



KITSAP COUNTY

KINGSTON GENERAL SEWER PLAN UPDATE

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PREPARED BY:

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Point of Contact: Erika Schuyler, PE
600 University Street, Suite 300
Seattle, WA 98101
p: 206.462.7030
e: erika.schuyler@consoreng.com

PREPARED FOR:

Kitsap County

Sewer Utility Division of Public Works
Department
507 Austin Avenue
Port Orchard, WA 98366

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 Kingston General Sewer Plan Update (Plan) provides a road map for the Kingston 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 Local 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 Sewer 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 Sewer Plan have been reviewed to confirm alignment with the 2044 planning horizon of the Comprehensive Plan.

This Plan is also aligned with the County's *Water as a Resource* policy, adopted in 2009 and reaffirmed in 2016. One of the aims of *Water as a Resource* policy is to 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 Kingston wastewater system:

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

- **Section 3: Population, Load, and Flow Projections** estimates the current sewer system population, analyzes the impact of projected population growth, and estimates future wastewater flows and loads within the Kingston 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 Plant Existing Conditions** evaluates existing conditions of the Kingston 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 Kingston 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 Kingston 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 (O&M) 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 Kingston 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 Plan 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

Section	Section Description	Location in Plan
3.d.i	Boundaries. The boundary lines of the municipality or special district to be sewerred, 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
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 O&M 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 (FWPCA) as amended.	Section 4
3.n	A statement regarding compliance with the State Environmental Policy Act (SEPA) and the National Environmental Policy Act, if applicable.	Section 4

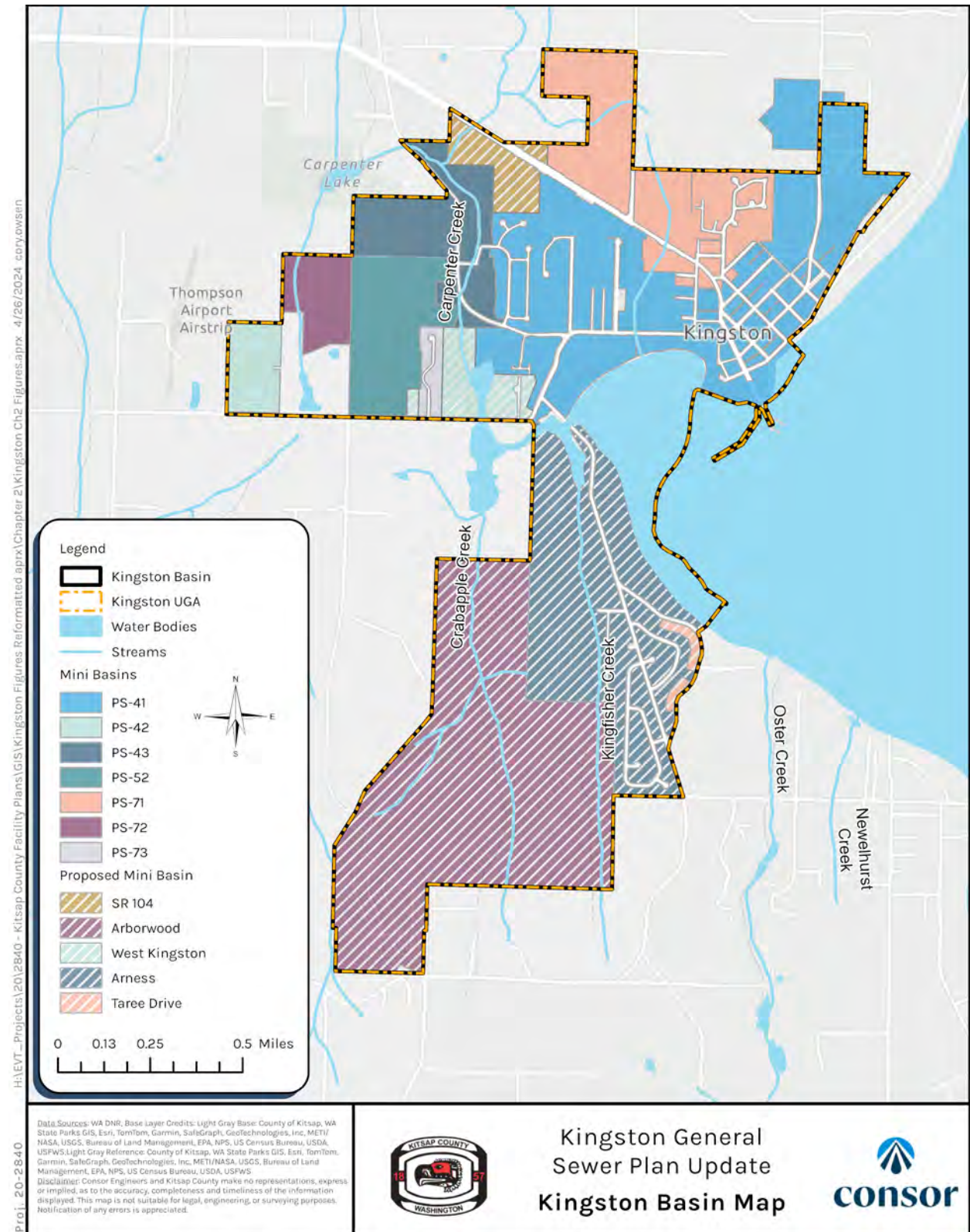
ES.2 Service Area Characterization

The County provides sewer service within the Kingston basin. The Kingston basin map is shown in **Figure ES-1**. The Kingston basin spans approximately 1,235 acres and is bounded by rural residential properties on

three sides and Puget Sounds to the east. The basin contains small, unnamed lakes and streams in addition to several parks and neighborhood developments.

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, is not allowed outside of the UGA with limited exceptions. The County owns and maintains the sewer collection system that provides service primarily to the northern portion of the Kingston UGA, except the Kingston WWTP which is located to the west of the UGA. The system includes approximately 57,400 feet of gravity pipe, 26,000 feet of force main pipe, and 7 pump stations. All sewer flows within the basin are conveyed and treated at the Kingston WWTP.

Figure ES-1 | Kingston Basin Map



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Data Sources: WA DNR, Base Layer Credits: Light Gray Base: County of Kitsap, WA State Parks GIS, Esri, TomTom, Garmin, SafeGraph, Geotechnologies, Inc, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau, USDA, USFWS; Light Gray Reference: County of Kitsap, WA State Parks GIS, Esri, TomTom, Garmin, SafeGraph, Geotechnologies, Inc, METI/ NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau, USDA, USFWS
 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.



Kingston General
 Sewer Plan Update
 Kingston Basin Map



E.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 Kingston 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.

Growth is presumed to occur within the UGA according to the land use designations and zoning in the 2016 KCCP. This plan, at the time of writing, is in alignment with the KCCP effort and is able to support the growth strategies described therein. The sewered population growth rate is estimated to be 4.04 percent based on the Puget Sound Regional Council (PSRC) and Washington State Office of Financial Management (OFM) information. The total current and projected populations for the sewered areas in Kingston 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. The population projects presented in this General Sewer Plan Update are consistent with the Comprehensive Plan update.

Table ES-2 | Kingston Basin Current and Projected Sewered Population

Year	Sewered Population
2020	2,553
2028	3,929
2042	6,337
2044	6,681*

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 flows and loads at Kingston WWTP were evaluated from January 2018 through June 2020 and correlated to current population to develop per capita values. The existing and projected flows and loads for the Kingston 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 | Kingston WWTP Current and Projected Flows

Flow Event	2020	2028	2042
AAF (MGD)	0.11	0.17	0.27
MMWWF (MGD)	0.15	0.23	0.36
MMDWF (MGD)	0.12	0.18	0.29
PDF (MGD)	0.21	0.32	0.51
PHF (MGD)	0.57	0.87	1.41

Note:

MGD = million gallons per day

Table ES-4 | Kingston WWTP Current and Projected Loads

Parameter	2020			2028			2042		
	AA	MMWW	MMDW	AA	MMWW	MMDW	AA	MMWW	MMDW
BOD (ppd)	280	533	525	431	821	766	696	1,324	1,236
TSS (ppd)	285	429	378	438	660	550	707	1,064	887
TKN (ppd)	54	65	72	84	101	111	135	162	179

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 Kingston WWTP, which has been issued NPDES Permit No. WA0032077. The permit went into effect in 2015, was set to expire in 2020, 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 O&M requirements.

In addition, Ecology recently issued the first Puget Sound Nutrient General Permit (PSNGP), effective as of Jan. 1, 2022. The Kingston WWTP is classified as a small Total Inorganic Nitrogen (TIN) load plant and is required to implement nutrient monitoring and reporting, develop a nutrient optimization plan, prepare and submit an approvable all known, available, and reasonable methods of prevention, control, and treatment (AKART) analysis. Evaluating compliance with the new PSNGP and developing options for anticipated future nutrient permit requirements is a key focus of the Kingston WWTP condition assessment and alternative analysis.

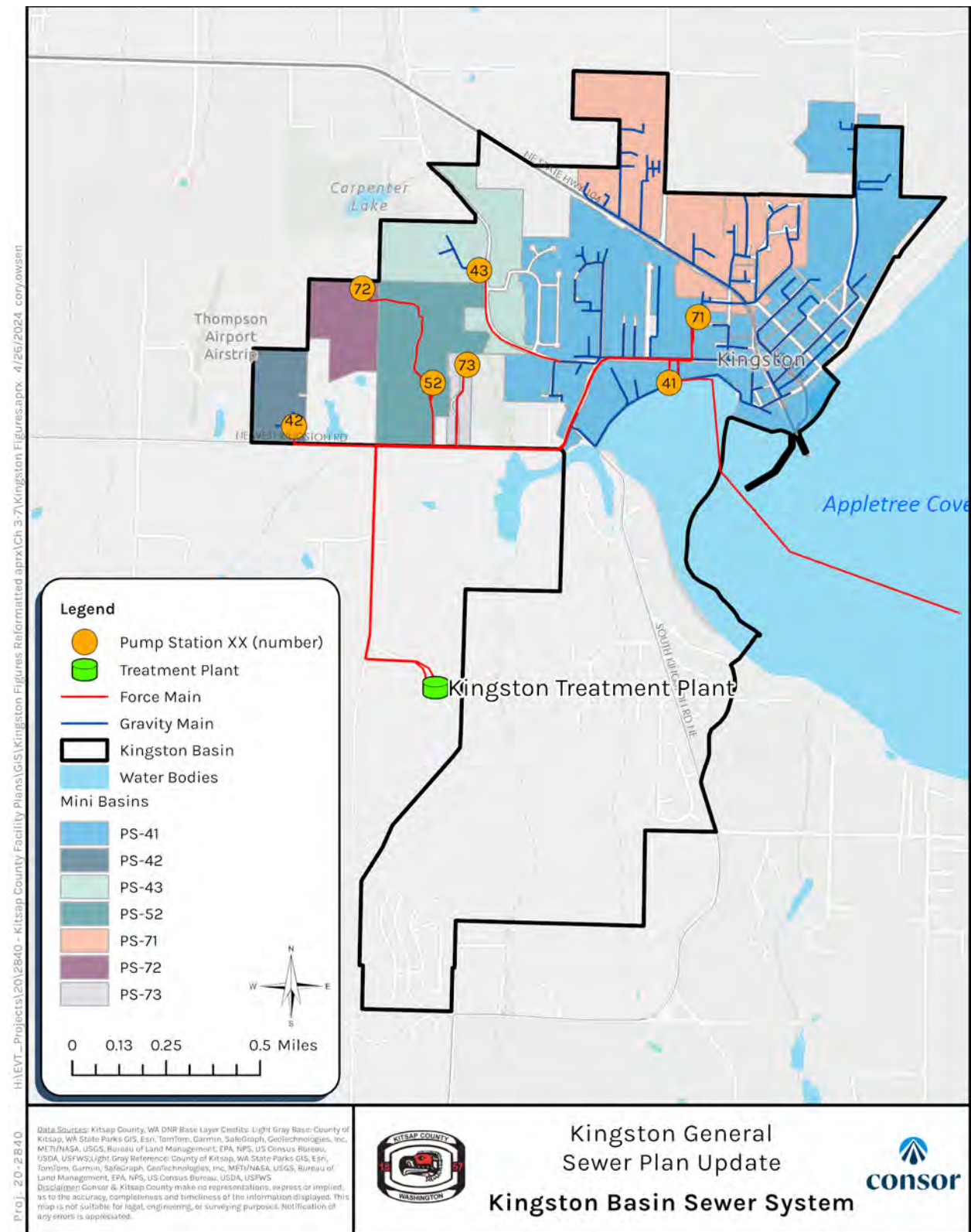
ES.5 Collection and Conveyance Existing Conditions

The Kingston basin collection and conveyance system is comprised of sewer assets owned and operated by the County within the northern portion of the Kingston UGA, except the Kingston WWTP which is located to the west of the UGA. The Kingston 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**.

Flows from the northern portion of the basin are routed through pump stations to the Kingston WWTP. Effluent from the WWTP is conveyed via an 18-inch diameter force main to Appletree Cove where it discharges. The Kingston basin currently contains seven mini basins: 41, 42, 43, 52, 71, 72, and 73. It is anticipated that sewer service will be eventually extended to cover the Kingston UGA.

There is approximately 57,400 feet of gravity main in the Kingston collection system. The County owns most of the pipes, which range in size from 6 inches to 12 inches in diameter. Approximately 1,000 feet of pipe are privately owned. There are approximately 26,000 feet of sewer force mains that convey pumped wastewater.

Figure ES-2 | Kingston Sewer System



There are seven pump stations within the Kingston sewer system: PS-41, PS-42, PS-43, PS-52, PS-71, PS-72, and PS-73. The firm capacity ranges from 20 gallons per minute (gpm) at PS-52 to 450 gpm at PS-71. 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 Kingston basin. Pump station capacity typically increases from about 100 gpm for satellite stations to about 350 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 Kingston Basin
Satellite	0	5
Relay	1	0
Regional	2-3	0
Critical	4+	2

An evaluation of the pump stations was conducted consisting of site visits and discussions with County staff. 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). 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 16, with one pump station rating higher than 10, five pump stations rated between five and 10, and one pump station rated below five.

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, the system is in good condition and none of the pipes in the Kingston basin are rated as moderate or severe condition.

Table ES-6 | Summary of Pipes OCI Scores

OCI Range	Length (ft)	Percentage of Total
0-20	-	0%
20-40	-	0%
40-60	-	0%
60-80	-	0%
80-99	3,600	6%
100	53,800	94%

ES.6 Wastewater Treatment Facilities Existing Conditions

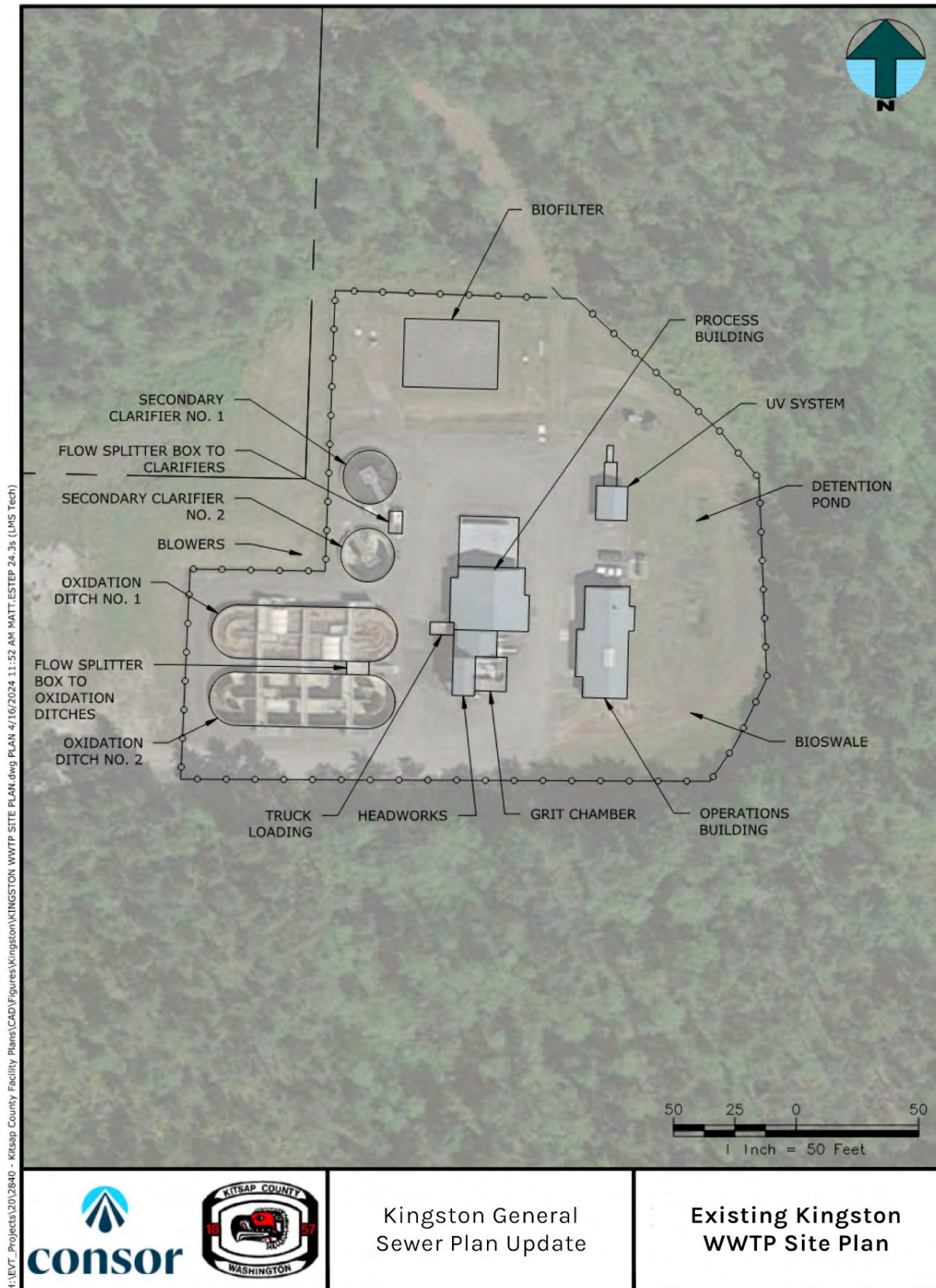
The Kingston WWTP was constructed in 2005, replacing a WWTP originally constructed in 1974. In 2006, the outfall to Appletree Cove was replaced and realigned. The Kingston WWTP is permitted to treat a maximum month design flow of 0.292 MGD. The plant is an oxidation ditch (extended aeration) type activated sludge facility. The Kingston WWTP site plan is shown in **Figure ES-3** with major structures and processes identified. The plant is located at the south end of Norman Road NE with undeveloped forested property on the east, south, and west sides, and rural residential properties to the north.

Plant processes are preliminary screening and grit removal, biological treatment in two oxidation ditches, two secondary clarifiers, and ultraviolet (UV) disinfection. Sludge removed from the secondary clarifiers is thickened with a gravity belt thickener (GBT) and sent to the County's Central Kitsap WWTP for further treatment and disposal. Treated effluent is discharged to the Appletree Cove of the Puget Sound in accordance with the NPDES Permit.

An evaluation of Kingston WWTP was conducted that consisted of a site review of equipment, facilities, processes, discussions with WWTP staff to understand operational issues, and analysis and modeling to determine capacity. Overall unit process Asset Health scores were developed, using the same method as the pump stations, to synthesize the condition and CoF. 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). All of the processes scored between 5 and 10, indicating fair to good overall condition.

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 existing Kingston WWTP unit processes. Model results indicated that all unit processes have sufficient hydraulic and biological capacity to handle existing and future flow and loads to meet current permit requirements.

Figure ES-3 | Existing Kingston WWTP Site Plan



Kingston General
Sewer Plan Update

Existing Kingston
WWTP Site Plan

ES.7 Collection and Conveyance System Analysis

The Kingston collection system was modeled using the Danish Hydraulic Institute’s (DHI’s) MIKE+ hydraulic and hydrologic (H/H) modeling platform to determine capacity deficiencies in the system. The projected population and increased rainfall due to climate change are the basis for establishing future system requirements. The model was developed using geographic information system (GIS) shapefiles, provided by the County, for the collection system, land use, contours, and soils in the Kingston basin. The model was calibrated to data from flow monitors installed in the collection system. The meters collected flow data from October 2020 through April of 2021. Results were compiled for the existing, 2042, and 2080 planning horizons using a 25-year 12-hour design storm.

Manholes, pipes, and pump stations were analyzed for deficiencies using the H/H 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, surcharged gravity pipes, and velocity exceeded pipes are included in **Table ES-7**. Detailed maps can be found in **Section 7**. The results indicate that the PHF exceeds the firm capacity of PS-41 and PS-71 in all three planning horizons. These are the two largest pump stations in the Kingston basin, and PS-41 collects flow from the other stations and pumps to PS-71.

Table ES-7 | Pipe and Manhole Capacity Criteria

Scenario	Surface Sewer Overflows (SSO)	Number of Pipes Surcharged (Either end)
2022	0	10
2042	0	10
2080	0	11

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 WWTP improvements for the 6-year and 20-year planning horizons. Minor maintenance, repairs, and direct replacements were not subject to a full alternatives analysis due to the relatively simple nature of replacements or expansions. The recommended improvements follow.

Preliminary Treatment

All components (mechanical equipment, piping, and structures) of the preliminary treatment system are in fair or good condition and have adequate capacity through the 2042 planning period, therefore no improvements are required.

Secondary Treatment

The secondary treatment system was originally constructed in 2005 and upgrades to equipment and instrumentation in oxidation ditches were completed in 2020. The secondary clarifiers are generally in good

condition. The only recommended improvement is to install ammonia and nitrate probes in the oxidation ditch to provide direct monitoring of nitrogen removal.

Disinfection

The UV equipment was installed in 2015 and is an older, basic model. Additional control and monitoring capabilities beyond what the current basic controller can offer is desired by the plant staff and will improve energy efficiency. Replacing the UV system with a Trojan UV3000Plus unit and controller is recommended but is not urgent, as the current unit works consistently and has adequate capacity.

Solids Treatment

The GBT was installed in 2005. It was observed that the GBT room had a very strong odor and operation staff confirmed this is common, indicating that the heating, ventilating, and air conditioning (HVAC) system may be underperforming. This may contribute to a more corrosive environment in the room. Maintenance and investigation of the HVAC system in the GBT room is recommended to address this issue before it creates bigger problems. Other solids treatment equipment works well and has adequate capacity, so additional upgrades are not needed.

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

The odor control system was not functioning during the condition assessment visit but has since been repaired. Strong odor and corrosion were noted in the GBT room during the condition assessment. The odor should be reduced now that the odor control system is running again, but the corrosion may indicate that the HVAC system is not providing enough ventilation. Further investigation of the HVAC system is recommended to determine if upgrades are needed.

Electrical and Power Distribution System

Replacement of obsolete adjustable frequency drives (AFDs), programmable logic controllers (PLCs) and operator interface terminals (OITs) programs verification, 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 technical memoranda* (HDR, 2022, **Appendix F**) 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 non-potable purposes, such as irrigation, toilet flushing, reduces the stress on area groundwater and supports sustainable management of that limited resource. Prior County planning has resulted in the definition of a potential recycled water project. As described in the *Kingston Recycled Water Facility Plan* (Brown and Caldwell, 2020, **Appendix I**),

the two applications deemed most feasible for recycled water use if it were produced at the Kingston WWTP are:

- Summer-time irrigation at the White Horse Golf Course (WHGC).
- Winter-time indirect groundwater recharge in an area north of WHGC, at North Kitsap Heritage Park.

The envisioned recycled water project would replace 29 million gallons (MG) per year of groundwater supply provided by the Kitsap Public Utility District (KPUD) for irrigation purposes at WHGC and infiltrate approximately 107 MG per year into the shallow aquifer that provides baseflow to Grovers Creek and its tributaries. Through this bolstering of groundwater levels, the baseflow in Grovers Creek could increase by up to 0.5 cubic feet per second, potentially providing 328 acre-feet per year to serve as an offset to consumptive impacts of new permit-exempt domestic groundwater withdrawals.

In addition to the projects described in the *Kingston Recycled Water Facility Plan*, a cursory review of other potential uses of recycled water was conducted. The County coordinated with water providers and potential stakeholders to determine if there are opportunities for irrigation use in the vicinity of the Kingston WWTP. Entities contacted were:

- Kitsap Public Utility District. KPUD has actively researched recycled water opportunities, having implemented a system in Port Gamble and considering integration into future housing developments. Additional coordination with that development group would be required to determine the level of feasibility of implementing such uses.
- Kitsap County Parks Department. A discussion was held but it was determined that there are no sites where recycled water use would be cost-effective at this time.

To produce Class A reclaimed water for the proposed irrigation and infiltration uses, upgrades to Kingston WWTP are required. *Kingston Recycled Water Facility Plan* presents a conceptual layout and sizing of facilities to produce 0.7 MGD of recycled water. The required upgrades include upgrades to the oxidation ditches, a new secondary effluent equalization tank, a tertiary filtration system, a UV and chlorine disinfection system, a recycled water pump station, and a recycled water distribution pipeline.

The capital investment to implement recycled water can be significant and is greater than what can be realistically recouped through recycled water rates. The County should seek low-interest loans or grant money from the state or federal government to support reuse implementation. Additionally, the County should continue stakeholder and public outreach and engagement and development of recycled water policies and procedures to support the program.

ES. 10 Operations and Maintenance

Section 10 includes a summary of the O&M programs for the collection and conveyance system, and the Kingston WWTP. A review of state and federal requirements that impact the County's O&M program are also included in **Section 10**.

The 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 O&M manual.

A staffing analysis was conducted for the collection and conveyance system and Kingston WWTP and determined that staffing levels and certifications are appropriate and adequate for current operations. No additional staff is expected to be required through the 20-year planning period.

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 assessment to improve the consistency of sewer inspecting rating.
- 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 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**, **Table ES-9**, and **Table ES-10**. A preliminary implementation timeline of the CIP is provided in **Section 11**. There are no treatment projects proposed for the 6-year planning horizon. If funding becomes available, two proposed CIP projects, one collection and conveyance and one treatment, should be considered in the 6-year CIP.

Table ES-8 | 6-Year Kingston Collection and Conveyance Capital Improvement Projects

CIP No.	Item	Total Project Cost
CIP-K-CC-CAP-1	Replace PS-41 and Forcemain	\$3,700,000
Total		\$3,700,000

Table ES-9 | 20-Year Kingston Collection and Conveyance Capital Improvement Projects

CIP No.	Item	Total Project Cost
CIP-K-CC-CAP-2 ¹	Upgrade PS-71 and Replace Forcemain	\$7,400,000
CIP-K-CC-DEV-4	Arness Pump Station and Conveyance	Expected to be paid for by developers
CIP-K-CC-DEV-5	Highway 104 Pump Station and Conveyance	Expected to be paid for by developers
CIP-K-CC-DEV-6	Taree Pump Station and Conveyance	Expected to be paid for by developers

CIP No.	Item	Total Project Cost
CIP-K-CC-DEV-7	Extend Gravity Sewer Flowing to PS-41	Expected to be paid for by developers
CIP-K-CC-DEV-8	Extend Gravity Sewer Flowing to PS-43	Expected to be paid for by developers
CIP-K-CC-DEV-9	Extend Gravity Sewers Flowing to Arborwood	Expected to be paid for by developers
CIP-K-CC-OM-10 ¹	Annual Pipe Replacement	\$14,000,000
Total		\$21,400,000

Note:

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

Table ES-10 | 20-Year Kingston WWTP Capital Improvement Projects

CIP No.	Item	Total Project Cost
CIP-K-WWTP-OB-1 ¹	Replace UV System	\$880,000
CIP-K-WWTP-REG-2 ²	Nitrogen Optimization Improvements	\$99,000
CIP-K-WWTP-REG-3	Reclaimed Water Improvements	\$13,660,000
CIP-K-WWTP-OB-4	Replace Clarifier Drives	\$480,000
Total		\$15,120,000

Notes:

1. If funding becomes available, this project should be considered in the 6-year CIP.
2. 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.

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 Kingston 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.

Table 11-5 | Recommended Capital Improvement Program Summary

Kingston Basin CIP Plan																									
		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-K-CC-CAP-1	20	Replace PS-41 and Forcemain	\$ 3,700,000				\$ 1,850,000	\$ 1,850,000																
	20 CIP-K-CC-OM-10	20	Annual Pipe Replacement	\$ 14,000,000							\$ 1,000,000	\$ 1,000,000	\$ 1,000,000	\$ 1,000,000	\$ 1,000,000	\$ 1,000,000	\$ 1,000,000	\$ 1,000,000	\$ 1,000,000	\$ 1,000,000	\$ 1,000,000	\$ 1,000,000	\$ 1,000,000	\$ 1,000,000	
	20 CIP-K-CC-CAP-2	25	Upgrade PS-71 and Replace Forcemain*	\$ 7,400,000							\$ 3,700,000	\$ 3,700,000													
	20 CIP-K-WWTP-OB-1	7.2	Replace UV System*	\$ 800,000										\$ 880,000											
	20 CIP-K-WWTP-REG-2	6.5	Nitrogen Optimization Improvements	\$ 99,000											\$ 99,000										
	20 CIP-K-WWTP-OB-4	6.5	Replace Clarifier Drives	\$ 480,000																	\$ 480,000				
	20 CIP-K-WWTP-REG-3	6.6	Class A Reclaimed Water Improvements	\$ 13,661,000				\$ 1,850,000	\$ 1,850,000		\$ 4,700,000	\$ 4,700,000	\$ 1,000,000	\$ 1,880,000	\$ 1,099,000	\$ 1,000,000	\$ 1,000,000	\$ 1,000,000	\$ 1,000,000	\$ 1,000,000	\$ 1,480,000	\$ 1,000,000	\$ 1,000,000	\$ 1,000,000	\$ 13,661,000
			Total Project Cost (2023)	\$ 40,220,000	\$ -	\$ -	\$ -	\$ 1,850,000	\$ 1,850,000	\$ -	\$ 4,700,000	\$ 4,700,000	\$ 1,000,000	\$ 1,880,000	\$ 1,099,000	\$ 1,000,000	\$ 1,000,000	\$ 1,000,000	\$ 1,000,000	\$ 1,480,000	\$ 1,000,000	\$ 1,000,000	\$ 1,000,000	\$ 14,661,000	
			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	\$ -	\$ -	\$ -	\$ 2,416,781	\$ 2,537,620	\$ -	\$ 7,107,736	\$ 7,463,123	\$ 1,667,293	\$ 3,291,237	\$ 2,020,172	\$ 1,930,101	\$ 2,026,606	\$ 2,127,936	\$ 2,234,333	\$ 3,472,153	\$ 2,463,352	\$ 2,586,519	\$ 2,715,845	\$ 41,807,858		

