.1.2 CIP-CK-WWTP-CAP-12: Install New Primary Clarifiers and Primary Sludge Pumps

The primary clarifiers are expected to reach the maximum recommended surface overflow rate near the end of the planning horizon so additional capacity is required. The existing primary clarifiers are within an area that has been allocated for Aeration Basins 5 and 6, so new primary clarifiers will be constructed near the headworks to provide increased capacity and allow the existing clarifiers to be abandoned. The existing primary sludge pumps will not have sufficient capacity and will be replaced also.

11.4.4.1.3 CIP-CK-WWTP-REG-13: Install New Effluent Flow Meter

Central Kitsap WWTP does not currently have an effluent flow meter. A meter will be installed to provide accurate and direct measurement of effluent flow.

11.4.4.1.4 CIP-CK-WWTP-OB-14: Replace Thickened Primary Sludge Grinders

The thickened primary sludge grinders are expected to reach the end of their useful lifespan and will be replaced with new grinders.

11.4.4.1.5 CIP-CK-WWTP-OB-15: Replace Scum Grinder and Pumps

The scum grinder and pumps are expected to reach the end of their useful lifespan and will be replaced with a new grinder and new pumps.

11.4.4.1.6 CIP-CK-WWTP-OB-16: Replace Centrifuge Sludge Feed Grinders and Pumps

The centrifuge sludge feed grinders and pumps are expected to reach the end of their useful lifespan and will be replaced with new grinders and pumps.

11.4.4.1.7 CIP-CK-WWTP-OB-17: Replace Centrate Pumps

The centrate pumps are expected to reach the end of their useful lifespan and will be replaced with new pumps.

11.4.4.1.8 CIP-CK-WWTP-OB-18: Replace Blower Building Primary Power Switchgear and Transformers

The blower building primary power switchgear and transformers are expected to reach the end of their useful lifespan and will be replaced.

11.4.4.1.9 CIP-CK-WWTP-REG-19: Aeration Basin Air Distribution Study

Conduct an engineering study to review flow meters, control valve sizing and locations, and the air distribution network to develop design improvements to the physical air distribution and control equipment. This project is needed for Central Kitsap to achieve consistent annual TIN below 5 mg/L and summertime effluent TIN of approximately 3 mg/L.

11.4.4.1.10 CIP-CK-WWTP-REG-20: Replace Aeration Blowers 1 &2, and Channel Blowers 1 &2

Replace the existing centrifugal blowers (Blowers 1 &2) with additional high-speed turbo blowers. This will allow for additional capacity, redundancy, and keep the aeration operation consistent with one type of blower. The secondary treatment channel blowers 1 & 2 should also be replaced at the same time, as they have exceeded their typical expected lifespan. This project is needed for Central Kitsap to achieve consistent annual TIN below 5 mg/L and summertime effluent TIN of approximately 3 mg/L.

11.4.4.1.11 CIP-CK-WWTP-CAP-21: Construct Aeration Basins 5 & 6

Although optimization will help improve the aeration basins ability to remove TIN, eventually capacity will be limited by hydraulic retention time. Installing a new set of aeration basins will provide more hydraulic retention time to allow for lower effluent TIN concentrations and/or additional flow. The need for additional capacity will depend on TIN permit requirements, recycled water use, and plant flows.

11.4.4.1.12 CIP-CK-WWTP-REG-22: Near-term Recycled Water Improvements

Improvements will connect the effluent piping from the recycled water filters to the existing, unused 18-inch HDPE pipeline that then runs from the filter location south through the plant site. These improvements include a small piping connection and associated appurtenances, insertion of a motorized control valve and associated control and power wiring (for diversion of "off-spec" water), an additional chlorine residual meter (sampling from the 72-inch secondary effluent pipeline, to check for chlorine-free discharge of "off-spec" water), and system control programming to integrate water quality monitoring data (e.g., filter effluent turbidity) into valve control logic.

*If funding becomes available, this project should be considered in the 6-year CIP.

11.4.4.1.13 CIP-CK-WWTP-REG-23: Long-term Recycled Water Improvements

A new UV system designed to meet recycled water disinfection requirements will be constructed to provide primary disinfection without the use of chlorine. The system will consist of two parallel channels. Each channel would have four duty banks and one standby bank. When both channels and four duty banks per channel are operational, the system would be capable of handling a recycled water disinfection flow rate of 3.5 MGD. The 'Near-term Recycled Water Improvements' must be implemented before this project to connect the recycled water piping and provide sufficient controls to route 'off-spec' water to the outfall.

Table 11-4 | 20-Year Central Kitsap WWTP Capital Improvement Projects

CIP No	Asset Health Score	Project	Replacement[1]	Upgrade[2]	Capacity[3]	Total Project Cost (2023 Dollars)	Project Description
CIP-CK-WWTP-REG-4[6]	**8.5**	RAS Distribution Box Hydraulic Study & Improvements		X		$ 1,000,000	➢ Conduct an engineering study of the aeration basin influent hydraulic box to determine how RAS and primary effluent can be mixed more efficiently. ➢ Implement automatic flow pacing of the RAS system. ➢ This project will contribute towards refinements so effluent TIN can be kept consistently below 10 mg/L.
CIP-CK-WWTP-CAP-12[4]	14.5	Install New Primary Clarifiers and Primary Sludge Pumps	X	X	X	$12,400,000	➢ Replace and expand the primary clarifiers with new clarifiers that have additional capacity. ➢ Replace and increase capacity of the primary sludge pumps.
CIP-CK-WWTP-REG-13	3.0	Install a New Effluent Flow Meter		X		$1,000,000	➢ Install an effluent flow meter.
CIP-CK-WWTP-OB-14[4]	14.5	Replace Thickened Primary Sludge Grinders		X		$ 200,000	➢ Replace the thickened primary sludge grinders.
CIP-CK-WWTP-OB-15[4]	14.5	Replace Scum Grinder and Pumps		X		$ 440,000	➢ Replace the scum grinder ➢ Replace the scum pumps
CIP-CK-WWTP-OB-16	9.0	Replace Centrifuge Sludge Feed Grinders & Pumps		X		$ 760,000	➢ Replace the centrifuge feed grinders ➢ Replace the centrifuge feed pumps
CIP-CK-WWTP-OB-17	9.0	Replace Centrate Pumps		X		$ 140,000	➢ Replace the centrate pumps
CIP-CK-WWTP-OB-18	9.5	Replace Blower Building Primary Power Switchgear and Transformers		X		$ 200,000	➢ Replace the blower building primary power switchgear and transformers

CIP No	Asset Health Score	Project	Replacement[1]	Upgrade[2]	Capacity[3]	Total Project Cost (2023 Dollars)	Project Description
CIP-CK-WWTP-REG-19[5]	8.5	Aeration Basin Air Distribution Study		X		$1,300,000	➢ Conduct an engineering study to review the aeration basin air system to develop design improvements. ➢ This project will contribute towards ensuring effluent TIN can be kept consistently below 5 mg/L and a seasonal TIN below 3 mg/L
CIP-CK-WWTP-REG-20[5]	8.5	Replace Aeration Blowers 1&2 and Channel Blowers 1&2		X		$1,600,000	➢ Replace existing aeration basin blowers 1 and 2. ➢ Replace channel blowers 1 and 2. ➢ This project will contribute towards ensuring effluent TIN can be kept consistently below 5 mg/L and a seasonal TIN below 3 mg/L
CIP-CK-WWTP-CAP-21[5]	8.5	Construct Aeration Basins 5 & 6	X		X	$23,900,000	➢ Construct aeration basins 5 & 6 and expand associated support systems ➢ This project will contribute towards ensuring effluent TIN can be kept consistently below 5 mg/L and a seasonal TIN below 3 mg/L
CIP-CK-WWTP-REG-22[6]	6.9	Near-term Recycled Water Improvements	X			$ 600,000	➢ Connect recycled water filters to transmission pipe with control valve and chlorine monitoring and controls. ➢ Project allows recycled water production up to approximately 1.5 MGD. Higher flows will result in insufficient chlorine contact time.
CIP-CK-WWTP-REG-23	6.9	Long-term Recycled Water Improvements	X			$4,700,000	➢ Construct a new UV disinfection system to provide recycled water disinfection. ➢ Project allows disinfection of the full 3.5 MGD capacity of the recycled water filters.
					Total	$48,240,000	

Notes:
1. Replacement projects will construct a new facility.
2. Upgrade projects will replace components of the facility.
3. Capacity Increase projects will increase hydraulic capacity.
4. Asset health scores for the WWTP are grouped by process. This project has a high asset health score because of other health deficiencies in the process, but the specific equipment addressed by the project is not in urgent need of improvement.
5. Future nutrient requirements and timing are unknown. Based on the current permit cycle for the PSNGP, it is assumed that effluent TIN restrictions to values below 10 mg/L will not be implemented until 2031 at the earliest.
6. If funding becomes available, this project should be considered in the 6-year CIP.

11.4.5 Central Kitsap O&M Projects

Each of the O&M projects are summarized in Table 11-5. Costs and drivers of improvements are not included for O&M projects since these are relatively minor projects implemented by County staff and not included in the CIP budget.

Table 11-5 | O&M Projects

O&M Project No	Asset Health Score[1]	Item	Project Description
O&M-CK-WWTP-1	4.8	Manual Screen Replacement	➢ Replace the manual screen
O&M-CK-WWTP-2	8.5	Nitrogen Probe Upgrades	➢ Upgrade nitrogen probes to wet chemistry probes to allow for better low-level monitoring and control
O&M-CK-WWTP-3	4.0	Add Support Under Motors	➢ Add support under motors to reduce wear
O&M-CK-WWTP-4	8.5	Recoat Secondary Clarifier Walkway and Drive Equipment	➢ Repaint the corroded areas of clarifier walkway and drive to prevent further corrosion.
O&M-CK-WWTP-5	19.5	Clean and Paint Scum Pumps	➢ Repaint corroded areas of the scum pumps
O&M-CK-WWTP-6	6.0	Replace Bearing on Septage Odor Control Fan	➢ Replace the bearing on the septage odor control fan to prevent failure
O&M-CK-WWTP-7	17.5	Restart Biogas Treatment and Cogen System	➢ Restart the biogas odor control and cogen system
O&M-CK-WWTP-8	N/A	Outfall Inspection	➢ Inspect the outfall when required by NPDES permit renewal
O&M-CK-WWTP-9	9.5	Control Panel Housekeeping, Electrical Spare Parts Inventory, Electrical Replacement Plan and Electrical Safety Plan	➢ General control panel housekeeping will help extend the lifespan of existing electrical equipment. ➢ Building and maintaining an electrical spare parts inventory, and defining an electrical replacement plan will help respond to and prevent electrical failures. ➢ An Electrical Safety Plan that complies with NFPA 70E should be implemented. This would include electrical equipment hazard labeling, coordination settings of overcurrent devices, clearly defining working space clearances and many other safety requirements as defined in NFPA 70E.
O&M-CK-WWTP-10	9.5	Transformer 2951, 3010, 3020 and Generator 2996 Recoating	➢ Clean and repaint rusted areas of Transformer 2951 ➢ Clean and repaint rusted areas of Transformer 3010 ➢ Clean and repaint rusted areas of Transformer 3020 ➢ Clean and repaint rusted areas of Generator 2996
O&M-CK-WWTP-11	8.5	BNR Optimization	➢ Continue BNR testing to gain additional data and operational experience. ➢ Refine ABAC mode controls to optimize performance. ➢ This project will contribute towards ensuring effluent TIN can be kept consistently below 10 mg/L
O&M-CK-WWTP-12	6.9	Replace 3W Pumps	➢ Replace the plant process water pumps and strainer.

O&M Project No	Asset Health Score[1]	Item	Project Description
O&M-CK-CC-13	7.4	Annual Pump Station Upgrade Program	➢ This project is for minor upgrades to pump stations
O&M-CK-WWTP-14	6.9	Dewatering Odor Control System Reassessment	➢ Reassess dewatering odor control system in 3 to 5 years

Note:

1. Asset health scores for the WWTP are grouped by process. Some items have a high asset health score because of other health deficiencies in the process, but the specific equipment addressed by the project may not be in urgent need of improvement. Review Section 6 for details about the condition of specific equipment.

11.5 Wastewater System 20-Year CIP

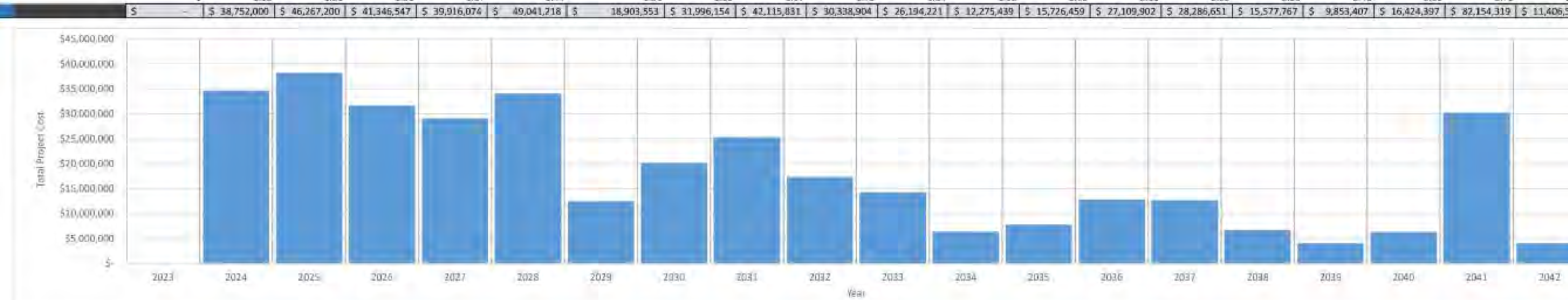
The 20-Year CIP is summarized in **Table 11-6** below along with the consultant proposed spend plan over the 20-year planning horizon.

Table 11-6 | Recommended CIP Summary

Central Kitsap Basin CIP Plan

consor

					6-Year CIP						20-Year CIP													
6 or 20 Year CIP	CIP No.	Asset Health Score	Project Name	Total Project Cost	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
6	CIP-CK-CC-CAP-2	25	Replace PS-4 and Forcemain	$ 13,200,000		$ 6,600,000	$ 6,600,000																	
6	CIP-CK-WWTP-CAP-1	17.5	Solids and Liquid Hauled Waste Upgrades	$ 140,000,000		$ 28,000,000	$ 28,000,000	$ 28,000,000	$ 28,000,000	$ 28,000,000														
6	CIP-CK-CC-CAP-3	15.5	Upgrade PS-24	$ 7,300,000			$ 3,650,000	$ 3,650,000																
6	CIP-CK-WWTP-OM-11	6.9	Central Kitsap Buildings HVAC Improvements	$ 2,200,000					$ 1,100,000	$ 1,100,000														
6	CIP-CK-WWTP-REG-2	8.5	Construct Third Secondary Clarifier and Replace RAS pumps	$ 9,900,000						$ 4,950,000	$ 4,950,000													
20	CIP-CK-CC-OM-30	20	Annual Pipe Replacement	$ 56,000,000							$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000	$ 4,000,000
20	CIP-CK-WWTP-OB-18	9.5	Replace Blower Building Primary Power Switchgear and Transformers	$ 200,000							$ 200,000													
20	CIP-CK-WWTP-REG-22	6.9	Near-term Recycled Water Improvements	$ 600,000							$ 600,000													
20	CIP-CK-CC-CAP-27	25	Anderson Hill Sewer Upgrades	$ 5,500,000							$ 2,750,000	$ 2,750,000												
20	CIP-CK-CC-CAP-7	25	Northern Old Military Road Sewer Upgrades*	$ 12,200,000								$ 6,100,000	$ 6,100,000											
20	CIP-CK-CC-CAP-28	25	Dickey Road Sewer Upgrades	$ 3,800,000								$ 1,900,000	$ 1,900,000											
20	CIP-CK-CC-OM-11	11.1	Replace PS-13	$ 3,200,000								$ 1,600,000	$ 1,600,000											
20	CIP-CK-CC-CAP-12	14.4	Replace PS-12	$ 7,600,000								$ 3,800,000	$ 3,800,000											
20	CIP-CK-CC-OM-5	7	Replace PS-11*	$ 760,000									$ 760,000											
20	CIP-CK-WWTP-REG-19	8.5	Aeration Basin Air Distribution Study	$ 1,300,000									$ 1,300,000											
20	CIP-CK-WWTP-REG-20	8.5	Replace Aeration Blowers 1&2 and Channel Blowers 1&2	$ 1,600,000									$ 1,600,000											
20	CIP-CK-CC-OM-4	7.4	Replace PS-36*	$ 1,900,000									$ 950,000	$ 950,000										
20	CIP-CK-CC-CAP-29	25	Myhre Road Sewer Upgrades	$ 3,700,000									$ 1,850,000	$ 1,850,000										
20	CIP-CK-CC-OM-16	6.6	Replace PS-2	$ 2,800,000									$ 1,400,000	$ 1,400,000										
20	CIP-CK-CC-OM-18	6.4	Upgrade PS-40	$ 240,000										$ 240,000										
20	CIP-CK-CC-OM-6	7	Upgrade PS-33*	$ 240,000										$ 240,000										
20	CIP-CK-CC-CAP-13	14.5	Replace PS-34	$ 7,600,000										$ 3,800,000	$ 3,800,000									
20	CIP-CK-CC-OM-17	6.6	Replace PS-37	$ 1,900,000										$ 950,000	$ 950,000									
20	CIP-CK-CC-CAP-1	25	Replace PS-3*	$ 7,800,000										$ 3,900,000	$ 3,900,000									
20	CIP-CK-WWTP-REG-4	8.5	RAS Distribution Box Hydraulic Study & Improvements*	$ 1,000,000											$ 1,000,000									
20	CIP-CK-CC-OM-19	6.4	Upgrade PS-35	$ 1,200,000											$ 600,000	$ 600,000								
20	CIP-CK-CC-OM-20	6.2	Upgrade PS-9	$ 260,000												$ 260,000								
20	CIP-CK-CC-OM-21	6.2	Replace PS-65	$ 3,000,000												$ 1,500,000	$ 1,500,000							
20	CIP-CK-CC-OM-15	6.8	Replace PS-32	$ 1,900,000													$ 1,900,000							
20	CIP-CK-CC-OM-14	8.1	Upgrade PS-22	$ 360,000													$ 360,000							
20	CIP-CK-WWTP-CAP-12	14.5	Install a New Primary Clarifiers and Primary Sludge Pumps	$ 12,400,000														$ 6,200,000	$ 6,200,000					
20	CIP-CK-WWTP-OB-14	14.5	Replace Thickened Primary Sludge Grinders	$ 200,000														$ 200,000						
20	CIP-CK-WWTP-OB-15	14.5	Replace Scum Grinder and Pumps	$ 440,000														$ 440,000						
20	CIP-CK-WWTP-OB-16	9	Replace Centrifuge Sludge Feed Grinders & Pumps	$ 760,000														$ 760,000						
20	CIP-CK-WWTP-OB-17	9	Replace Centrate Pumps	$ 140,000														$ 140,000						
20	CIP-CK-WWTP-REG-13	3	Install a New Effluent Flow Meter	$ 1,000,000														$ 1,000,000						
20	CIP-CK-CC-OM-22	6	Upgrade PS-26	$ 250,000															$ 250,000					
20	CIP-CK-CC-OM-23	6	Upgrade PS-30	$ 1,200,000															$ 600,000	$ 600,000				
20	CIP-CK-CC-OM-24	5.8	Upgrade PS-20	$ 660,000															$ 660,000					
20	CIP-CK-CC-CAP-26	4	Upgrade PS-69	$ 1,900,000															$ 950,000	$ 950,000				
20	CIP-CK-CC-OM-25	3.2	Upgrade PS-61	$ 1,090,000																$ 1,090,000				
20	CIP-CK-WWTP-REG-23	6.9	Long-term Recycled Water Improvements	$ 4,700,000																		$ 2,350,000	$ 2,350,000	
20	CIP-CK-WWTP-CAP-21	8.5	Construct Aeration Basins 5 & 6	$ 23,900,000																			$ 23,900,000	
			Total Project Cost (2023)	$ 347,900,000	$ -	$ 34,600,000	$ 38,250,000	$ 31,650,000	$ 29,100,000	$ 34,050,000	$ 12,500,000	$ 20,150,000	$ 25,260,000	$ 17,330,000	$ 14,250,000	$ 6,360,000	$ 7,760,000	$ 12,740,000	$ 12,660,000	$ 6,640,000	$ 4,000,000	$ 6,350,000	$ 30,250,000	$ 4,000,000
			Assumed Inflation Rate			12%	8%	8%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
			Inflation Multiplier		1	1.12	1.21	1.31	1.37	1.44	1.51	1.59	1.67	1.75	1.84	1.93	2.03	2.13	2.23	2.35	2.46	2.59	2.72	2.85
			Future Value Cost		$ -	$ 38,752,000	$ 46,267,200	$ 41,346,547	$ 39,916,074	$ 49,041,218	$ 18,903,553	$ 31,996,154	$ 42,115,831	$ 30,338,904	$ 26,194,221	$ 12,275,439	$ 15,726,459	$ 27,109,902	$ 28,286,651	$ 15,577,767	$ 9,853,407	$ 16,424,397	$ 82,154,319	$ 11,406,550



SECTION 12

Financial Strategy

12.1 Introduction

This chapter documents the Sewer Financial Plan, which shows how the investments in the CIP can be funded by the County sewer utility.

This Sewer Financial Plan was written by FCS, a Bowman company, under subcontract with Consor, the County's consulting engineers who have prepared the other required elements of this Plan.

12.1.1 Four Basins, One Financial Entity

The County sewer system has four basins, each with a treatment plant and a corresponding collection system: Central Kitsap, Manchester, Suquamish, and Kingston. The capital planning has been performed separately for each basin. However, the County does not separate its sewer utility financial information by basin, so all information shown in this Sewer Financial Plan document—unless explicitly stated otherwise—refers to the County sewer utility as a whole.

This sewer financial plan document has been written so it can be included with each of the Wastewater Facilities and Sewer Plan documents: Central Kitsap, Manchester, Suquamish, and Kingston. At the end of this chapter, a table showing the allocation of costs and revenues across the four basins is included, so that the Plan documents will each contain the required elements needed for submission to Ecology.

12.1.2 Sequence of Topics

After reviewing the historical performance of the sewer utility, we describe the methodology and key assumptions underlying the financial forecast. The key assumptions address the assumed fiscal policies, economic assumptions, and data sources. This section also summarizes the CIP, expressing total project costs in both constant 2023 dollars and future inflated dollars.

After the key assumptions and data sources, this chapter then shows the results of the revenue requirement forecast. This is a two-step process. First, the capital funding strategy describes how the capital costs can be financed over time, using both debt and non-debt sources. The debt issues lead to annual debt service costs. The second step is the annual forecast, which incorporates the debt service and other annual costs into a forecast that is balanced against projected revenues. The forecast is tested assuming existing rates. If either the projected cash balances are insufficient or the required bonded debt service coverage is not achieved, then rates are adjusted until the forecast is balanced. In this forecast, the forecast can be balanced with overall rate increases of 6.31% in 2025 (already adopted by the County) and 6% per year from 2026 through 2042.

This document then shows the implications of these rate increases on several metrics and policy targets: reserve fund balances, rate-funded capital investment, bonded debt service coverage, outstanding debt as a percentage of total assets, annual debt service as a percentage of total revenue ("debt service load"), and the average single-family bill as a percentage of median household income.

The next section of this document allocates the forecast results to the four basins. Finally, Appendix R contains a list of loan and grant programs administered by State agencies.

12.2 Financial History

This section is a summary of historical financial performance as reported on the County sewer utility income statements.

Table 12-1 shows comparative financial statements for the six-year period 2018 through 2023. These statements summarize the revenues, expenses, and ending reserves for each year.

Table 12-1 | Sewer Utility Income Statement Summary

Kitsap County Sanitary Sewer Statement of Revenue, Expenses, and Changes in Fund Net Position	2018	2019	2020	2021	2022	2023
Operating Revenues						
Charges For services	$ 29,148,750	$ 22,655,426	$ 22,463,052	$ 29,309,413	$ 29,874,573	$ 33,131,359
Miscellaneous	8,186	1	1,830	(952)	29,607	26,281
Total Operating Revenue	29,156,936	22,655,427	22,464,882	29,308,461	29,904,180	33,157,640
Operating Expenses						
Personnel services	6,300,329	6,279,287	5,685,451	4,687,211	7,096,959	7,204,619
Contractual services	2,457,856	1,139,373	2,005,189	3,274,795	1,526,763	1,677,788
Utilities	1,730,524	1,572,611	1,629,789	1,658,245	1,829,897	2,031,543
Repair and maintenance	363,500	206,538	124,609	276,907	67,014	383,963
Other supplies and expenses	822,068	2,411,869	2,904,338	24,091	3,522,734	3,624,846
Insurance claims and other benefits	23,206	41,016	48,593	36,905	55,869	71,221
Depreciation	8,067,911	8,229,732	7,938,653	7,936,876	7,798,372	7,564,530
Amortization	-	-	-	-	18,185	43,554
Total Operating Expense	19,765,394	19,880,426	20,336,622	17,895,030	21,915,793	22,602,064
Operating Income (loss)	9,391,542	2,775,001	2,128,260	11,413,431	7,988,387	10,555,576
Nonoperating Revenues (Expense)						
Interest and investment revenue	557,566	992,414	501,061	(108,225)	(514,379)	1,599,427
Grant Revenue	-	-	-	-	12,077,611	1,617,967
Miscellaneous revenue	7,995,466	974,624	-	-	-	11,521
Interest expense	(2,332,621)	(2,574,476)	(1,774,693)	(1,663,145)	(1,534,251)	(1,592,572)
Miscellaneous expense	(2,362)	-	-	-	-	-
Total Nonoperating Revenue (Expense)	6,218,049	(607,438)	(1,273,632)	(1,771,370)	10,028,981	1,636,343
Income (loss) Before Contributions & Transfers	15,609,591	2,167,563	854,628	9,642,061	18,017,368	12,191,919
Capital contributions	1,746,374	1,079,087	3,304,592	358,850	8,815	3,378,392
Transfers in	133,903	2,116,097	-	-	-	-
Transfer out	(167,214)	(364,731)	(139,181)	(47,868)	(47,940)	(78,250)
Transfer to Fiscal Agent	-	(2,066,310)	-	-	-	-
Change in Net Position	17,322,654	2,931,706	4,020,039	9,953,043	17,978,243	15,492,061
Net Position - Beginning	92,589,114	109,914,129	104,363,824	108,683,150	118,636,193	136,614,438
Prior period adjustment	-	(8,482,011)	299,286	-	-	-
Net Position - Ending	109,911,768	104,363,824	108,683,149	118,636,193	136,614,436	152,106,499

Following are some observations about the sewer utility's historical financial performance:

- "Charges for services" revenue varies from year to year, with the total ranging from $22.4 million to $33.1 million over the past six years. While population growth and retail rate increases account for a general upward trend over time, the "up and down" variability from year to year is largely driven by changes in capital cost sharing from contract customers.

The three primary contract customers are the City of Poulsbo, U.S. Navy Keyport, and Bangor. All three contract customers pay for ongoing service at the commercial rate. Poulsbo and U.S. Navy Keyport have separate cost-sharing agreements for capital costs. In the County's accounting system, capital cost-sharing is included in the "charges for services" revenue category.

- In 2018, the County received $7,995,466 in miscellaneous revenue, with a smaller amount ($974,625) received the following year. The County's annual report showed this revenue in the "operating grants and contributions" category. While we did not determine the source, it is clearly a non-recurring revenue.
- Total operating expenses have increased over time, with an average increase of 2.3% per year. There was a temporary decrease from 2020 to 2021 followed by a rebound in 2022. This pattern may have been influenced by the COVID-19 pandemic.
- The County received approximately $13.7 million in grants over the last two years with the majority ($12.1 million) being accounted for in 2022.
- The financial statements suggest that the County utility has been drawing down its balance of outstanding debt through the six-year period, since interest expense decreased from $2.3 million in 2018 to $1.6 million in 2023.
- In the annual report, the term "net position" refers to the utility's total assets minus total liabilities. (It is analogous to "owner's equity" in private sector financial statements.) The Kitsap County sewer utility's net position has increased by $59.5 million (64%) from the beginning of 2018 to the end of 2023. This equates to an average increase of 8.6% per year during the period.

12.3 Methodology and Assumptions

12.3.1 Revenue Requirement Forecast Methodology

The revenue requirement forecast identifies the total revenue needed to fully fund the utility on a stand-alone basis considering current and future financial obligations. For this analysis, the resulting rate increases are assumed to be applied "across-the-board" to all customer classes; no rate design changes are proposed in this financial plan.

Table 12-2 shows that the forecast is a two-step process. The first step is the capital funding strategy, shown in the left column. We begin with the total capital program provided by Consor as part of the General Sewer Plan Updates for each of the County's four wastewater basins. We then subtract all of the non-debt funding sources. The remainder is the amount of borrowing needed. The number at the bottom of the first column—the debt needed to fund the remainder of the capital program—determines the amount of new debt service, which is an annual cost.

The second step is the annual forecast, shown in the column to the right. The fiscal policy targets include the minimum reserve balances that must be maintained in the forecast. To that number we add each year's projected operating costs, existing and new debt service, and the amount of current rate funding used for capital expenditures. After deducting non-retail revenue, we now know how much money is needed each year from rates.

Table 12-2 | Revenue Requirement Overview

	Capital Funding Strategy
	Total Capital Projects
-	Grants
-	Wholesale Contributions
-	Newcomer Fees
-	Rate-Funded Capital
-	Cash Reserves
=	Debt Funding (Loans or Bonds)

	Annual Forecast
	Fiscal Policy Targets
+	Operating Costs
+	Existing & New Debt Service
+	Rate-Funded Capital
=	Revenue Requirement
-	Offset Revenues
=	Revenue Required from Retail Rates

The rate revenue requirement is next compared with the revenue projected to be generated by current rates. In addition, we test the current rates against required "debt service coverage," which is an important fiscal policy explained below. If the current rates are insufficient—either because they do not generate enough cash or because the debt service coverage target is not met—then the forecast rates are adjusted to the degree necessary to balance the cash flow requirements and ensure that the coverage target is achieved.

12.3.2 Fiscal Policies

The fiscal policies that affect a rate forecast include the target operating reserve, minimum capital reserve, minimum operating and capital cash, debt service coverage, rate-funded capital reinvestment. Each type of policy is discussed below.

12.3.2.1 Target Operating Reserve

"Reserves" are another word for fund balance. An operating reserve is a liquidity cushion; it protects the utility from the risk of short-term variation in the timing of revenues or expenses.

For operating reserves, we often characterize the target with both a minimum and a maximum. For any given year, if the forecast shows an ending fund balance below the minimum, then rates need to be raised higher to replenish the reserve. If the forecast shows the ending balance above the maximum, then the excess cash is re-characterized as a capital reserve.

The most common operating reserve target for sewer utilities is between 45 days and 60 days (12%-16%) of annual operating expenses. However, Kitsap County sewer rates include a volume charge for non-residential and contract customers, which introduces more revenue variability. We therefore suggest a larger cushion—an operating reserve target of 90 days (25%) of annual operating expenses.

Recommended Policy: Achieve a year-end operating fund balance of 90 days (25%) of total annual operating expenses. Results: For 2024, this amount is forecasted to be about $4.1 million; it increases throughout the forecast period as operating costs increase with inflation.

12.3.2.2 Minimum Capital Reserve

The capital fund balance fluctuates naturally because it serves two functions. First, capital reserves are a capital funding tool, the means by which a utility saves up in advance of major capital projects and avoids overreliance on debt. Utilities tend to go through waves of capital investment, so the reserve balance tends to grow over time and then drop suddenly after a large capital project.

There is also a second function of a capital reserve. It also serves as a risk reserve just like the operating reserve, giving the utility the flexibility to respond to unanticipated needs. Such needs could include a capital cost overrun, or an unexpected failure of a major asset. It could be an unexpected regulatory requirement or simply an opportunity-driven capital improvement. A cash cushion gives the utility flexibility to address unforeseen capital needs in a logical way.

That cash cushion is achieved by having a minimum capital fund balance in the projections. In other words, when we forecast capital spending and the fund balance naturally goes up and down, we only allow it to go down so far—only as far as the target minimum—not all the way to zero.

The target minimum capital fund balance could be defined as a certain percentage of the average CIP, or as the projected replacement cost of specified high-value assets. However, a simple and common way to set a target minimum capital reserve is to define it as 1% of the original cost of fixed assets in the system. This minimum naturally increases over time since future capital investment leads to a growing inventory of assets. That is the approach we recommend in this financial plan.

Recommended Policy: Achieve a year-end minimum capital balance target of 1% of the original cost of plant-in-service. Results: This equates to roughly $2.9 million for year-end 2024 and increases to $9.0 million in 2042 as capital is constructed.

12.3.2.3 Minimum Operating and Capital Cash

In recent years, bond rating agencies have focused on the combined operating and capital cash balance. A favorable indicator is when a utility maintains a combined year-end cash reserve of at least 180 days (50%) of annual operating expenses. That is the policy target we recommend here.

Recommended Policy: Maintain a minimum year-end operating and capital balance of 180 days (50%) of annual operating expenses. Results: This equates to roughly $8.2 million for year-end 2024 and increases thereafter. In this forecast, the 180-day target is achieved in all years.

12.3.2.4 Debt Management

The sewer utility currently has three revenue bonds, two Public Works Trust Fund (PWTF) loans, and four Department of Ecology (DOE) state loans. Additionally, the County is in the process of selling additional revenue bonds and securing another DOE loan. In 2024, debt service is about $5.2 million. With existing debt and the new debt arrangements already underway, debt service will rise above $7 million per year for 2027-2040, dropping off after 2040. In addition, to address the capital needs identified in this plan, additional revenue bonds are forecasted to be issued in future years. Each bond issue is assumed to have a 20-year term, issuance cost of 1%, and an interest rate of 5%.

12.3.2.4.1 Debt Service Coverage

Debt service coverage is a requirement typically associated with revenue bonds and some state loans. It is also a useful benchmark to measure the riskiness of a utility's capital funding plans. Coverage is best understood as a factor applied to annual debt service. A typical requirement in selling revenue bonds is that bonded debt service coverage must be at least 1.25 throughout the life of the bonds. That means the County agrees to collect enough revenue each year to meet operating expenses and not only pay debt service but also an additional 25% above bonded debt service. This cushion makes bondholders more confident that debt service will be paid on time. The extra revenue can be used for capital expenditures, to build reserves, or for debt service on subordinate debt.

While the County's contractual minimum coverage is 1.25, achieving coverage greater than the minimum is a positive signal that bond rating agencies notice, and it can result in more favorable terms for future borrowing. For that reason, many utilities set a policy target higher than 1.25.

Recommended Policy: Set rates to achieve bonded debt service coverage of at least 1.50. Results: The utility is forecasted to achieve this policy in all years except 2032 and 2034, when coverage decreases to 1.38 and 1.49. That is still safely above the legal minimum of 1.25.

12.3.2.5 Rate-Funded Capital Investment

To avoid overreliance on debt, it is useful to have a target for the amount of capital investment that is funded by rates ("pay-as-you-go"). A common benchmark is to aim for rate-funded capital of at least 100% of original cost depreciation by the end of the forecast period. We recommend that approach.

Recommended Policy: Rate revenue should fund 100% of original cost depreciation expense by the end of the forecast period. Annual depreciation is $7.5 million in 2023, growing to $19.8 million by 2042. Results: In this forecast, rate-funded capital at 100% of depreciation is first achieved in 2039 and continues through the remainder of the forecast.

Table 12-3 provides a summary of the recommended fiscal policies for the sewer utility.

Table 12-3 | Summary of Fiscal Policies

Policy	Recommended Target
Operating Reserve	90 days (25%) of annual O&M expenses (initially, $4.1 million)
Minimum Capital Reserve	1% of original cost of plant-in-service (initially, $2.9 million)
Minimum Operating & Capital Cash	180 days (50%) of annual O&M expenses (initially, $8.2 million).
Debt Service Coverage	A policy target of at least 1.50 for bonded debt, which is higher than the contractual minimum of 1.25
Rate-Funded (Pay-as-You-Go) Capital Reinvestment	Rate-funded capital should equal 100% of original cost depreciation by the end of the study period ($19.8 million per year by 2042)

12.3.3 Key Assumptions and Data Sources

12.3.3.1 Economic & Inflation Factors

The operating expenditure forecast relies primarily on the County's 2024 adopted budget. The line items in the budget are then adjusted each year by one of the following factors:

- General Cost Inflation – After conversations with staff, we assumed 4% in 2024 followed by 3% per year thereafter.
- Construction Cost Inflation – Unless otherwise mentioned, all project costs were given in 2023 dollars, then escalated for construction inflation of 8% in 2024, 4% per year thereafter.
- Labor Cost Inflation – Assumed at 10% for 2025 to reflect the County's compensation study adjustments, followed by 3% per year based on the Employment Cost Indices for wages.

- Benefits Cost Inflation – Assumed at 5% per year, based on the Employment Cost Indices for benefits.
- Taxes – The State excise tax rate is 3.852%, the State Business and Occupation (B&O) tax rate is 1.75%. The State excise tax applies to rate revenue allocated to the collection system. The B&O tax applies to rate revenue allocated to treatment and transmission, as well as to system development charges and other miscellaneous fees.
- Fund Earnings – Assumed to be 4% in 2024 and decreasing one percentage point per year until 2027 and then remaining at 1% for the forecast period. Based on market conditions as well as historical Local Government Investment Pool (LGIP) returns.
- Customer Growth – Conservatively assumed to be 0.5% per year, based on discussion with staff. The assumed growth rate in sewered population varies for each of the County's four service areas, which are projected to be between 0.6%/yr and 4.8%/yr. Therefore, a 0.5%/year customer base growth rate represents a conservative estimate for the purposes of financial planning in the event assumed sewered population growth rates are not realized.
- Operating Budget Execution Factor – 95% in 2024 followed by 90% for all other years, based on discussions with staff and historical data on actual vs. budgeted spending.

12.3.3.2 Fund Balances

The County manages both an operating and capital fund related to the sewer utility. For the purpose of showing funds restricted for debt service repayment, the forecast contains a third category: debt reserves. These funds are assumed to come from the operating fund. **Table 12-4** shows the updated allocated cash balance for 2024 between operating, capital, and debt purposes for the financial modeling. It also shows the projected beginning fund balance for 2024, the beginning of the forecast period.

Table 12-4 | Cash Balances

Description	2024 Beginning Cash Balances
Operating Fund	$11,560,996
Capital Fund	$369,483
Debt Reserves	$6,827,376
Total Fund Balance	**$18,784,376**

While the capital fund reserves are below the initial target of $2.9 million for 2024 beginning balance, the operating fund balance more than covers the difference. In our forecast, any excess operating reserves are re-categorized as available for capital purposes.

12.3.3.3 Existing Debt

As stated previously, current outstanding debt for the sewer utility includes three revenue bonds, two Public Works Trust Fund (PWTF) loans, and four Ecology loans. Annual debt service payments are about $5.2 million in 2024. The County has opted to time the bonded debt service payments to smooth out year-to-year fluctuations in total debt service. The 2015 bond is retired in 2027 while the 2010C QECB loan is retired in 2028. Starting in 2028, the 2010B refunding bond starts to require principal payments. The two outstanding PWTF loans are fully repaid in 2031 and 2041. Two of the DOE loans are fully repaid in 2025 while the others are repaid gradually through 2038.

12.3.3.4 Near-Term Future Debt Obligations

Although not currently making payments on them, the County has begun the process of obtaining two additional debt issues. The first is a 20-year revenue bond which assumes repayment starting in 2025. The bond proceeds (including a bond premium) are assumed to be $32.5 million, requiring annual payments of $2.5 million once principal repayment begins in 2027.

The second loan in process is a $3.78 million DOE loan for the Capital Facility Plans update. Remaining draws on this loan are assumed to occur in 2024. Repayment starts in 2025, with annual payments of about $200,000 per year.

As of the time of writing, the County has also applied for other low-cost loans from State agencies. These additional loans will be described later in this document, under “Capital Funding Strategy.”

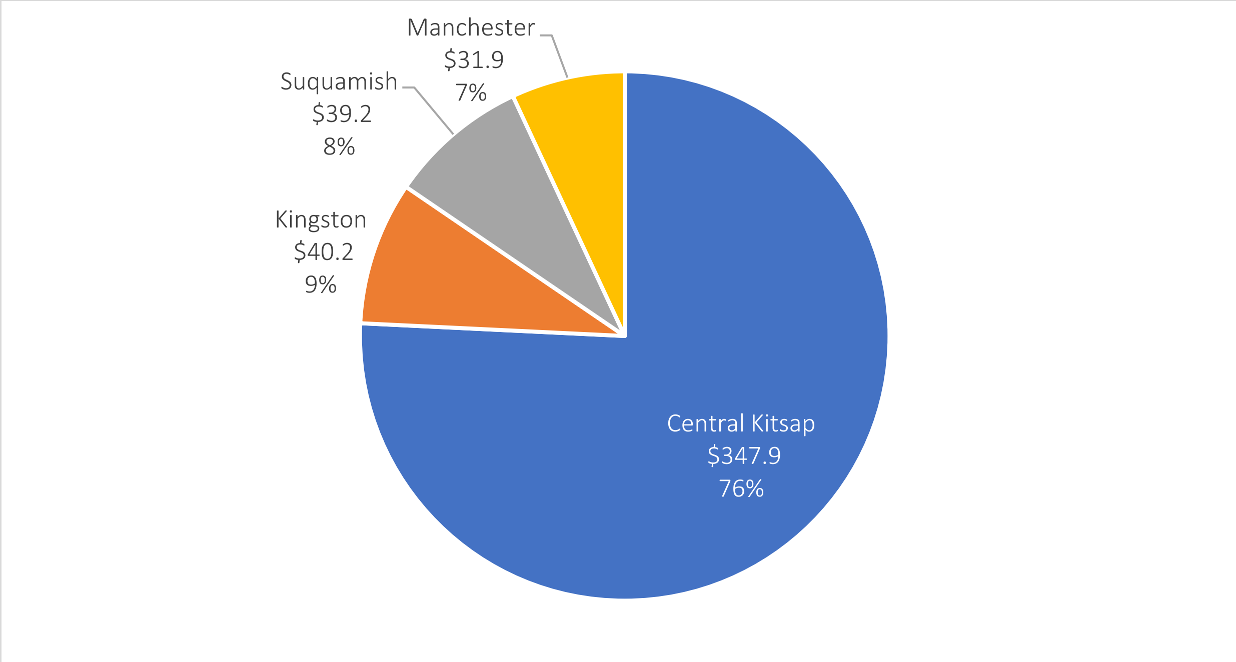
12.3.3.5 Capital Expenditure Forecast

12.3.3.5.1 Capital Projects Before Escalation

Capital project costs and timing were developed by Consor with County staff input. The resulting 2024-2042 capital improvement plan (CIP) shows estimated spending of about $459.2 million in 2023 dollars. Total capital costs in 2023 dollars by basin is shown in **Figure 12-1**. Central Kitsap is the largest treatment plant, and the Kitsap basin has 76% of the capital requirements.

The largest project in the early part of the CIP is the Solids and Liquid Hauled Waste Upgrades at the Central Kitsap treatment plant. Design for this project is currently underway, and its construction schedule is assumed to continue through 2028. (For convenience, it is sometimes referred to as the “digester project,” even though it actually includes other elements besides new digesters.) Its total remaining cost (in escalated dollars) is assumed to be $140 million, and it dominates the early years of the forecast—much of the borrowing and resulting rate increases in the next few years are focused on financing the digester project. Because of the size of the project and the fact that its engineering is well advanced, its cost estimate is given in escalated dollars — no further inflation factor is applied to the $140 million cost. For the other projects, however, **Figure 12-1** shows cost estimates in 2023 dollars.

Figure 12-1 | Unescalated Capital Spending (Millions) 2024-2042



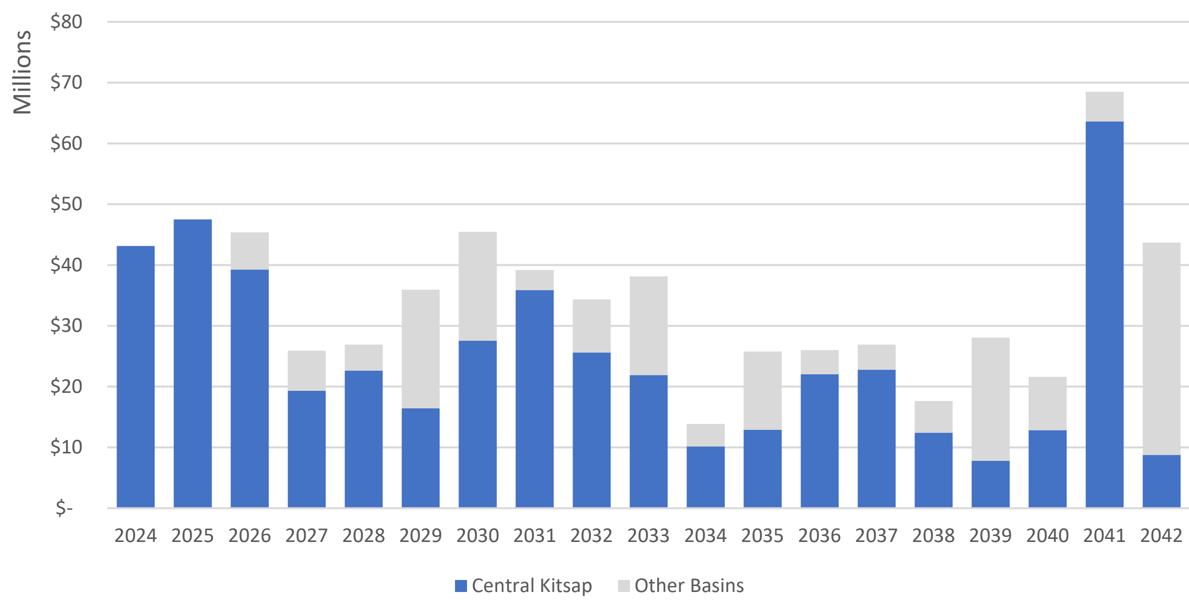
12.3.3.5.2 Projected Capital Expenditures after Cost Escalation

Figure 12-2 shows the year-by-year funding needs after applying the assumed inflation factors.

The digester project has expenditures extending from 2024 through 2028. After 2028, many of the identified capital projects are focused on the collection systems—the pipes and pumps that deliver wastewater to the four treatment plants. The 2029-2040 projects include needed improvements in the Kingston, Suquamish and Manchester basins in addition to the Central Kitsap basin.

In 2041, the CIP shows a major project ($50.3 million, in escalated dollars) to construct Aeration Basins 5 and 6 at the Central Kitsap plant, based on assumed requirements from the State. In 2042, a major upgrade (Class A Reclaimed Water Improvements, costing $29.9 million in escalated dollars) is shown for the Kingston plant. For these 2041 and 2042 projects, the nature of the regulatory requirements from the State are uncertain, but these estimates serve as a placeholder to flag the need for additional major investments in future years.

Figure 12-2 | Capital Expenditure Forecast 2024-2042 (escalated dollars) – Central Kitsap vs All Other Basins



The dark part of each column represents the Central Kitsap basin capital cost needs. The total escalated cost of capital improvements for the Central Kitsap basin is $472.6 million, about 72% of the total $654 million in escalated capital needs for the County.

12.4 County-Wide Revenue Requirement Results

The County currently has an adopted sewer rate increase for 6.31% in 2025. Following the adopted rate increase, the forecast shows that 6.0% annual rate increases would be necessary to continue to cover operations as well as fund the capital plan through a mix of cash funding and debt financing.

12.4.1 Capital Funding Strategy

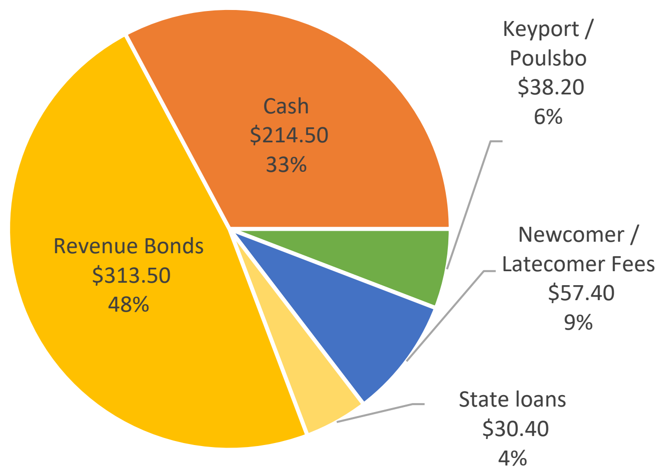
Over the full 19-year period from 2024 through 2042, the capital expenditure forecast (including inflation) contains $654 million of projects. In the capital funding strategy, our task is to identify where that $654 million will come from.

Figure 12-3 shows the forecasted sources of funding for this capital program.

- First is the capital cost sharing from U.S. Navy Keyport and Poulsbo. County staff provided estimates for 2024-2029, totaling $28.1 million for the 6-year period. We assumed that the cost share for 2029 ($778,000) continues in future years, so the total through 2042 is $38.2 million.
- Second, any available Newcomer or Latecomer revenue is applied to the capital program. The forecast assumes about $3,000,000 per year in revenue assuming no changes to the charge, or a total of $57.4 million.
- Next, we assume the low-interest loans that the County is currently pursuing from both Public Works and Department of Ecology. The assumed total is $30.4 million.

- The remaining capital funding need is balanced with a mix of cash vs. revenue bond debt. Each type of funding works to complement the other to fill the remaining funding gap. This includes:
  - Revenue bonds: issued in two-year cycles as needed, to cover capital costs for the year of issuance and the following year. Total debt proceeds are $313.5 million (48% of the total) through 2042. Except for the 2024/25 bond issue, we assumed 20-year bonds at 5% interest.
  - Cash funding: The covers the remaining $214.5 million (33% of the total). It is generated by the rate increases needed to repay revenue bonds and fund the remaining capital needs.

Figure 12-3 | Capital Funding Sources 2024 – 2042



12.4.1.1 Planned Low Interest Loans

The County has applied for low-interest State loans in the short term. The forecast assumes that the County receives the maximum $10 million in both 2025 and 2026 from the Public Works Trust Fund as well as an additional $9.85 million from the Department of Ecology. The total forecasted debt service on these loans is $1.8 million dollars.

12.4.1.2 Planned Revenue Bond Debt Issues

The first bond issue is currently in process as of 2024, but funding may not be available until 2025. After the first revenue bond debt issuance, additional issues are forecasted every two years as needed through 2041. **Table 12-5** shows the timing and magnitude of the bonded debt proceeds assumed in the financial plan, along with the annual debt service associated with each issue.

Table 12-5 | Planned Revenue Bond Issues in the Financial Plan

Year	Net Proceeds	Annual Debt Service
2024/2025	$32.5 million*	$2.5 million*
2026	$22 million	$1.9 million
2028	$42 million	$3.7 million
2030	$70 million	$5.9 million
2032	$58 million	$4.9 million
2034	$19 million	$1.6 million

Year	Net Proceeds	Annual Debt Service
2036	$25 million	$2.1 million
2039	$5 million	$0.4 million
2041	$40 million	$3.4 million
Total	**$313.5 million**	**$26.5 million**

Note:
*2024/2025 issue includes approximately $2.5m premium. Debt service is planned to have two years of interest-only payments in 2025 and 2026

12.4.1.3 Potential Grants and Other Low Cost State Loans

Due to the reliance on revenue bond funding for the capital program, the County should continue to pursue additional low-cost State loans. Grants and state loans provide two benefits. The first is the cost savings compared to the assumed alternative of issuing revenue bonds. In addition, by reducing its reliance on revenue bonds, the County improves its bonded debt service coverage calculation.

The following document is a helpful summary of the funding, eligibility, and contact details for water and sewer infrastructure assistance programs (both grants and low-cost loans) in Washington State: http://www.infrafunding.wa.gov/resources.html. This summary is updated each year by the Department of Commerce. The most recent version (September 17, 2024) is included as **Appendix R** to this report.

12.4.2 Annual Forecast

Figure 12-4 graphically represents the annual forecast through 2042. Total operating revenues are about $31.0 million in 2024 and $90.4 million in 2042. These figures exclude revenue restricted to capital purposes—debt proceeds, capital cost sharing from contract customers, or newcomer charges.

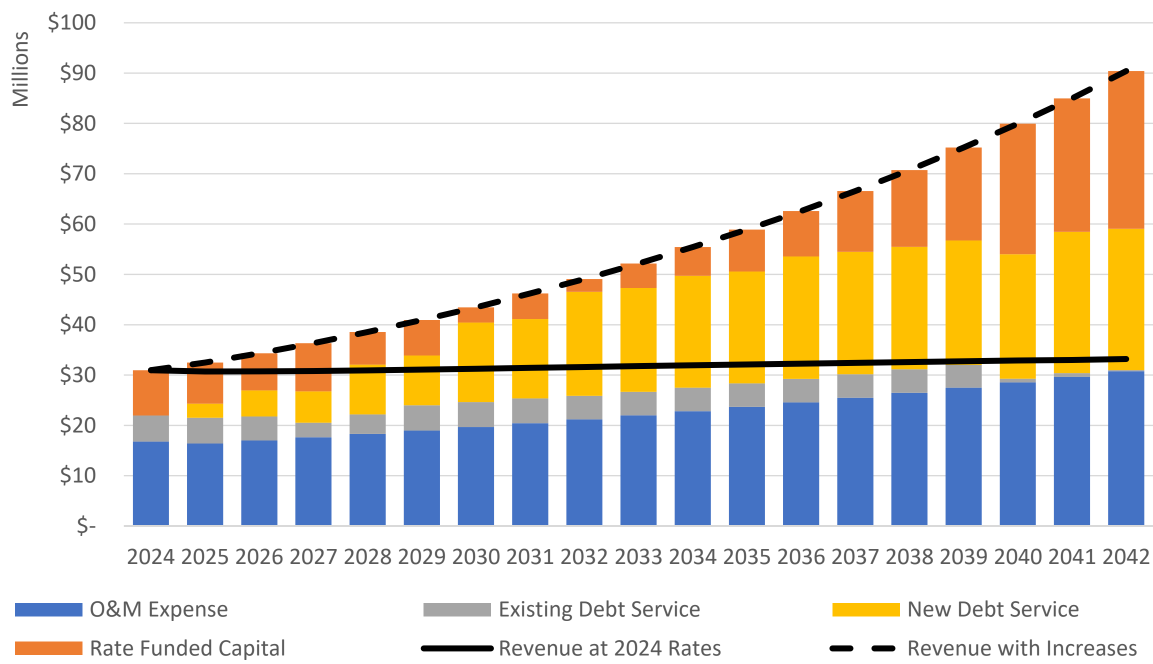
The stacked columns represent the costs of the utility, such as operating expenses, existing debt service, new debt service, and annual cash funding used for capital projects. The solid black line represents revenue at existing rates and the dashed line shows forecasted revenue with rate increases.

Below are further observations about these variables.

- Solid line: Revenue at existing rates.
  - Revenue is projected to increase with customer growth, even without future rate adjustments.
- Dashed line: Revenues with rate increases.
  - After the recommended rate increases, revenue is expected to grow to $90.4 million by 2042.
- Blue bar: Operating expenses.
  - Operating expenses increase with the annual cost escalation assumptions described earlier.
- Grey bar: Existing debt service.
  - Annual payments of about $5.2 million in 2024, declining to $214,000 by 2042.
- Yellow bar: New debt service.
  - New debt service begins in 2025. By 2042, it is about $28.1 million per year.

- **Orange bar:** Rate revenue available for capital projects.
  - This amount fluctuates year to year as the debt issues impact the difference between revenue collected and total other obligations.

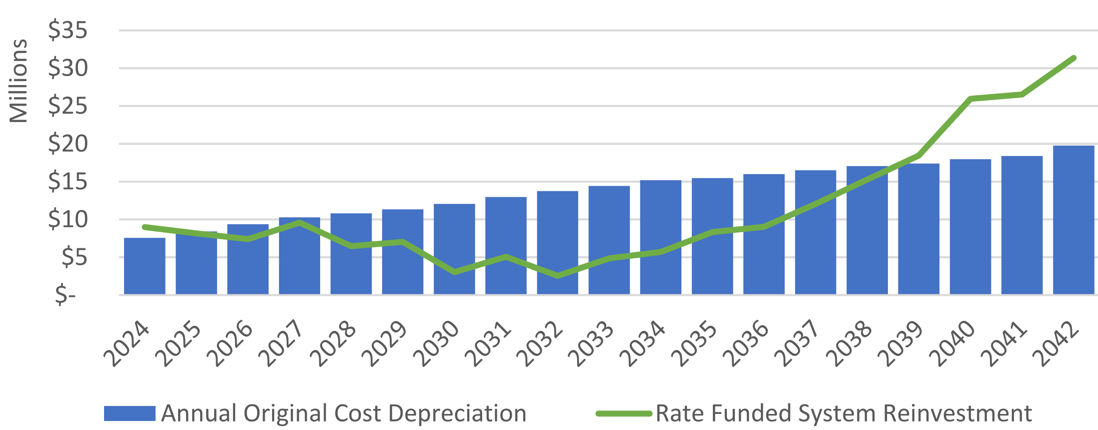
Figure 12-4 | Revenue Requirement Forecast



12.4.2.1 Rate-Funded Capital Investment

The green line in **Figure 12-5** shows the sewer utility's projected annual level of rate-funded capital investment in relation to annual depreciation.

Figure 12-5 | Annual Rate-Funded System Reinvestment



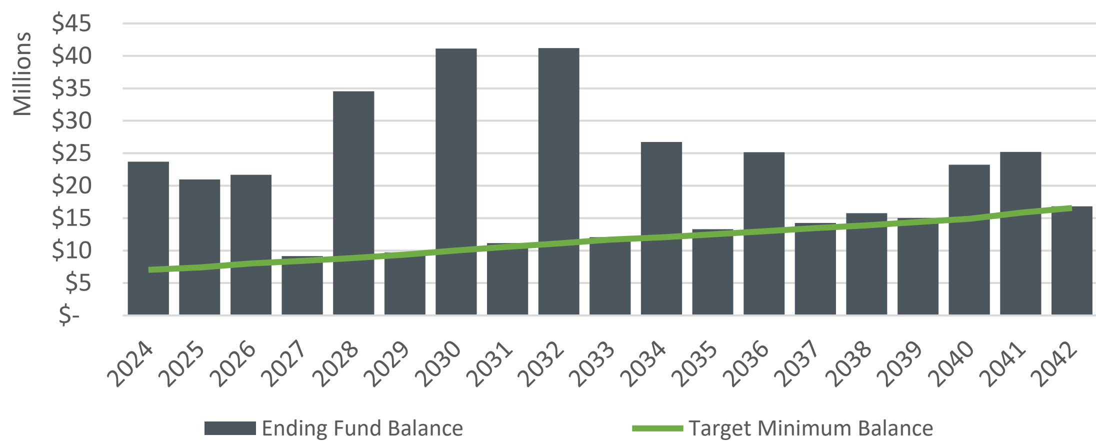
Over the forecast period, annual depreciation cost increases as the County completes capital projects. The blue line represents the same amount as the light green bar in **Figure 12-4**. Over this period, rate-funded system reinvestment reaches a low of 9% of annual depreciation in 2032. This coincides with the lowest bonded debt coverage (1.38) in the forecast. Beginning in 2039, rate-funded capital is projected to achieve the assumed policy target of at least 100% of annual depreciation cost.

12.4.2.2 Operating and Capital Reserve Level

The recommended minimum operating fund balance is 90 days of total annual operating expenses, and the recommended minimum capital fund balance is 1% of the original cost of assets. The sum of these two targets represents the combined minimum reserve balance—about $7.0 million in 2024. It grows to $16.6 million in 2042 as operating costs increase and the County adds assets to the system.

Figure 12-6 shows projected unrestricted fund balances through 2042 in relation to the reserve target (the green line). The utility is projected to achieve the reserve target each year.

Figure 12-6 | Operating and Capital Reserve Forecast

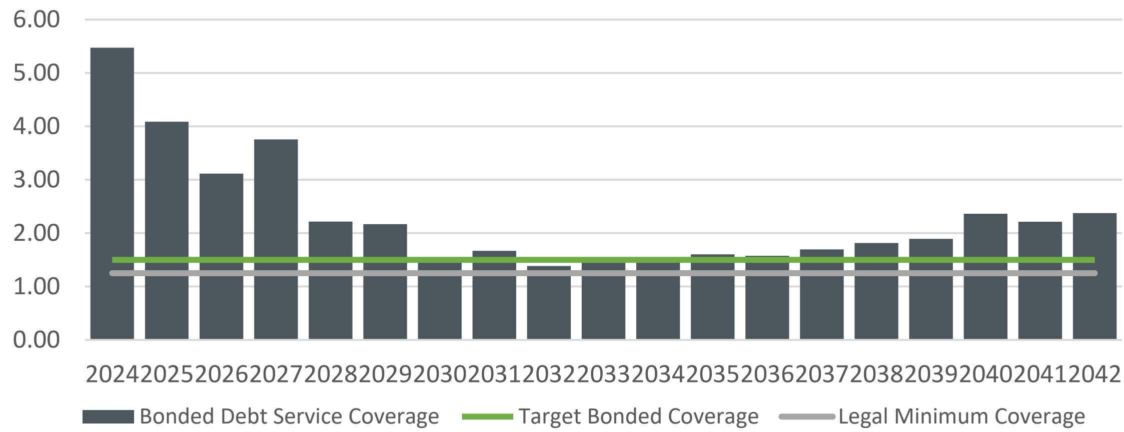


12.4.2.3 Bonded Debt Service Coverage

The legal minimum for revenue bond debt service coverage is 1.25 in each year in which bonds are outstanding. To enhance creditworthiness, many utilities set a policy target that is higher than the legal minimum. In this forecast, assumed a policy goal of at least 1.50 for bonded debt service coverage. However, we allowed exceptions to keep planned rate increases from going above 6% per year.

Figure 12-7 shows projected bonded debt service coverage through 2042 in relation to the assumed policy target of 1.50 and the legal minimum of 1.25. The utility is projected to achieve the policy target each year except for 2032 and 2034, when coverage drops to 1.38 and 1.49. The forecast stays above the legal minimum of 1.25 throughout the forecast period.

Figure 12-7 | Projected Bonded Debt Service Coverage in Relation to Target and Legal Minimum



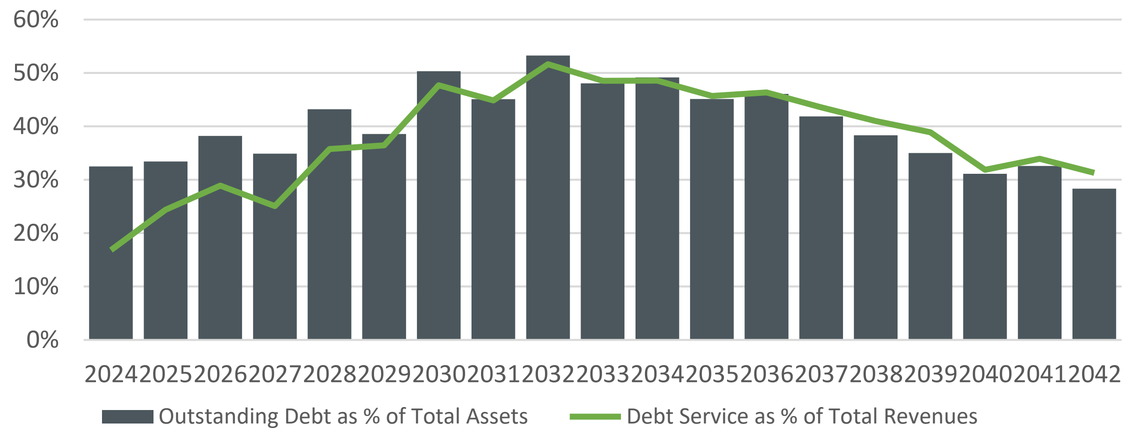
12.4.2.4 Analysis of Outstanding Debt and Debt Service Load

Because the County will need to borrow heavily to fund this CIP, two other debt-related metrics are relevant: the level of outstanding debt in relation to total assets ("debt-to-total assets ratio"), and the projected debt service as a percentage of total revenues ("debt service load"). Debt is a useful component in the capital funding toolbox, but it should not be overused. The cumulative effect of a series of borrowing decisions can be assessed by looking at these two metrics.

Figure 12-8 shows the projected debt-to-total assets ratio and the debt service load throughout the 2024-2042 forecast period. There is not a formal policy target to compare with, but we are aiming to keep both metrics below 50%. In this forecast, both metrics stay at or below 50% except in 2032, when outstanding debt is 53% of total assets and debt service is 52% of total revenue.

Based on these results, we observe that this forecast relies heavily on debt during the next 19 years, and we do not suggest greater borrowing. The significance of this finding comes from the fact that there is a tradeoff between rate increases and the level of borrowing. Higher rate increases allow more "pay-as-you-go" rate-funded capital funding (in lieu of debt), while higher levels of borrowing allow the rate impact to be pushed into future years. In this forecast, the recommended rate increases—6% per year after 2025—should not be ameliorated by more borrowing.

Figure 12-8 | Projected Debt-to-Total Assets Ratio and Debt Service as % of Total Revenue



12.4.2.5 Affordability

Since the inception of the Clean Water Act, the US Environmental Protection Agency (EPA) has provided some guidance on how to measure financial burdens. Called the residential indicator (RI), the EPA measure is the annual residential cost of utility service divided by the median household income (MHI) of the relevant service area. An RI of 2.0% or higher indicates a "high burden" according to the EPA standard for sewer utilities.

The median household income for Kitsap County is estimated to be $103,593 as of 2024. This is based on a survey from the Census Bureau 2023 American Community Survey plus one year of inflation.

Table 12-6 presents an average single-family sewer bill with projected annual rate increases for the forecast period, tested against the affordability threshold. We assumed that median household income increases at the same rate as general inflation, which after 2023 is 3.0% per year. Applying the 2.0% test, Kitsap County's sewer rates are forecasted to remain within the EPA affordability range through 2042. Note that the median income benchmark does not measure the impact on low-income households; the forecasted rates could be a significant burden on households at the lowest income levels.

Table 12-6 | Affordability Table

Year	Inflation	Median HH Income	Projected Monthly Bill	Projected Annual Bill	% of Median HH Income
2023		$99,609	$92.24	$1,107	1.11%
2024	4.00%	$103,593	$98.06	$1,177	1.14%
2025	3.00%	$106,701	$104.25	$1,251	1.17%
2026	3.00%	$109,902	$110.51	$1,326	1.21%
2027	3.00%	$113,199	$117.14	$1,406	1.24%
2028	3.00%	$116,595	$124.17	$1,490	1.28%
2029	3.00%	$120,093	$131.62	$1,579	1.32%
2030	3.00%	$123,696	$139.52	$1,674	1.35%
2031	3.00%	$127,407	$147.89	$1,775	1.39%
2032	3.00%	$131,229	$156.76	$1,881	1.43%
2033	3.00%	$135,166	$166.17	$1,994	1.48%

Year	Inflation	Median HH Income	Projected Monthly Bill	Projected Annual Bill	% of Median HH Income
2034	3.00%	$139,221	$176.14	$2,114	1.52%
2035	3.00%	$143,397	$186.71	$2,241	1.56%
2036	3.00%	$147,699	$197.91	$2,375	1.61%
2037	3.00%	$152,130	$209.78	$2,517	1.65%
2038	3.00%	$156,694	$222.37	$2,668	1.70%
2039	3.00%	$161,395	$235.71	$2,829	1.75%
2040	3.00%	$166,237	$249.85	$2,998	1.80%
2041	3.00%	$171,224	$264.84	$3,178	1.86%
2042	3.00%	$176,361	$280.73	$3,369	1.91%

12.5 Basin-Specific Revenue Requirement Forecasts

While the previous section discussed the overall financial obligations of the County's sewer utility, this section focuses on the obligations as allocated to individual basins. Because the County provides system-wide rates rather than area-specific rates, all customers share the same level of support for funding the Countywide sewer utility. The capital planning is performed for individual basins, but the funding of capital projects—including all debt obligations—and the subsequent rate changes are applied to the County sewer utility as a whole, not for individual basins.

However, this financial plan is one chapter within a set of larger General Sewer Plan Updates documents, and those documents are specific to each basin. In order to meet the Department of Ecology requirements for the planning documents, this section provides information about costs and revenues as they are allocated for each of the four basins: Central Kitsap, Manchester, Suquamish, and Kingston.

12.5.1 Allocating Costs Across Basins

As part of the financial forecast, the County provided an estimated number of Residential Billing Equivalents served by each basin. A Residential Billing Equivalent is used as a metric to estimate the proportion of revenue each basin generates and is based on how much a non-single family residential customer pays compared to a residential customer. For example, based on the County's current billing structure, a multi-family customer bill is approximately 80% of a single-family bill and would be treated as 0.8 Residential Billing Equivalent. Of the approximately 28,000 equivalents, the Central Kitsap area serves the vast majority of customers, representing 89.5% of the revenue. Accordingly, we allocated 89.5% of the overall costs to the Central Kitsap Basin. The same approach is taken to the other basins—the cost of O&M, capital, debt service, and required reserves are allocated in proportion to each basin's share of the system-wide total Residential Billing Equivalents. The Residential Billing Equivalents and resulting allocation percentages are shown in **Table 12-7**.

Table 12-7 | Allocation to Basins

Basin	Residential Billing Equivalents	Percentage
Central Kitsap	25,011	89.46%
Manchester	1,026	3.67%
Suquamish	970	3.47%
Kingston	950	3.40%
Total	**27,957**	**100%**

12.5.2 Results by Basin

The allocation of the revenue requirement to individual basins is shown in **Table 12-8**. For simplicity in presentation, we show the allocated revenue requirement only for the years 2025 and 2030, but the same percentage allocations can be applied to any of the forecast years.

Table 12-8 | Projected Revenue Requirement by Basin – 2025 and 2030

	Total	Central Kitsap	Manchester	Suquamish	Kingston
Allocation Percentage		89.46%	3.67%	3.47%	3.40%
2025					
Revenues					
Rate Revenue after Rate Increases	$30,005,499	$26,843,636	$1,101,178	$1,041,075	$1,019,610
Non-Rate Revenue	2,479,539	2,218,255	90,997	86,030	84,257
Total Revenue	**$32,485,038**	**$29,061,255**	**$1,192,175**	**$1,127,105**	**1,103,866**
Requirements					
Cash Operating Expenses	$16,403,199	$14,674,694	$601,985	$569,128	$557,393
Existing Debt Service	5,114,100	4,575,196	187,683	177,440	173,781
New Debt Service	2,802,218	2,506,931	102,839	97,226	95,221
Rate Revenue Available for Capital	8,165,521	7,305,070	299,668	283,312	277,471
Total Requirements	**$32,485,038**	**$29,061,891**	**$1,192,175**	**$1,127,105**	**$1,103,866**
2030					
Revenues					
Rate Revenue after Rate Increases	$41,168,068	$36,829,937	$1,510,836	$1,428,373	$1,398,922
Non-Rate Revenue	2,291,740	2,050,245	84,105	79,515	77,875
Total Revenue	**$43,459,808**	**$38,880,182**	**$1,594,941**	**$1,507,888**	**$1,476,797**
Requirements					
Cash Operating Expenses	$19,681,630	$17,607,656	$722,300	$682,877	$668,797
Existing Debt Service	4,946,317	4,425,094	181,526	171,618	168,080
New Debt Service	15,786,416	14,122,905	579,349	547,728	536,434
Rate Revenue Available for Capital	3,045,444	2,274,527	111,765	105,665	103,486
Total Requirements	**$43,459,808**	**$38,880,182**	**$1,594,941**	**$1,507,888**	**$1,476,797**

The sewer rate increases needed to support the above revenue requirements are the same for all four basins: 6.31% in 2025 and 6% per year through the remaining forecast period. Similarly, the projected debt service coverage is the same for all basins, as are the assumed policies for cash reserves. While the CIP is differentiated by basin, the debt obligations that are needed to fund the capital projects are all incurred at the countywide level, and all financial obligations apply to the County sewer utility as a whole, not to individual basins.