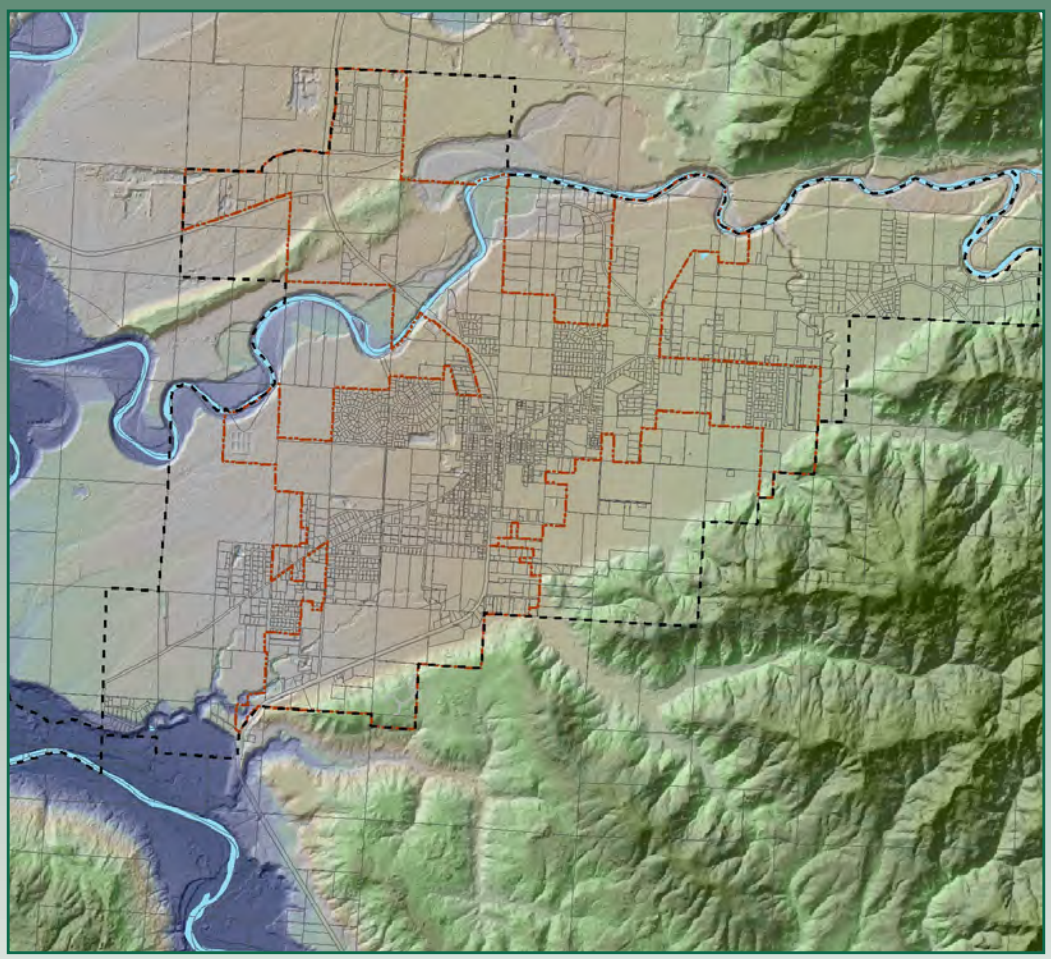
CITY OF FORKS

CLALLAM COUNTY, WASHINGTON

GENERAL SEWER/WASTEWATER FACILITY PLAN



G&O #13543
FEBRUARY 2016

Gray & Osborne, Inc.
CONSULTING ENGINEERS

CITY OF FORKS

CLALLAM COUNTY **WASHINGTON**

GENERAL SEWER/WASTEWATER FACILITY PLAN

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STATE OF WASHINGTON
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REGISTERED
PROFESSIONAL ENGINEER
10/17/2014

G&O #13543
FEBRUARY 2016

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CONSULTING ENGINEERS

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GENERAL

This *General Sewer/Wastewater Facility Plan* (2014 Plan) for the City of Forks was prepared to address the City's planning needs for wastewater collection, transmission, treatment, and disposal for the 20-year planning period (2014 – 2034). The 2014 Plan provides proposed conceptual designs, cost estimates, schedule, and financing plan for recommended major facility improvements. The projects described in the 2014 Plan are consistent with Washington State regulations relating to the prevention and control of discharge of pollutants into waters of the state, anti-degradation of existing and future beneficial uses of ground waters, and anti-degradation of surface waters.

The City owns and operates a municipal sewage collection and treatment system that serves a utility local improvement district (ULID located in the center of the City. The remainder of the City is swerved by individual septic systems. The collection and treatment system includes one pump station with associated force main, approximately 4.7 miles of gravity sewer pipes, and a wastewater treatment facility (WWTF) that receives and treats all of the sewage from the ULID. Treated effluent is infiltrated to groundwater via eight infiltration basins located on the WWTF site.

Since the 2014 Plan is intended to be both a General Sewer Plan and a Wastewater Facilities Plan, the 2014 Plan evaluates both the wastewater collection system and the wastewater treatment system in detail. This evaluation includes collection and treatment system modeling and analysis and development of a recommended capital improvement plan with project cost estimates and implementation schedule.

SERVICE AREA POPULATION

The projected future City population is based on a linear annual growth rate of 1.0 percent in concurrence with the planned Growth Management Act update, 2016 to 2036. Projected population in the current sewer service area is assumed to grow at the same rate as the City. Table E-1 provides the population projections through the year 2034 for the City and the existing sewer service area.

TABLE E-1

City of Forks Sewer Service Area Projected Population 2014 to 2034

Year	Projected City Population	Projected Annual Growth Rate(1)	Projected Sewer Service Area Population (ULID)(2)
2014	3,580	1.0%	1,109
2015	3,616	1.0%	1,120
2016	3,653	1.0%	1,131
2017	3,689	1.0%	1,143
2018	3,726	1.0%	1,154
2019	3,763	1.0%	1,166
2024	3,956	1.0%	1,225
2029	4,157	1.0%	1,297
2034	4,369	1.0%	1,363

(1) Growth projections based on a linear growth rate of 1.0 percent in concurrence with Growth Management Act update, 2016 to 2036.

Table E-2 provides an estimate of the number of sewer service connections by customer class in 2013, based on billing records obtained from the City's Finance Department.

TABLE E-2

2013 City of Forks Sewer Service Connections by Customer Class

	2013
Single-Family Residential	321
Multi-family Residential	26
Commercial	100
TOTAL	**446**

(1) Average number of active connections by customer class estimated by billing data provided by the City.

(2) Multi-family residential connections do not reflect the number of units or population served.

SERVICE AREA EXPANSIONS

To limit reliance on septic systems within the City limits, three currently non-sewered areas have been identified by the City for potential expansion of the sewer service area. Current and projected future ERUs in these areas were developed through a count of the lots within these areas and the associated zoning. The number ERUs within the expansion areas is projected to increase at the same rate of growth as the general population with the

City of Forks, 1 percent per year. Current and future ERU within the expansion areas are presented in Table E-3.

TABLE E-3

Sewer Expansion Areas Current and Projected ERU, 2014 to 2034

Wastewater Customer Types and Flows			
Zone	**2014 ERU**	**2024 ERU**	**2034 ERU**
Robin Hood Expansion Zone	236	260	288
Bogachiel Way Expansion Zone	214	236	261
Trillium Avenue Expansion Zone	137	151	167
Total	**587**	**647**	**716**

PROJECTED WASTEWATER ERUS, FLOWS AND LOADINGS

Current wastewater flows and loadings measured at the WWTF were used in conjunction with projected population, water consumption records, and ERU (Equivalent Residential Unit) data to estimate the projected wastewater flows and loadings for the 20-year planning period.

The current and projected 10-year, 20-year wastewater ERUs and flows are shown in Table E-4. A summary of projected BOD_5, TSS and TKN loads to the WWTF are presented in Table E-5.

TABLE E-4

Current and Projected Wastewater ERUs and Flows

Wastewater Customer Types and Flows			
Zone	**2014 ERU**	**2024 ERU**	**2034 ERU**
Existing Sewer Service Area	666	739	812
Sewer Expansion Areas[(1)]	-	205	716
Total	**666**	**944**	**1,528**
Design Flow			
Total Base Flow	0.085	0.120	0.194
Average Annual Flow	0.099	0.139	0.225
Maximum Month	0.125	0.176	0.285
Permitted Maximum Month	0.5	0.5	0.5
Peak Day	0.242	.0342	0.553
Peak Hour	0.427	0.513	0.976

(1) Connections from the Sewer Expansion Areas assumed to begin in 2020.

TABLE E-5

Current and Projected WWTF Loadings

ERUs and Loadings	NPDES Permit	2014	2024	2034
Total ERUs	NA	666	941	1,528
Annual Average BOD_5 (lb/d)	NA	300	423	688
Maximum Month BOD_5 (lb/d)	434	374	529	860
Annual Average TSS (lb/d)	NA	201	282	458
Maximum Month TSS (lb/d)	434	297	418	678
Annual Average TKN (lb/d)	NA	46	65	105
Maximum Month TKN (lb/d)	NA	58	82	133

NA – Not Applicable

As shown in Table E-5, the projected year 2034 maximum month BOD_5 and TSS loadings of 860 and 678 lb/d respectively is in excess of the permitted capacities of 434 lb/d.

EVALUATION OF EXISTING COLLECTION SYSTEM

The City of Forks's existing sewer collection system was determined to have adequate capacity, based on pipe diameter and pipe slope provided in the collection system as-built drawings, to convey the projected 2034 flows to the treatment plant.

The estimated Inflow and infiltration into the collection system was determined to be below EPA guidelines used to determine excessive inflow and infiltration. No projects to reduce inflow and infiltration are recommended at this time.

It is recommended that the Mill Creek lift station be upgraded with new pumps, pump retrieval system and control panel. The lift station pumps are beyond their anticipated life span, are in poor condition and are no longer reliable.

Projects associated with expansion areas are not recommended in the Capital Improvement Projects for this plan. It is assumed that construction of the collection systems for these areas will not begin within the 6-year capital improvement projects window.

Improvement projects recommended for the City of Forks collection system are summarized in Table E-6.

TABLE E-6

Collection System Improvement Projects Summary

Project	Project Cost (2014 Dollars)
Mill Creek Pump Station Improvements(1)	$80,000
Robin Hood East Collection System(2)	$ 1,630,000
Robin Hood West Collection System(2)	$ 1,496,000
Bogachiel East Collection System(2)	$ 1,374,000
Bogachiel West Collection System(2) (3)	$ 3,069,000
Trillium North Collection System(2)	$ 1,344,000
Trillium South Collection System(2)	$ 920,000

(1) Recommend in Capital Improvement Projects.
(2) Not Recommended in Capital Improvement Projects
(3) Includes Cost of associated new pump station and force main.

EVALUATION OF EXISTING WATER RECLAMATION FACILITY

Evaluation of the water reclamation facility addressed the condition of existing equipment, capacity to treat projected flow and loadings, compliance with current permit limits, solids handling to produce Class A biosolids, standby power to meet reliability requirements, facilities for operations staff and plant maintenance, and other needs to maintain reliability and redundancy.

It was determined that the projected 2034 flows will not exceed the plant design criteria during the planning period. Loading to the plant exceeds current permit limits, but an analysis of the unit processes within the plant concludes that with some modifications,

increased aeration and mixing in the aerated lagoon, adequate treatment capacity exists to treat the increased load through the planning period. Other WWTF deficiencies were identified and include the following:

- Deteriorated equipment.
- Lack of clarifier redundancy to meet reliability standards.
- Sludge handling system limitations preventing production of Class B biosolids.
- Lack of fixed emergency generator capacity.
- Inadequate separation between city and non-potable water system.

At the request of the City, an analysis to determine the viability of a septage receiving/treatment facility was included in the plan. The analysis determined that the necessary rates to pay for the facility's construction, operation and maintenance would not be competitive with other facilities.

RECOMMENDED CAPITAL IMPROVEMENT PLAN AND FINANCING

The recommended sewer and WWTF improvements will correct existing deficiencies within the City's collection system and at the WWTF to increase capacity to handle future flows and to improve treatment performance and reliability to meet the City's effluent permit limits. The recommended capital improvements, including estimated project costs, are listed in Table E-7.

TABLE E-7

Recommended Capital Improvement Projects

Collection System Improvements	**2014 Project Cost**
Mill Creek Pump Station	$80,000
Water Reclamation Facility Improvements	**2014 Project Cost**
Headworks Improvements	$262,000
Aerated Lagoon Improvements	$520,000
Clarifier No. 2, RAS/WAS Pump Station No. 2, Scum Pump Station	$915,000
RAS/WAS Pump Station No. 1	$136,000
Digester	$814,000
In-Plant Pump Station Improvements	$80,000
Electrical Improvements / Backup Generator	$320,000
Lab & Maintenance Building Improvements	$50,000
Air-Gap Non-Potable Water System Improvements	$80,000
Total	**$3,257,000**

CHAPTER 1

INTRODUCTION

PURPOSE

This *General Sewer/Wastewater Facility Plan* (2014 Plan) for the City of Forks was prepared to address the City's planning needs for wastewater collection, transmission, treatment, and disposal for the 20-year planning period. This plan was prepared in accordance with the provisions of the Revised Code of Washington (RCW), Section 90.48, *Water Pollution Control*, Washington Administrative Code (WAC) Section 173-240-050, *General Sewer Plan*, and WAC 173-240-060, *Engineering Report.* Development of the plan has been coordinated with the 2007 update of the 1995 *Clallam County City of Forks Urban Growth Area Comprehensive Plan*.

The 2014 Plan provides proposed conceptual designs, cost estimates, schedule, and financing plan for recommended major facility improvements. A State Environmental Policy Act (SEPA) checklist is provided in Appendix A. The projects described in the 2014 Plan are consistent with Washington State regulations relating to the prevention and control of discharge of pollutants into waters of the state, anti-degradation of existing and future beneficial uses of groundwater, and anti-degradation of surface water.

OVERVIEW

The City of Forks is situated on the northwestern corner of the Olympic Peninsula in Clallam County, approximately 100 miles northwest of Seattle. The location of Forks is shown on Figure 1-1. The City covers approximately 2,276 acres and has a population of approximately 3,545.

The City owns and operates a municipal sewage collection and treatment system that serves a utility local improvement district (ULID) located in the center of the City. The remainder of the City is served by individual septic systems. The collection and treatment system includes one pump station with associated force main, approximately 4.7 miles of gravity sewer pipes, and a wastewater treatment facility (WWTF) that receives and treats all of the sewage from the ULID. Treated effluent is infiltrated to groundwater via eight infiltration basins located on the WWTF site.

The City is governed by a Mayor and City Council. The Public Works Director serves as the Sewer System Manager. The City's mailing address is:

City of Forks
500 East Division Street
Forks, Washington 98331

The physical address for the WWTF is:

Forks Wastewater Treatment Facility
10 Nottingham Way
Forks, Washington 98331

HISTORY AND DEVELOPMENT OF THE SEWER SYSTEM

The City of Forks' wastewater collection and treatment system was originally constructed in the mid-1980s. Prior to construction of the collection and treatment system, sewage was discharged to individual septic tanks and drainfields located on the individual properties. In 1986, the City constructed the existing wastewater treatment facility and sewer collection system to eliminate failing septic systems. The existing collection system only serves the City's central core. The outlying portions of the City continue to be served by individual septic systems. The City's sewer system has not been significantly expanded since its original construction.

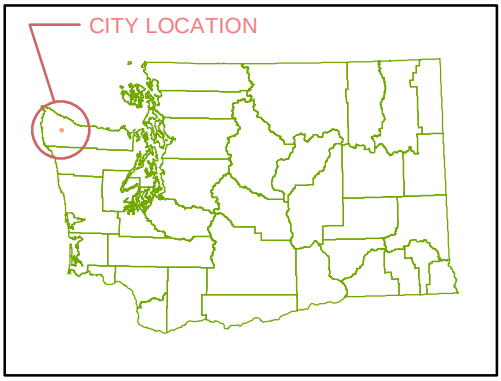
The treatment facility originally consisted of a headworks structure, a single earthen aeration basin lined with a PVC liner, a concrete secondary sedimentation tank, and eight earthen rapid infiltration basins, which are used to infiltrate treated effluent to groundwater. Residual solids were originally land applied on two spray fields located on the WWTF site. In 2002, due to overloading, the City discontinued the application of biosolids on the two spay fields and entered into an interlocal agreement with the City of Port Angeles and began hauling all of their biosolids to the Port Angeles WWTF for further treatment and land application. In 2004, the City installed a FKC lime stabilization and heated screw press system and began producing Class A biosolids, which are land applied on City parks and at the local airport.

Since the WWTF effluent is not discharged to surface water, the WWTF is not permitted under the National Pollutant Discharge Elimination System. The WWTF does, however, have a State Waste Discharge Permit for discharge of treated effluent to groundwater via rapid infiltration basins.

PLAN ELEMENTS

Since the 2014 Plan is intended to be both a General Sewer Plan and a Wastewater Facilities Plan, the 2014 Plan evaluates both the wastewater collection system and the wastewater treatment system in detail. This evaluation includes collection and treatment system modeling and analysis, and a capital improvement plan with financial analysis and project implementation schedule. The 2014 Plan addresses the following project elements:

- Background Data
- Service Area Characteristics



LEGEND:

CITY LIMITS

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CITY OF FORKS

GENERAL SEWER/WASTEWATER FACILITY PLAN
FIGURE 1-1
LOCATION MAP

Gray & Osborne, Inc.

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- Population and Land Use
- Regulatory Criteria
- Projected Future Flow and Loadings to the WWTF
- Pertinent Performance and Design Criteria for System Facilities
- Evaluation of the WWTF
- Computer Model and Evaluation of Wastewater Collection System
- Evaluation of Water Reuse Alternatives
- Identification of System Improvements with Cost Estimates
- Financing Plan for Capital Improvement Plan

RELATED PLANNING DOCUMENTS

The following documents were consulted in the preparation of this General Sewer/Wastewater Facilities Plan:

GROWTH MANAGEMENT ACT (GMA)-RELATED PLANS, POLICIES AND DEVELOPMENT REGULATIONS

City of Forks Urban Growth Area Comprehensive Plan, Clallam County, 1995 (updated 2007)

The City of Forks Urban Growth Area Comprehensive Plan, which was prepared by Clallam County, was originally adopted in 1995 and was updated in 2007. This document was developed to comply with the Growth Management Act (GMA), and is consistent with the planning policies of Clallam County. The Comprehensive Plan addresses land use, transportation, community character, parks, recreation and open space, cultural and historic resources, environmental resources, economic development, capital facilities and utilities, and annexation. The Comprehensive Plan for the City of Forks provides:

- Policies and recommendations to direct public and private decisions affecting future growth and development;

- A framework of goals and policies adaptable to the changing attitudes and resources of the region;

- A long-range vision, based on community values and goals, of how citizens want Forks to look and function in the future as well as guidance for achieving that vision; and

- Guidelines for making decisions on growth, land use, transportation, public facilities, and services, parks, and open space.

The existing Comprehensive Plan used an annual growth rate of 59 people per year for the City for 20-year growth projections. The actual growth rate tends to fluctuate based on available employment in the timber industry and the two state prisons located nearby. The planned Growth Management Act update, 2016 to 2036, uses a projected population growth rate of 1.0 percent. In concurrence with the proposed update, this plan is based on a linear growth rate of 1.0 percent per year.

WASTEWATER SYSTEM PLANNING

The City has not prepared any wastewater system planning documents prior to the preparation of this plan.

WATER SYSTEM COMPREHENSIVE PLANS

City of Forks Comprehensive Water System Plan, Gray & Osborne, Inc., September 2007

The *City of Forks Comprehensive Water System Plan* describes the existing water system facilities, water usage and design criteria, conservation programs, system expansion, and recommended water system improvements. The plan recommends numerous system improvements to expand the water distribution system and update the telemetry and control systems.

CHAPTER 2

REGULATORY REQUIREMENTS

INTRODUCTION

The purpose of this chapter is to identify and summarize the pertinent federal and state regulations that affect the planning, design, and approval of recommended improvements discussed in this report.

This chapter does not describe each regulation in detail; rather, it addresses important facets of the regulations that affect the planning and design process. Subsequent sections of this plan address technical requirements of the regulations at a level of detail appropriate for the evaluation provided by that section.

FEDERAL AND STATE STATUTES, REGULATIONS AND PERMITS

This section discusses some of the various federal and state laws that may affect wastewater system construction and operations, as well as other relevant permits, programs, and regulations.

FEDERAL CLEAN WATER ACT

The Federal Water Pollution Control Act is the principal law regulating the water quality of the nation's waterways. Originally enacted in 1948, it was significantly revised in 1972 and 1977, when it was given the common title of the "Clean Water Act" (CWA). The CWA has been amended several times since 1977. The 1987 amendments replaced the Construction Grants program with the Water Pollution Control State Revolving Fund (SRF) that provides low-cost financing for a range of water quality infrastructure projects.

The National Pollutant Discharge Elimination System (NPDES) Program was established by Section 402 of the CWA and its subsequent amendments. The Washington State Department of Ecology administers NPDES permits in the State of Washington for the U.S. Environmental Protection Agency (EPA). NPDES permits place limits on the quantity and quality of pollutants that may be discharged and are required by any entity discharging wastewater to surface water or discharges having the significant potential to impact surface water.

FEDERAL ENDANGERED SPECIES ACT

On March 16, 1999, the National Marine Fisheries Service (NMFS) listed the Puget Sound chinook as "threatened" under the Endangered Species Act (ESA). In 1999, the United States Fish and Wildlife Service (USFWS) listed the bull trout as "threatened."

The NMFS listed Puget Sound steelhead as "threatened" in 2007. ESA listings impact activities that affect salmon and trout habitat, such as water use, land use, construction activities, and wastewater disposal. Impacts to the greater Forks area may include longer timelines for permit applications, and more stringent regulation of construction impacts and activities in riparian corridors.

In response to existing and proposed ESA listings of salmon, steelhead, and trout species throughout Washington State, Governor Locke established the Office of Salmon Recovery in 1997 to direct the state's salmon recovery efforts. Rather than attempting to avert additional ESA listings, the Statewide Strategy provides local input into, and maintains some local control over, the salmon recovery regulatory processes that affects the majority of Washington State.

In order to minimize liability under the ESA, local governments need to demonstrate that their land use regulations will not result in a prohibited "take" of a listed species, including adverse modification of critical habitat.

RECLAIMED WATER STANDARDS

The standards for the use of reclaimed water are outlined in RCW 90.46 and in a separate document published by the Washington State Departments of Health and Ecology entitled "Water Reclamation and Reuse Standards." Reclaimed water is the effluent derived from a wastewater treatment system that has been adequately and reliably treated, such that it is no longer considered sewage and is suitable for a beneficial use or a controlled use that would not otherwise occur. The legislature has declared that "the utilization of reclaimed water by local communities for domestic, agricultural, industrial, recreational, and fish and wildlife habitat creation and enhancement purposes (including wetland enhancement) will contribute to the peace, health, safety, and welfare of the people of the State of Washington."

The *Water Reclamation and Reuse Standards* define the water quality standards for reclaimed water. The generation of Class A reclaimed water has minimum requirements that are described below:

- **Continuously Oxidized** – Wastewater that at all times has been stabilized such that the monthly average CBOD is less than 25 mg/L and weekly average CBOD is less than 40 mg/L and contains a measurable amount of dissolved oxygen. The monthly average TSS is required to be less than 30 mg/L with an average weekly maximum of 45 mg/L TSS. The monthly average total nitrogen as N is required to be less than 10 mg/L with a sample maximum of 15 mg/L.

- **Continuously Coagulated** – Oxidized wastewater that at all times has been treated by a chemical or equally effective method to destabilize and agglomerate colloidal and finely suspended matter prior to filtration.

- **Continuously Filtered** – Oxidized and coagulated wastewater that at all times has been passed through a filtering media so that the turbidity of the filtered effluent does not exceed an average of 2 nephelometric turbidity units (NTU), determined monthly, and does not exceed 5 NTU at any time.

- **Continuously Disinfected** – Oxidized, coagulated, and filtered wastewater that at all times has been disinfected to destroy or inactivate pathogenic organisms. A group of indicator microorganisms, coliform bacteria, are used to measure the effectiveness of the disinfection process. The Class A reclaimed water standard is a total coliform density of 2.2 per 100 milliliters (ml) for the median of the last 7 days of samples, with no sample having a density greater than 23 per 100 ml.

NATIONAL ENVIRONMENTAL POLICY ACT

The National Environmental Policy Act (NEPA) was established in 1969 and requires federal agencies to determine environmental impacts on all projects requiring federal permits or funding. Federally delegated activities such as NPDES permits or Section 401 Certification are considered state actions and do not require NEPA compliance. The federal agency responsible for funding or permitting the project performs an Environmental Assessment to determine whether an Environmental Impact Statement must be prepared. If project impacts are found to be insignificant, a Finding of No Significant Impact (FONSI) is issued by the responsible federal agency. NEPA is not applicable to projects that do not include a federal component. Currently, State Revolving Fund and Centennial Grant projects are reviewed under the State Environmental Policy Act (SEPA) and the State Environmental Review Process (SERP) to satisfy the intent of NEPA, as the Clean Water Act has not been reauthorized.

STATE ENVIRONMENTAL REVIEW PROCESS

The Washington State Department of Ecology has developed the SERP to satisfy the intent of NEPA for projects funded by the State Revolving Fund and Centennial Clean Water Fund. SERP review is similar to NEPA in that it reviews the potential impacts of an action on a defined set of environmental resources; however, SERP relies on the alternatives analysis presented in the facilities plan, SEPA checklist, and a federal cross-cutter checklist for review of potential project impacts.

Facilities plans require submittal of a SERP Coversheet, which documents completion of SEPA review, Project Cost-Effectiveness Analysis, and the Public Participation process. It also provides a federal cross-cutter overview checklist to highlight any potential environmental issues for projects identified in the facilities plan for potential funding applications. Public entities submitting funding applications for construction projects must submit a federal “Cross-Cutter Report” which documents potential project impacts

to the list of NEPA environmental parameters and compliance with federal executive orders to protect the environment. Cross-cutter reviews should be initiated prior to submittal of funding applications to Ecology, and must be approved before funding agreements can be signed and funds disbursed. Endangered Species Act consultation and National Historic Preservation Act Section 106 review are among the cross cutters that can require considerable review time, so the environmental review process should be initiated early in the process of project development and funding applications. The cross-cutter report is reviewed and approved by Ecology staff, which issues an approval letter once all environmental review requirements are completed. Unlike the federal NEPA process, no FONSI is issued.

FEDERAL CLEAN AIR ACT

The Federal Clean Air Act requires all wastewater facilities to plan to meet the air quality limitations of the region. The City falls in the jurisdiction of the Olympic Region Clean Air Agency (ORCAA). The ORCAA is responsible for enforcing federal, state, and local outdoor air quality standards and regulations in Clallam, Grays Harbor, Jefferson, Mason, Pacific, and Thurston Counties of Washington State. The WWTF operates under the authority of ORCAA.

STATE STATUTES, REGULATIONS AND PERMITS

STATE WATER POLLUTION CONTROL ACT

The intent of the state Water Pollution Control Act is to "maintain the highest possible control standards to ensure the purity of all waters of the state consistent with public health and the enjoyment…the propagation and protection of wildlife, birds, game, fish and other aquatic life, and the industrial development of the state." Under the Revised Code of Washington (RCW) 90.48 and the Washington Administrative Code (WAC) 173-240, Ecology issues permits for wastewater treatment facilities and land application of wastewater under WAC 246-271.

State Waste Discharge Permit, WAC 173-216

Industrial, commercial, and municipal operations that discharge waste materials to ground and surface waters of the state and into municipal sewerage systems are subject to the State Waste Discharge Permit Program. This permit program implements applicable pretreatment requirements of Section 307 of the Federal Water Pollution Control Act.

The City of Forks discharges treated effluent from its WWTF to groundwater via rapid infiltration basins and therefore is required to maintain and comply with the requirements of their State Waste Discharge Permit, which was originally issued in 1986. The City's State Waste Discharge Permit and associated Fact Sheet are included in Appendix B.

Condition S1, Discharge Limitations, requires the WWTF to meet limits for 5-day biochemical oxygen demand (BOD5), total suspended solids (TSS) , pH, and flow.

Condition S2 lists monitoring requirements including influent and effluent flow, BOD_5, TSS, pH, total dissolved solids, fecal coliform, total kjeldahl nitrogen (TKN), nitrate, and ammonia. The City is required to conduct additional monitoring of the groundwater near the rapid infiltration basins for temperature, dissolved oxygen, pH, conductivity, total coliform, chloride, sulfate, total dissolved solids nitrate, TKN and sodium.

Condition S4.A specifies that the WWTF design capacity for maximum month influent BOD_5 and TSS loading is 434 lb/d. The maximum month average flow capacity for the WWTF is 0.5 million gallons per day (mgd). Condition S4.B requires the City to prepare a plan to maintain adequate capacity when flows and loadings to the WWTF exceed 85 percent of design capacity for 3-consecutive months or the projected increase would reach design capacity within 5 years (whichever occurs first).

Condition S4.C requires the City to perform an annual Inflow and Infiltration (I/I) Evaluation. The I/I evaluation shall summarize any measurable I/I. If increases in I/I are more than 15 percent from that found in the first report based on equivalent rainfall, the report shall contain a plan and a schedule for locating and correcting the I/I.

Condition S6 specifies that residual solids shall be stored and handled in such a manner so as to prevent their entry into state ground or surface waters and compliance with WAC 173-308 and any associated order for handling biosolids.

Condition S7 specifies that the City must work with Ecology to make sure that all commercial and industrial users comply with pretreatment regulations.

Submission of Plans and Reports for Construction of Wastewater Facilities, WAC 173-240

Prior to construction or modification of domestic wastewater facilities, engineering reports, and plans and specifications must be submitted to and approved by Ecology. This regulation outlines procedures and requirements for the development of an engineering report that thoroughly examines the engineering and administrative aspects of a domestic wastewater facility project. This state regulation defines a facility plan as an engineering report under federal regulations, 40 CFR Part 35.

Key provisions of WAC 173-240 are provided below:

- An engineering report for a wastewater facility project must contain everything required for a general sewer plan unless an up-to-date general sewer plan is on file with Ecology.

- An engineering report shall be sufficiently complete so that plans and specifications can be developed from it without substantial changes.

- A wastewater facility engineering report must be prepared under the supervision of a professional engineer.

Criteria for Sewage Works Design, Washington State Department of Ecology

Ecology has published design criteria for collection systems and wastewater treatment factilities. While these criteria are not legally binding, their use is strongly encouraged by Ecology since the criteria are used by the agency to review engineering reports for upgrading wastewater treatment systems. Commonly referred to as the "Orange Book," these design criteria primarily emphasize unit processes through secondary treatment, and also include criteria for planning and design of wastewater collection systems. Any expansion or modification of the City of Forks' collection system and/or WWTF will require continued conformance with Ecology criteria.

Certification of Operators of Wastewater Treatment Plants, WAC 173-230

Wastewater treatment plant operators are certified by the state Water and Wastewater Operators Certification Board. The operator assigned overall responsibility for operation of a wastewater treatment plant is defined by WAC 173-230 as the "operator in responsible charge." This individual must have state certification at or above the classification rating of the plant. The City of Forks WWTF is currently assigned a Class II rating. The operating staff assigned to the plant have the required certification. Table 2-1 presents the certifications of the WWTF operational staff.

TABLE 2-1

Operator Certification

Title	Class	Certification Number
Wastewater Superintendent	III	3650
Public Works Director	II	2768
Senior Operator	II	3974
Operator	I	7432
Operator	I	8168

WATER QUALITY STANDARDS FOR SURFACE WATERS OF THE STATE OF WASHINGTON, CHAPTER 173-201A WAC

WAC 173-201A establishes water quality standards for the State of Washington. The standards are based on two objectives: protection of public health and enjoyment, and protection of fish, shellfish, and wildlife. For each surface water body in the state, the

revised standards assign specific uses, such as aquatic life, recreation, or water supply uses. Water quality standards have been developed for each use, for parameters such as fecal coliform, dissolved oxygen, temperature, pH, turbidity, and toxic, radioactive, and deleterious substances.

It is the policy of the State of Washington to maintain existing beneficial uses of surface water by preventing degradation of existing water quality. However, certain allowances are made by Ecology for discharging treated wastewater into surface water that enable a temporary or mitigated degradation to occur. These allowances are made by establishing mixing zones and determining the assimilative capacity of the receiving water.

STATE OF WASHINGTON BIOSOLIDS REGULATIONS, WAC 173-308

WAC 173-308 is the basis for the statewide Biosolids Management Program. Rather than applying for a permit, facilities that are subject to the permit program apply for coverage under the existing statewide general permit. The City of Forks is covered under the general permit. The City of Forks produces Class A biosolids, which are permitted for unrestricted land application and public use.

STATE ENVIRONMENTAL POLICY ACT

WAC 173-240-050 requires a statement in all wastewater comprehensive plans regarding proposed projects in compliance with SEPA, if applicable. The capital improvements proposed in this plan will fall under SEPA regulations. A SEPA checklist is included in Appendix A of this plan for use in the environmental review for the project. In most cases a determination of non-significance is issued (DNS); however, if a project will have a probable significant adverse environmental impact an environmental impact statement (EIS) will be required. In addition to SEPA, facilities planning documentation must include SERP, which serves as NEPA for Ecology's State Revolving Fund and Centennial Clean Water Act funded projects.

ACCREDITATION OF ENVIRONMENTAL LABORATORIES (WAC 173-050)

The State of Washington established a requirement that all laboratories reporting data to comply with NPDES permits must be generated by an accredited laboratory. This accreditation program establishes specific tasks for quality control and quality assurance (QA/QC) that are intended to ensure the integrity of laboratory procedures. Accreditation requirements must be met for any on-site laboratory or outside laboratory used to analyze samples. Only accredited laboratories may be used for analyses reported for compliance with NPDES permits. In planning for an on-site laboratory, staffing must be sufficient to allow for QA/QC procedures to be performed. The Forks WWTF laboratory is currently accredited for determination of the following parameters: specific conductance, total suspended solids, pH, dissolved oxygen, and biochemical oxygen demand.

MINIMAL STANDARDS FOR SOLID WASTE HANDLING (WAC 173-304)

Grit and screenings are not subject to the Sludge Regulations in WAC 173-308, but their disposal is regulated under the state Solid Waste Regulations, WAC 173-304. Waste placed in a municipal solid waste landfill must not contain free liquids, nor exhibit any of the criteria of a hazardous waste as defined by WAC 173-303. To be placed in a municipal solid waste landfill, grit, screenings, and incinerator ash must pass the paint filter test. This test determines the amount of free liquids associated within the solids, and includes the toxicity characteristic leaching procedure (TCLP) test, which determines if the waste has hazardous characteristics.

WETLANDS

Dredging and Filling Activities in Natural Wetlands (Section 404 of the Federal Water Pollution Control Act)

A U.S. Army Corps of Engineers (Corps) permit is required when locating a structure, excavating, or discharging dredged or fill material in waters of the United States or transporting dredged material for the purpose of dumping it into ocean waters. Typical projects requiring these permits include the construction and maintenance of piers, wharves, dolphins, breakwaters, bulkheads, jetties, mooring buoys, and boat ramps.

If wetland fill activities cannot be avoided, the negative impacts can be mitigated by creating new wetland habitat in upland areas. If other federal agencies agree, the Corps would generally issue a permit.

Wetlands Executive Order 11990

This order directs federal agencies to minimize degradation of wetlands and enhance and protect the natural and beneficial values of wetlands. This order could affect siting of lift stations and sewer lines.

SHORELINE MANAGEMENT ACT

The Shoreline Management Act of 1971 (RCW 90.58) establishes a broad policy giving preference to shoreline uses that protect water quality and the natural environment, depend on proximity to the water, and preserve or enhance public access to the water. The Shoreline Management Act jurisdiction extends to lakes or reservoirs of 20 acres or greater, streams with a mean annual flow of 20 cubic feet per second (cfs) or greater, marine waters, and an area inland 200 feet from the ordinary high-water mark. Projects are reviewed by local governments according to state guidelines and a local Shoreline Master Program.

FLOODPLAIN DEVELOPMENT PERMIT

Local governments that participate in the National Flood Insurance Program are required to review projects in a mapped floodplain and impose conditions to reduce potential flood damage from floodwater. A Floodplain Development Permit is required prior to construction, including projects involving wastewater collection facilities.

HYDRAULIC PROJECT APPROVAL

Under the Washington State Hydraulic Code (WAC 220-110), the WDFW requires a hydraulic project approval (HPA) for activities that will "use, divert, obstruct, or change the natural flow or bed" of any waters of the state. For City activities, such as pipeline crossings of streams, an HPA will be required. The HPA will include provisions necessary to minimize project-specific and cumulative impacts to fish.

CITY SEWER ORDINANCES

The Forks Municipal Code, Title 13, addresses rules and regulations for the City's sewer system. Table 2-2 lists the chapters in Title 13. As shown in Table 2-2, the sewer ordinances address such issues as requirements for connections to sewer system, permits for sewer installation by developers, rates for sewer service, development requirements for private sewer systems, conditions for sewer service extensions, and sewage pretreatment regulations.

TABLE 2-2

Forks Sewer System Municipal Code

Chapter	Title	Description
13.05.020	Sewer Connections Required	Requires connection of all parcels within the existing sewer service area to connect to the sewer system within 30 days of notice from the City.
13.05.050	Water and Wastewater Discharge Restrictions	Establishes that it is unlawful to discharge stormwater, surface water, groundwater, or other prohibited materials into the sanitary sewer system.
13.05.060	Wastewater Pretreatment Requirements	Establishes requirements for pretreatment of certain waste streams prior to discharge to the collection system.
13.05.070	Permit – Requirement	Establishes the requirement for a permit to connect to the sewer system.
13.05.140	Sewerage Facilities Design Criteria	Identifies design criteria, including requirement to comply with the Washington State Department of Ecology "Criteria for Sewage Works Design" for all sewer extensions, side sewers, pump stations, and other collection and conveyance facilities.
13.05.180	Requirements for Certain Businesses	Includes requirements for removal of grease from the waste stream from restaurants and other food service businesses.
13.10	Sewer Rates and Charges	Establishes the monthly sewer service fee for each connection.
13.15	Septic Tank Waste	Establishes requirements for sizing and design of septic systems and fees for disposal of septage at the Forks WWTF.

CHAPTER 3

LAND USE, POPULATION PROJECTIONS, AND SERVICE AREA CHARACTERISTICS

The 2007 update of the 1995 *Clallam County City of Forks Urban Growth Area Comprehensive Plan* and the 2007 *Water System Plan* were used as the basis for the descriptions of land use and the planning criteria included in this chapter. In addition, planning criteria and population projections provided by the City's Planning Department were used in the development of this chapter.

PLANNING PERIOD

In order to provide wastewater services for future growth, the wastewater system is in need of continuous evaluation and improvement. A planning period for the evaluation of the wastewater utility should be long enough to be useful for an extended period of time, but not so long as to be impractical. The planning period for this *General Sewer/Wastewater Facility Plan* is from 2014 through 2034, coinciding with a 20-year planning interval.

SEWER STUDY AREA

The City of Forks is on the Olympic Peninsula in Clallam County. Forks is approximately 100 miles northwest of Seattle in the far northwest corner of the state. The City limits, UGA, and current and future sewer services areas are shown in Figure 3-1. The City is surrounded by unincorporated Clallam County rural timberlands, with Olympic National Park immediately east of the City. The nearest incorporated cities to Forks are the City of Port Angeles, located approximately 56 miles to the east, and Hoquiam located 100 miles to the south.

The City is comprised of approximately 2,276 acres and has approximately 3,545 residents (2013). The sewer collection system serving the City of Forks is limited to a utility local improvement district (ULID) located in the center of the City, which includes the commercial core. The remainder of the City continues to be served by individual septic systems.

SEWER SERVICE AREAS

City of Forks Utility Local Improvement District

The City of Forks' current sewer service area includes connections within corporate limits. The collection system consists of gravity sewers with one pump station and force main,

including over 4.7 miles of mains and laterals. The sewer service area is described in detail in Chapter 4. The existing and future wastewater collection system plan is shown on Figure 3-2.

ADJACENT JURISDICTIONS

The City of Forks is surrounded by unincorporated timberlands with no adjacent jurisdictions.

AGREEMENTS AND INTERTIES

The City does not have any wastewater agreements or interties with any surrounding communities.

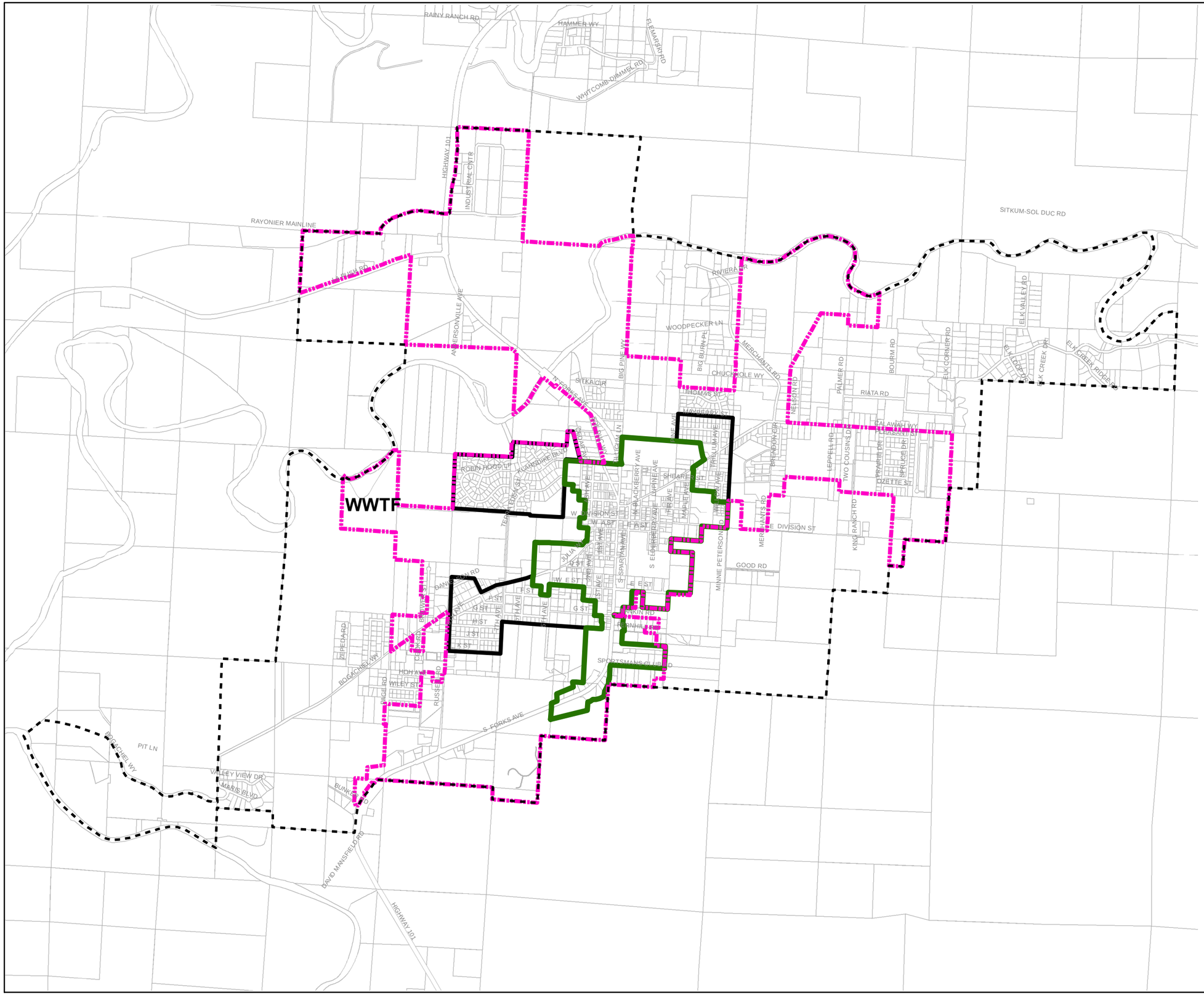
ZONING AND FUTURE LAND USE

Zoning within the City and the UGA is shown on Figure 3-3. The zoning designations are listed in Table 3-1, along with the amount of land per designation.

TABLE 3-1

Zoning Designations

Abbreviation	Zoning Designation	Acreage
City Zoning		
R-1	Very Low Density Residential	1,189
R-2	Low Density Residential	806
R-3	Moderate Density Residential	400
R-4	High Density Residential	0
OL-1	Low Density Commercial/High Density Residential	1.4
OL-2	Low Density Commercial/Moderate Density Residential	118
OL-3	Low Density Commercial/Low Density Residential	0
OL-4	Moderate Density Commercial/High Density Residential	0
OL-5	Moderate Density Commercial/Moderate Density Residential	23
OL-6	High Density Commercial/High Density Residential	0
C-1	Low Density Commercial	25
C-2	Moderate Density Commercial	16
C-3	High Density Commercial	9
PL	Public Land	24
IP	Industrial	113
Total City Zoning		**2,724.4**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5,000
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WWTF
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HAMMER WY
WHITCOMB-DIMMEL RD
ELEMARSON RD
HIGHWAY 101
INDUSTRIAL CNTR
RAYONIER MAINLINE
SITKUM-SOL DUC RD
ANDERSONVILLE AVE
RIVIERA DR
WOODPECKER LN
BIG BURN PL
MERCHANTS RD
CHUCKHOLE WY
BIG PINE WY
SITKA DR
N FORKS AVE
THOMAS ST
NEWBERRY ST
NELSON RD
PALMER RD
BOURM RD
ELK CORNER RD
ELK VALLEY RD
ELK CREEK DR
ELK CREEK RIDGE RD
RIATA RD
GALAWAY WY
ISABEL DR
SPRUCE DR
OZETTIE ST
LEPPELL RD
TWO COUSINS LP
PRENDON CIR
ROBIN HOOD LP
KLAHOOSE BLVD
TERRY ROBIN ST
W DIVISION ST
W A ST
W B ST
W C ST
W D ST
W EAST
E EAST
E DIVISION ST
MERCHANTS RD
KING RANCH RD
MINNIE PETERSON RD
GOOD RD
DANDY LION RD
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850TH AVE
851ST AVE
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861ST AVE
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863RD AVE
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867TH AVE
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881ST AVE
882ND AVE
883RD AVE
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890TH AVE
891ST AVE
892ND AVE
893RD AVE
894TH AVE
895TH AVE
896TH AVE
897TH AVE
898TH AVE
899TH AVE
900TH AVE
901ST AVE
902ND AVE
903RD AVE
904TH AVE
905TH AVE
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908TH AVE
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911TH AVE
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913TH AVE
914TH AVE
915TH AVE
916TH AVE
917TH AVE
918TH AVE
919TH AVE
920TH AVE
921ST AVE
922ND AVE
923RD AVE
924TH AVE
925TH AVE
926TH AVE
927TH AVE
928TH AVE
929TH AVE
930TH AVE
931ST AVE
932ND AVE
933RD AVE
934TH AVE
935TH AVE
936TH AVE
937TH AVE
938TH AVE
939TH AVE
940TH AVE
941ST AVE
942ND AVE
943RD AVE
944TH AVE
945TH AVE
946TH AVE
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971ST AVE
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981ST AVE
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983RD AVE
984TH AVE
985TH AVE
986TH AVE
987TH AVE
988TH AVE
989TH AVE
990TH AVE
991ST AVE
992ND AVE
993RD AVE
994TH AVE
995TH AVE
996TH AVE
997TH AVE
998TH AVE
999TH AVE
1000TH AVE
PIT LN
VALLEY VIEW DR
MARIE BLVD
BUNKER RD
DAVID MANSFIELD RD
HIGHWAY 101
BOGACHIEL WY
EDEDARD
HOH AVE
WILEY ST
RUSSELL RD
SWIGE RD
BOGACHIEL WY
S FORKS AVE
SPORTSMANS CLUB RD
TINKIN RD
CORNHILL RD
LEGEND:
UGA
CITY LIMITS
EXISTING SEWER SERVICE AREA
FUTURE SEWER SERVICE AREA
PARCELS
CITY OF FORKS
GENERAL SEWER/WASTEWATER FACILITY PLAN
FIGURE 3-1
CITY LIMITS AND UGA
Gray & Osborne, Inc.
CONSULTING ENGINEERS
L:\Forks\13543 Sewer Comp Plan\GIS\CITY LIMIT FIG 3-1.mxd

Calawah River

ROBIN HOOD EXPANSION AREA

TRILLIUM AVENUE EXPANSION AREA

BOGACHIEL WAY EXPANSION AREA

WWTF

N

0 500 1,000 2,000 Feet

LEGEND:

- CITY LIMITS
- EXISTING SEWER SERVICE AREA (ULID)
- FUTURE SEWER SERVICE AREA
- UGA
- PARCELS
- CLEANOUT
- MANHOLES
- PROPOSED MANHOLE
- PUMP STATION
- 6" FORCE MAIN
- 6" OR LESS
- 8"
- 10"
- 12"
- 15"

SEWER BASINS:

- NORTH BASIN
- SOUTH BASIN

CITY OF FORKS

GENERAL SEWER/WASTEWATER FACILITY PLAN
FIGURE 3-2
EXISTING AND FUTURE SEWER SERVICE AREA

Gray & Osborne, Inc.

L:\Forks\13543 Sewer Comp Plan\GIS\FIG 3-2 SERVICE AREA.mxd

N

0 1,250 2,500 5,000 Feet

WWTF

LEGEND:

- UGA
- CITY LIMITS
- EXISTING SEWER SERVICE AREA
- PARCELS

FUTURE UGA ZONING:

- High Density Commercial - C3
- Industrial Park - IP
- Low Density Residential - R2
- Low Density Commercial - C1
- Low Density Commercial / High Density Residential - OL1
- Low Density Commercial / Moderate Density Residential - OL2
- Low Density Residential - R2
- Moderate Density Commercial - C2
- Moderate Density Commercial / Moderate Density Residential - OL5
- Moderate Density Residential - R3
- Public Land District - PL
- Very Low Density Residential -R1

CITY ZONING:

- Commercial - C2
- General Industrial - I
- High Density Commercial - C3
- High Density Commercial / High Density Residential - OL6
- High Density Residential - R4
- Industrial Park - IP
- Low Density Commercial / High Density Residential - OL1
- Low Density Commercial / Moderate Density Residential - OL2
- Low Density Residential - R2
- Moderate Density Commercial - C2
- Moderate Density Commercial / High Density Residential - OL4
- Moderate Density Commercial / Moderate Density Residential - OL5
- Moderate Density Residential - R3
- Public Land (Open Space, Public Buildings) - PL
- Very Low Density Residential - R1

CITY OF FORKS

GENERAL SEWER/WASTEWATER FACILITY PLAN
FIGURE 3-3
ZONING MAP

Gray & Osborne, Inc.

L:\Forks\13543 Sewer Comp Plan\GIS\FIG 3.3 ZONING.mxd

Development of accurate and reasonable growth projections is essential in establishing capacity requirements for the wastewater collection system and treatment facility. Accurate projections allow the community to plan financially for needed infrastructure improvements and to establish appropriate facility capacities, locations, and implementation scheduling for wastewater system improvements.

The three major elements in predicting the amount and location of future growth and development in the City's wastewater collection system service area are land use, zoning, and population projections. Population forecasts, in conjunction with current water consumption data, provide a basis for estimating future wastewater collection system and treatment facility demands. Land use, zoning, and development plans play an important role in determining growth patterns. Future land use, variations in use, and changing population densities, as determined by applicable zoning ordinances, can significantly impact a system's ability to provide adequate capacity in the City's wastewater collection and treatment system. Increased residential and commercial densities, as well as new large industrial users, can greatly impact the flows and loadings of wastewater conveyed by the collection system and treated at the wastewater treatment facility.

Per the Forks Municipal Code, the following are the main types of land uses within the City:

- Very Low Density Residential (R-1) – This zone consists of properties 5 acres in size or larger that currently have little or no infrastructure in place, yet were placed into the agreed upon urban growth area in 1991. The R-1 zones are likely areas where urban development and/or infill development will occur in time, however, the density and lot size requirements take into account the undeveloped nature of the property within the zones.

- Low Density Residential (R-2) – This district is intended to incorporate some rural amenities related to certain agricultural and animal husbandry uses of property which may now exist inside the city limits of Forks as well as properties which may choose to annex to the City in the future. The minimum lot size is 20,000 square feet.

- Moderate Density Residential (R-3) – This use is designed to preserve small-town qualities enjoyed by area residents in the face of rapid growth and development. The minimum lot size is 13,500 square feet if a private septic system is being utilized rather than access to a state-approved sewer system such as that operated by the City of Forks.

- High Density Residential (R-4) – This zone allows space for a diversity of housing types with appropriate services to supply the more economical housing opportunities to area residents without interfering with other

residential or service areas. The zone shall be limited to that area that is serviced by both the City of Forks water system and a state-approved sewer system such as that operated by the City of Forks. The minimum lot size is 4,500 square feet.

- Low Density Commercial (C-1) – Provides for non-conflicting space for commercial uses or that may require large amounts of land. The minimum lot size is 13,500 square feet.

- Moderate Density Commercial (C-2) – Provides for adequate areas for commercial uses requiring relatively small amounts of land and that will act as a transition between residential and high-density commercial portions of the Forks Urban Growth Area. The minimum lot size is 4,500 square feet.

- High Density Commercial (C-3) – Provides areas within which specified commercial activities can be concentrated that will serve as a focal point for local citizens, but that will limit the amount of disruption of nearby residential activities. The minimum lot size is 2,500 square feet if connected to both sewer and water system, otherwise, per health code.

- Overlap Zones – Zones include Low Density Commercial/High Density Residential (OL1), Low Density Commercial/Moderate Density Residential (OL2), Low Density Commercial/Low Density Residential (OL3), Moderate Density Commercial/High Density Residential (OL4), Moderate Density Commercial/Moderate Density Residential (OL5), and High Density Commercial/High Density Residential (OL6). These zones reflect the type of development that has occurred in these areas over the past 50 years. In addition, these overlap zones act as transitional zones between established residential and commercial blocks.

- Public Land (PL) – The purpose of this zone is to create a specific zoning designation for those lands owned by the public entities located within the City of Forks as currently incorporated, and within those parts of the Forks Urban Growth Area subject to future annexation by the City. By creating a specific zoning designation for the public lands located within the City and creating a specific zoning code chapter for the regulation of those lands, the objective is to reduce uncertainty as to which part of the zoning code applies to projects undertaken on public land. Lot sizes shall be allowed to be made as small as reasonably necessary, as determined by the City Planner in consultation with the City Building Inspector and the City Public Works Superintendent, to address the public purpose and need for which the application is being submitted.

- Industrial (IP) – Reserves adequate space for manufacturing and other activities into two specific zones, one being the area in and about the Forks industrial park, the other being all other areas designated as industrial upon the map attached to the ordinance codified in this chapter.

As shown on Figure 3-1, the City's Urban Growth Area (UGA) extends beyond the City's corporate boundaries into unincorporated Clallam County. All of the land outside of the city limits within the UGA is zoned as residential, with the exception of a small area to the north of the City that is zoned industrial.

POPULATION

HISTORICAL RESIDENTIAL POPULATION

The City's population and annual growth rate over the last 14 years is shown in Table 3-2.

TABLE 3-2

City of Forks Historical Population 2000 to 2013

Year	Population	Annual Growth Rate
2000	3,120(1)	-0.4%
2001	3,166(3)	1.5%
2002	3,196(3)	0.9%
2003	3,223(3)	0.8%
2004	3,249(3)	0.8%
2005	3,282(3)	1.0%
2006	3,362(3)	2.4%
2007	3,402(3)	1.2%
2008	3,467(3)	1.9%
2009	3,486(3)	0.5%
2010	3,532(2)	1.3%
2011	3,500(3)	-0.9%
2012	3,545(3)	1.3%
2013	3,545(3)	0.0%

(1) Source: 2000 U.S. Census.
(2) Source: 2010 U.S. Census.
(3) Source: WA Office of Financial Management Intercensal Estimate.

As shown in Table 3-2, the City's population has grown very slowly since 2000 and generally follows the timber industry in the region. The average annual growth rate from 2000 to 2013 was 0.9 percent. Figure 3-4 shows population growth from 2000 to 2013 graphically.

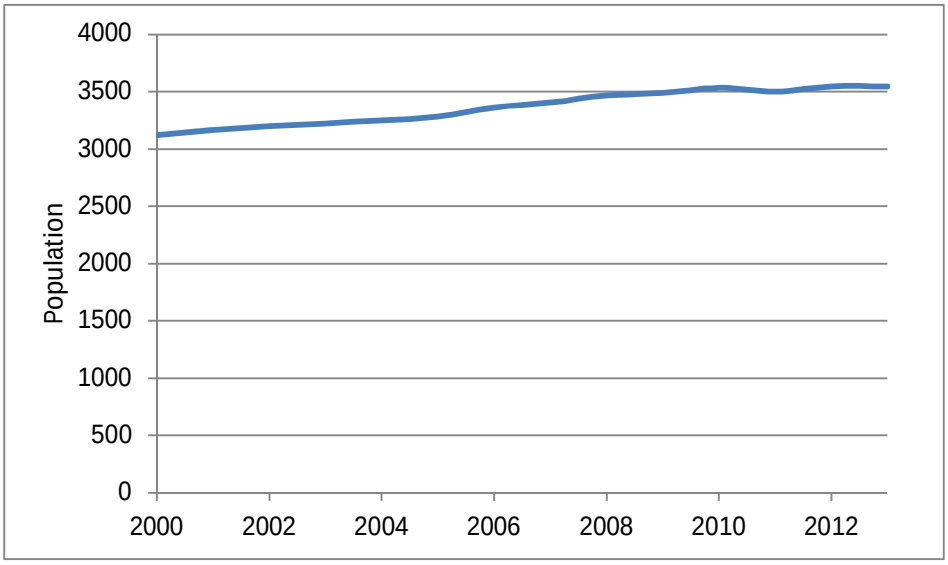


FIGURE 3-4

Historic Population 2000 to 2013

EXISTING SERVICE AREA POPULATION

As shown on Figure 3-2, the City of Fork's sewer service area includes the central core of the City defined by the ULID that was developed in 1986 when the sewer system was constructed. The collection system has not been expanded since 1986. The remainder of the City outside of the ULID is served by on-site septic systems. The City is planning to expand the collection system over the next 20 years to serve the homes located in the future sewer service areas shown on Figure 3-2, which are currently served by on-site septic systems. The existing service area population and projected future population within the existing service area are estimated based on the current number of single family residential units with active connections to the sewer system, plus the existing number of multi-family equivalent residential units (ERU), based on water meter data, multiplied by an estimated 2.8 people per household per the 2010 U.S Census. ERU are discussed in more detail in Chapter 5 of this plan.

The population projections presented in this chapter do not include the populations of the proposed sewer system expansion areas. Population projections for these areas are discussed in Chapter 5.

PROJECTED FUTURE CITY POPULATION

The projected future City population is based on a linear growth rate of 1.0 percent in concurrence with the planned Growth Management Act update, 2016 to 2036. Projected population in the current sewer service area is assumed to grow at the same rate as the

growth of the City. Table 3-3 provides the population projections through the year 2034 for the City and the sewer service area.

TABLE 3-3

Sewer Service Area Projected Population 2014 to 2034

Year	Projected City Population	Projected Annual Growth Rate[(1)]	Existing Service Area Population[(2)]
2014	3,580	1.0%	1,109
2015	3,616	1.0%	1,120
2016	3,653	1.0%	1,131
2017	3,689	1.0%	1,143
2018	3,726	1.0%	1,154
2019	3,763	1.0%	1,166
2024	3,956	1.0%	1,225
2029	4,157	1.0%	1,297
2034	4,369	1.0%	1,363

(1) Growth projections based on a linear growth rate of 1.0 percent in concurrence with the planned Growth Management Act update, 2016 to 2036.

(2) The existing service area population projections are estimated based on the current number of single family residential units with active connections to the sewer system plus the existing number of multi-family residential ERU, based on water meter data, multiplied by the estimated 2.8 people per household per the 2010 U.S Census. Multifamily ERU are discussed in more detail in Chapter5. Population growth in the service area is assumed to grow linearly at the same rate as the total City population. Expansion sewer service area projections are presented in Chapter 5.

SEWER CONNECTIONS

Table 3-4 provides an estimate of the number of sewer connections to the City of Forks' sewer system in 2013 and 2014, based on billing records obtained from the City's Finance Department.

TABLE 3-4

City of Forks Sewer Service Connections by Customer Class[(1)]

	2013/2014
Single-Family Residential	321
Multi-Family Residential	26[(2)]
Commercial	100
Total	**447**

(1) Average number of active connections by customer class estimated by sewer billing data provided by the City.

(2) Multifamily residential connections do not reflect the number of units or population served.

INDUSTRIES IN THE SEWER SERVICE AREA

Currently no industrial users are connected to the City of Forks sewer collection system. A small industrial area is located within the planned northwest expansion area.

NATURAL ENVIRONMENT

GEOGRAPHY AND CLIMATE

The City is located on the Forks Prairie in the northwest corner of the Olympic Peninsula between the Olympic Mountains and the Pacific Ocean. The Forks Prairie is relatively flat (slopes usually less than 1 percent) with elevations ranging from 100 to 400 feet, with the lower elevations and steep slopes primarily occurring along the banks of the Calawah and Bogachiel Rivers to the north, south and west, and the higher elevations located in adjacent Olympic foothills to the east. A map showing the topography of the City and surrounding area is shown on Figure 3-5.

The Forks area received an average of 98.7 inches of precipitation per year from 2009 to 2013. November is historically the wettest month and July the driest. The average annual temperature is 49.4 degrees F. Precipitation data gathered from the Forks 6.9 WSW weather station is presented in Table 3-5. The weather station is located at Latitude 47.9146°N Longitude 124.5309°W at 90 feet above sea level.

TABLE 3-5

City of Forks Precipitation 2009 to 2013

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
2009	10.97	3.11	10.36	5.15	3.64	1.01	1.03	0.34	3.72	12.19	27.01	5.99	84.52
2010	22.68	7.97	7.91	10.23	9.04	4.81	0.47	1.45	8.17	13.36	13.14	19.43	118.67
2011	14.72	10.11	19.49	9.18	6.38	2.50	2.54	0.08	7.78	9.62	14.96	6.81	104.17
2012	13.40	12.11	20.81	8.14	4.70	6.33	2.38	0.40	0.57	6.59	14.17	16.61	106.20
2013	10.37	10.68	6.60	11.12	6.89	3.31	0.11	2.71	10.60	3.19	7.50	6.84	79.92
Avg.	14.43	8.80	13.03	8.76	6.13	3.59	1.31	1.00	6.17	8.99	15.36	11.14	98.70
Min.	10.37	3.11	6.60	5.15	3.64	1.01	0.11	0.08	0.57	3.19	7.50	5.99	79.92
Max.	22.68	12.11	20.81	11.12	9.04	6.33	2.54	2.71	10.60	13.36	27.01	19.43	118.67

SOURCE: NOAA, Climatological Data, Forks 6.9 WSW.

SOILS AND GEOLOGY

The Forks Prairie had its origin many thousands of years ago as a result of glacial action. It is typical of the many western Washington prairies that exist in areas dominated by forests. The prairie is underlain with a gravelly substrate that has very high permeability with excellent infiltration rates. Because of the relatively flat nature and gravelly substrate (glacial outwash), minimal foundation and settling problems can be expected. Due to the flat topography, lower areas of the prairie are susceptible to winter flooding.

There are two dominant classifications of soils in the Forks area. These classifications are Solduc very gravelly sandy loam and Quillayute silt loam. Solduc soils are found on terraces and terrace escarpments formed in glacial outwash and Quillayute soils are found on river terraces formed in loess and old estuary deposits. Brief descriptions of these soils from the USDA Soil Conservation Service are provided below.

- **Solduc Very Gravelly Sandy Loam** – The soils in this classification were formed from loess and volcanic ash over glacial outwash, are somewhat excessively drained, and well drained, with 0 to 5 percent slopes.

- **Quillayute Silt Loam** – The soils in this classification were formed from estuarine deposits and loess, well drained, with 0 to 8 percent slopes.

Groundwater in the Forks area is contained in aquifers that consist of both river-deposited alluvium and glacially deposited outwash materials. The groundwater generally moves parallel to the bedrock in generally the same direction as the Calawah and Bogachiel Rivers.

SURFACE WATER

The City is bordered on the north by the Calawah River and the Bogachiel River on the south. The Sol Duc River is located further north of the City. There are various tributary creeks flowing throughout the City's UGA that feed into the Calawah and Bogchiel Rivers. The City is located approximately 15 miles inland from the Pacific Ocean.

SITE-SENSITIVE AREAS

The following section summarizes information regarding site-sensitive/critical areas within the sewer service area of the City. Site-sensitive areas within the sewer service area include those classified as wetlands, seismic hazard areas, slide hazard areas, flood hazard areas, and water bodies. The City of Forks Municipal Code Title 14, Environment, and Title 17, Zoning, provide protection to site-sensitive areas. Municipal Code 14.20.520, Policy Goals, provides the following summary of the code:

> *…it is the intent of this chapter to accomplish the following:*
>
> *(1) To conserve and protect the environmental attributes of the city of Forks that characterize the quality of life for residents of both the city of Forks and the state of Washington.*
>
> *(2) To identify and portray critical areas and the environmental functions these areas perform.*
>
> *(3) To protect critical areas and their functions by regulating use and management within these areas and on adjacent lands.*
>
> *(4) To maintain both acreage and ecological functions of regulated wetlands in the city of Forks and to restore or create wetlands to increase acreage, quality, and diversity of city of Forks wetlands.*
>
> *(5) To guide development proposals to the most environmentally suitable and naturally stable portion of a development site.*
>
> *(6) To avoid potential damage due to landslide, subsidence, erosion, or flooding.*
>
> *(7) To protect water quality by controlling erosion and carefully siting uses and activities which can release chemical or bacterial pollutants and maintaining stream flows and habitat quality for fish and marine shellfish.*
>
> *(8) To preserve natural flood control and stormwater storage from alterations to drainage or stream flow patterns.*

N

0 1,000 2,000 4,000 Feet

CALAWAH RIVER

WWTF

RAYONIER MAINLINE

HIGHWAY 101

INDUSTRIAL CNTR

SITKUM-SOL DUC RD

LA PUSH RD

ANDERSONVILLE AVE

RIVIERA DR

BIG BURN PL

THIMBLEBERRY LN

MERCHANTS RD

WOODPECKER LN

CHUCKHOLE WY

THOMAS ST

HUCKLEBERRY LN

MAYBERRY ST

COLLINS ST

ACKERLY ST

JOHNSON RD

N FORKS AVE

OLYMPIC DR

BIG PINE WY

TILLICUM LN

PINE AVE

TRILLIUM AVE

CEDAR AVE

BOB RICH WY

KLAHHANDIKE BLVD

TERRA EDEN ST

ROBIN HOOD LP

MARION'S PL

ASH AVE

WOOD ST

W DIVISION ST

SHEARER ST

CALAWAH WY

FIR AVE

MAPLE AVE

SWORD FERN AVE

WILLOW AVE

BRENDON CIR

LEPPELL RD

TWO COUSINS DR

PRAIRIE DR

SPRUCE DR

QUINAULT ST

OZETTE ST

BOURM RD

PALMER RD

NELSON RD

RIATA RD

ELK CORNER RD

ELK VALLEY RD

ELK LOOP DR

VALLEY CT

ELK CREEK DR

W A ST

E A ST

W C ST

W E ST

E E ST

1ST AVE

2ND AVE

S SPARTAN AVE

S ELDERBERRY AVE

MINNIE PETERSON RD

MERCHANTS RD

E DIVISION ST

KING RANCH RD

GOOD RD

JULIA W

D ST

F ST

G ST

H ST

J ST

K ST

6TH AVE

5TH AVE

7TH AVE

9TH AVE

DANIELSON RD

BROWER ST

RANKIN RD

FERNHILL RD

SPORTSMANS CLUB RD

ROBBINS RENTAL RD

COOK RD

EVERGREEN LP

ZEPEDA RD

BOGACHIEL WY

HOH AVE

WILEY ST

PERRY ST

PAGE RD

RUSSELL RD

MILL CREEK RD

S FORKS AVE

PIT LN

VALLEY VIEW DR

MARIS BLVD

BUNKER RD

LEGEND:

- 50-FOOT CONTOURS
- UGA
- EXISTING SEWER SERVICE AREA
- CITY LIMITS
- PARCELS

CITY OF FORKS

GENERAL SEWER/WASTEWATER FACILITY PLAN
FIGURE 3-5
TOPOGRAPHY MAP

Gray & Osborne, Inc.

L:\Forks\13543 Sewer Comp Plan\GIS\FIG 3.5 TOPO.mxd

(9) To maintain ground water recharge and prevent the contamination of ground water resources to ensure water quality and quantity for domestic and commercial/industrial uses.

(10) To protect areas with potential for marine aquaculture activities from degradation by other types of uses.

(11) To protect the general public against avoidable losses from maintenance and replacement of public facilities, property damage, subsidy cost of public mitigation of avoidable impacts, and costs for public emergency rescue and relief operations.

(12) To protect unique, fragile and valuable elements of the natural environment for the enjoyment of present and future generations.

(13) To prevent cumulative adverse environmental impacts to water availability, water quality, wetlands, fish and wildlife habitat conservation areas, frequently flooded areas and geologically hazardous areas.

(14) To implement the policies of the Growth Management Act, Chapter 36.70A RCW. (Ord. 342 § 230, 1992)

Erosion Hazard Areas

These areas are especially subject to erosion, if disturbed, and may not be well suited for high-density developments or intensive land uses. Municipal Ordinance 14.20.760 provides specific regulation of erosion hazard areas.

Seismic Hazard Areas

Seismic hazard areas are those with low-density soils that are more likely to experience greater damage due to seismic-induced subsidence, liquefaction, or landslides. Seismic hazard areas are regulated mainly with respect to public safety and with the exception of a severe earthquake, these hazard areas do not impact wastewater facilities. The risk of soil failure varies according to the quality of the soil and the expected ground motion produced by the earthquake. The International Building Code provides maps of the United States showing maximum considered earthquake ground motion parameters to be used across the country. The ground motion parameters in the Forks area are relatively high, which means the Forks building code should have the highest construction standards.

Flood Hazard Areas

Flood hazard areas are areas adjacent to lakes, rivers, and streams that are prone to flooding during peak runoff periods. Flood hazard areas deserve special attention due to the sensitive nature of their ecosystems as well as the potential for damage to structures located in the floodplain. Small portions of the City are located within the 100-year floodplain associated with the Calawah River and the streams tributary to the Bogachiel River. Figure 3-6 shows the flood hazard areas. The City's zoning regulations provide regulation of land use within the flood hazard areas.

Slide Hazard Areas

Slide hazards areas are those that are prone to unstable behavior due to steep slopes, lack of vegetation, or unconsolidated soils. Slide hazards in the City of Forks area are shown on Figure 3-6. Chapter 14.20 of the city code provides specific regulation of landslides.

Wetlands

Wetlands are defined by the EPA as areas that are inundated for at least part of the year. Wetlands support valuable and complex ecosystems and consequently development is severely restricted if not prohibited in most wetlands. Wetlands in the City of Forks area are shown on Figure 3-6. Chapter 14.15 of the city code provides specific regulation of wetlands.

Water Bodies

Lakes and streams are classified as sensitive areas due to the variety of facilities and animals that they support. Water bodies are shown on Figure 3-6.

Critical Aquifer Recharge Areas

The City of Forks uses groundwater as a significant portion of its water supply. The City has five wells within the city limits and all are active. Since three of the wells are in the sewer service area, critical aquifer recharge areas are important areas to protect. Forks Municipal Code 14.20, Article VII, Critical Aquifer Recharge Areas, requires a hydrogeologic assessment for all proposed hazardous activities in such areas or any case where the director determines that there is a potential to threaten the quality of groundwater in a critical aquifer recharge area.

Fish and Wildlife Habitat Conservation Areas

Sensitive fish and wildlife habitat is defined as areas which meet the definition of a "Fish and Wildlife Habitat Critical Area" pursuant to WAC 365-190-080(5) and is essential for maintaining specifically listed species in suitable habitats. Any proposed activity within

300 feet of these areas, including construction related to wastewater collection systems, requires that a habitat study be prepared. Forks Municipal Code 14.20, Article IV, Fish and Wildlife Habitat Conservation Areas, provides a listing of conservation areas and associated regulations.

WATER SYSTEM

WATER SYSTEM HISTORY

Prior to 1953, the Town of Forks was supplied by surface water from Elk Creek, which drains into the Calawah River northeast of town. The present water system for the City of Forks was created in 1953 with the drilling of Well 1, construction of a 175,000-gallon storage tank, and the completion of a piping system to serve the town site. The system serves the incorporated City as well as the unincorporated portions of the County immediately adjacent to the City. Approximately 40 percent of the residential water service connections are outside of the corporate limits.

As the population increased, the City drilled four additional production wells, and constructed two additional storage tanks totaling 1,750,000 gallons. The City has also added new pipelines to serve new subdivisions and an industrial park situated north of the city limits near the Sol Duc River.

Table 3-6 provides a brief summary of the water system development history in the City of Forks.

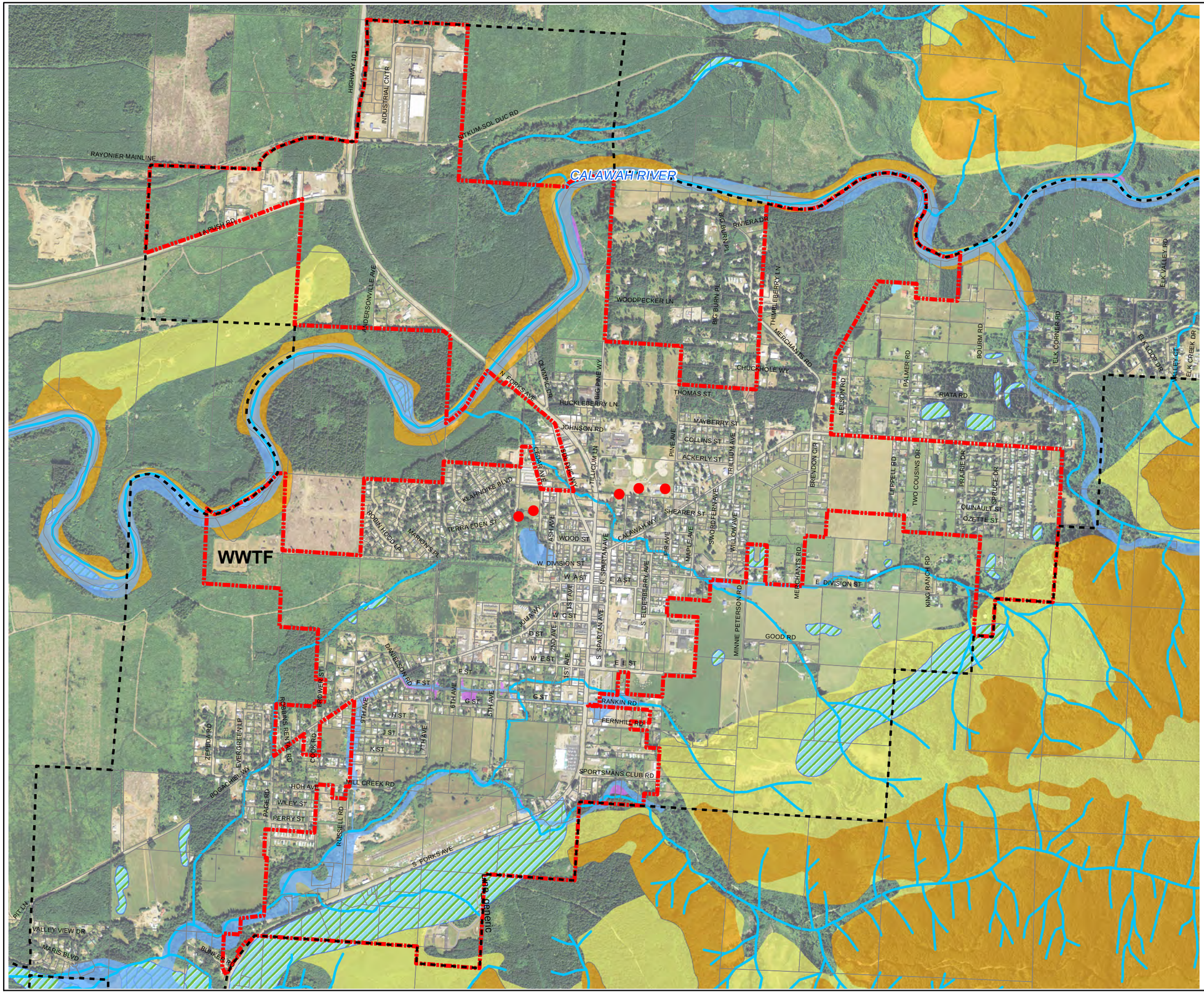
TABLE 3-6

Significant Events in the History of the City of Forks Water System

Date	Event
Pre-1953	City served by surface water from Elk Creek
1940s	Original gas chlorination system installed
1940s	Original fluoridation system installed
1953	Drill Well 1
1953	Drill Well 2
1954	Construct 150,000-gallon Reservoir 1
1961	Drill Well 3
1967	Drill Well 4
1969	Construct 750,000-gallon Reservoir 2
1979	Drill Well 5
1979	Construct 1,000,000-gallon Reservoir 3

EXISTING WATER SYSTEM

The existing system is all within one pressure zone, which is controlled by the overflow elevation of Reservoir 1. The system has five production wells operating as two independent wellfields, approximately 25 miles of distribution piping, and three storage tanks with a combined volume of 1.925 million gallons. The existing water distribution system is shown on Figure 3-7.



CITY OF FORKS

GENERAL SEWER/WASTEWATER FACILITY PLAN
FIGURE 3-6
SENSITIVE AREAS

Gray & Osborne, Inc.

L:\Forks\13543 Sewer Comp Plan\GIS\FIG 3-6 SENSITIVE.mxd

N

0 1,000 2,000 4,000 Feet

CALAWAH RIVER

WWTF

1000000 Gallon Tank

750000 Gallon Tank

150000 Gallon Tank

LEGEND:

- HYDRANTS
- WELLS
- VALVES
- RESERVOIRS

WATER SYSTEM

DIAMETER

- 1"
- 1-1/2"
- 2"
- 4"
- 6"
- 8"
- 10"
- 12"
- CITY LIMITS
- UGA
- PARCELS

CITY OF FORKS

GENERAL SEWER/WASTEWATER FACILITY PLAN
FIGURE 3-7
EXISTING WATER SYSTEM

Gray & Osborne, Inc.

L:\Forks\13543 Sewer Comp Plan\GIS\FIG 3-7 WATER.mxd

CHAPTER 4

EXISTING FACILITIES

INTRODUCTION

This chapter describes existing facilities that comprise the City of Forks' wastewater collection treatment and disposal systems. These facilities include force mains and gravity sewers, one pump station, wastewater treatment facilities, and effluent disposal facilities.

WASTEWATER COLLECTION SYSTEM

Pump Stations

The City of Forks has one pump station, the Mill Creek Pump Station, within its sanitary sewer system. The location of this pump station is shown on Figure 4-1. This pump station pumps sewage from the small basin on the southwest side of Mill Creek along Highway 101 via a 6-inch diameter force main suspended from the Highway 101 Mill Creek Bridge to a gravity sewer manhole located on the northeast side of Mill Creek. Basic information about the pump station is included in Table 4-1.

TABLE 4-1

Mill Creek Pump Station Data

Mill Creek Pump Station	
Location	Highway 101 at Mill Creek Bridge
Quantity of Pumps	2
Station Type	Submersible
Pump Motor Size (hp)	5
Pump Capacity (gpm, ea.)	350
TDH (ft.)	28
Force Main Dia. (in.)	6
Force Main Material	Ductile Iron
Force Main Length (ft.)	~250

History of Sewer Collection System

The City of Forks' original sewer system was installed in 1986 to serve a utility local improvement district in the core of the City. The original system has not been significantly expanded since it was originally constructed. The system consists primarily of, 8-, 10- or 12-inch PVC gravity sewer pipes that convey sewage from the ULID to a

15-inch-diameter PVC gravity interceptor pipe that extends to the WWTF located on the west side of the City. Sewers were laid at slopes between 0.2 and 1.6 percent, with most sewers averaging 6 to 8 feet below grade. Manholes were constructed of gasketed precast concrete sections with grouted concrete adjustment rings.

The City of Forks corporate limits encompass a total area of 2,276 acres. The sanitary sewer collection system provides service to approximately 329 acres within a utility local improvement district located with the city limits. The remainder of the City is unsewered and served by on-site septic systems.

Description of Gravity Collection System

The existing sanitary sewer system is shown on Figure 4-1 and a summary of the existing gravity sewer pipes and force mains is provided in Table 4-2. The system consists of over 24,651 linear feet of 6-inch to 12-inch PVC gravity sewers that collect and convey the sewage from the sewer service area to a 5,270-foot long 15-inch gravity interceptor pipe that conveys all of the sewage to the wastewater treatment facility. One pump station (Mill Creek Pump Station) and a short force main convey sewage from the portion of the service area located southwest of Mill Creek to the gravity system located on the northeast side of Mill Creek. With the exception of the sewage pumped by the Mill Creek Pump Station, all sewage is conveyed by gravity to the wastewater treatment facility located in the west side of the City.

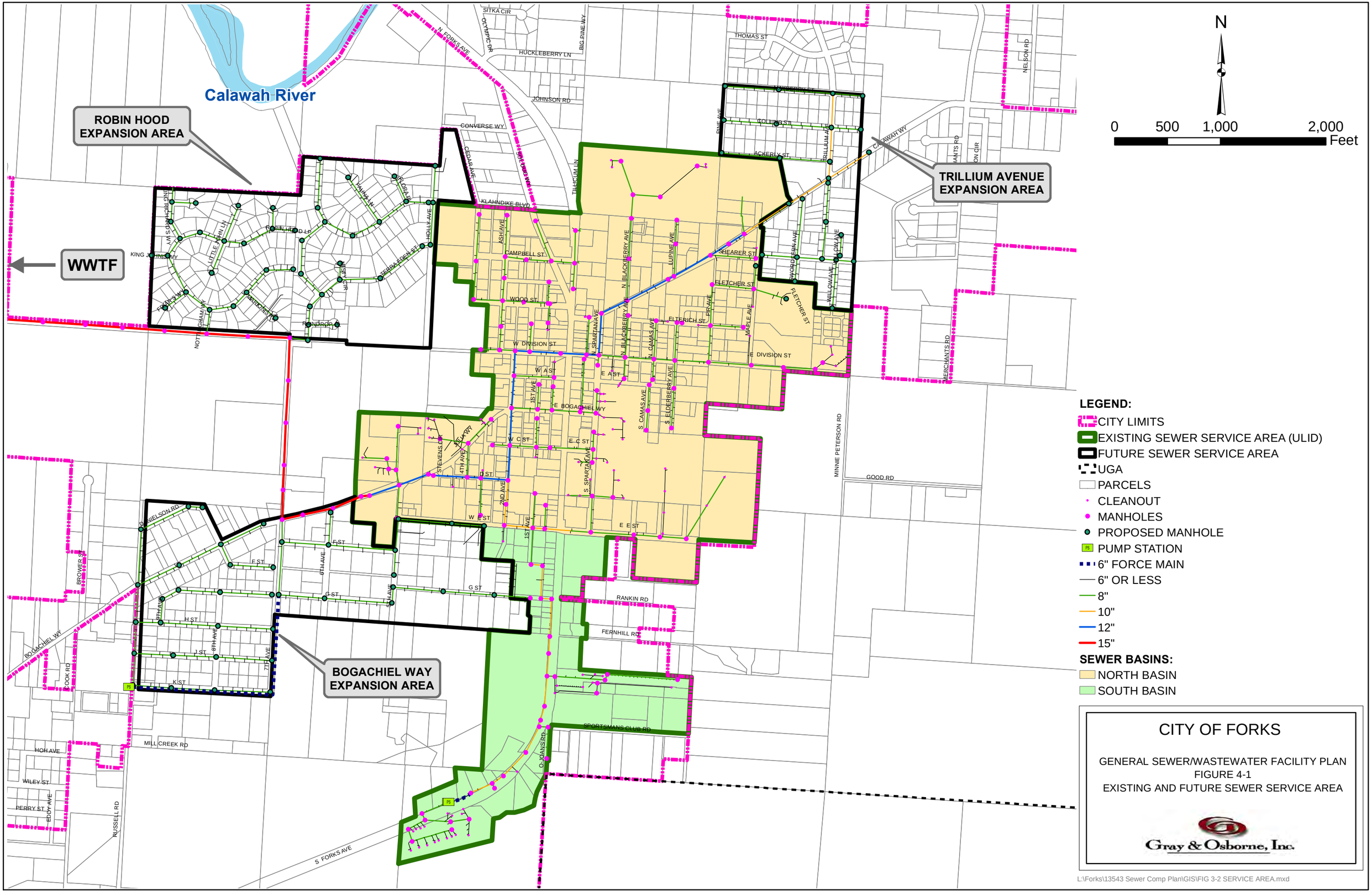
At the minimum slope of 0.2 percent, the 8, 12, and 15-inch pipes have a capacity of 0.4, 1.2 and 2.1 mgd, respectively. There are no known capacity issues within the system.

The City's sanitary sewer system also contains approximately 162 precast concrete manholes.

TABLE 4-2

Sewer Pipe Summary (All Lengths in Feet)

Pipe Diameter (in)	Pipe Length (ft.)
Gravity Sewers	
6	12,540
8	28,308
10	3,727
12	5,314
15	5,269
Total	**24,419 feet (4.7 miles)**
Force Mains	
6	232
Total	**232 feet**


Calawah River
ROBIN HOOD EXPANSION AREA
TRILLIUM AVENUE EXPANSION AREA
BOGACHIEL WAY EXPANSION AREA
WWTF
N
0
500
1,000
2,000
Feet
LEGEND:
CITY LIMITS
EXISTING SEWER SERVICE AREA (ULID)
FUTURE SEWER SERVICE AREA
UGA
PARCELS
CLEANOUT
MANHOLES
PROPOSED MANHOLE
PUMP STATION
6" FORCE MAIN
6" OR LESS
8"
10"
12"
15"
SEWER BASINS:
NORTH BASIN
SOUTH BASIN
CITY OF FORKS
GENERAL SEWER/WASTEWATER FACILITY PLAN
FIGURE 4-1
EXISTING AND FUTURE SEWER SERVICE AREA
Gray & Osborne, Inc.
L:\Forks\13543 Sewer Comp Plan\GIS\FIG 3-2 SERVICE AREA.mxd

Collection Areas

For the purposes of this report, the City of Forks collection system is divided into two collection areas, or drainage basins. The two major basins, which include one basin in the north end of the ULID (North Basin) and one basin in the south end of the ULID (South Basin), are shown on Figure 4-1. The approximate boundary between the two basins is E Street.

The following section describes the boundaries and land use designations of each basin, as well as information about the sewer lines within each basin.

North Basin

The North Basin includes the 258 acres of the ULID located north of E Street. The designated land use in most of the North Basin is high-density residential and mixed commercial and residential. Sewage from the North Basin is collected by 8-inch PVC gravity sewer pipes and conveyed to a 12-inch diameter PVC trunk sewer that discharges to the 15-inch interceptor pipe in the southwest corner of the basin.

South Basin

The South Basin includes the 71 acres of the ULID located south of E Street. The designated land use in most of the South Basin is mixed commercial and residential (trailer park). Sewage from the portion of the basin located southwest of Mill Creek is conveyed to the Mill Creek Pump Station, which pumps the sewage to the gravity sewers located on the northeast side of the creek. Sewage from the remainder of the basin flows by gravity to a 10-inch interceptor pipe that conveys all of the sewage from the basin to the gravity sewers on the south end of the North Basin prior to entering the 15-inch interceptor pipe.

Planned Collection System Expansions

The City has plans to expand the existing sewer service area to incorporate three areas currently not sewered. These expansion areas are shown in Figure 4-1. To incorporate these areas, it will be necessary to construct new collection systems to connect them to the existing system, as well as provide increased capacity at the wastewater treatment facility to handle the additional influent flow generated by these areas.

For planning purposes, it is assumed that the expansion of the sewer service area occurs during the 20-year planning period of this Sewer/Wastewater plan. These expansion areas are discussed in greater detail in Chapters 5 and 6.

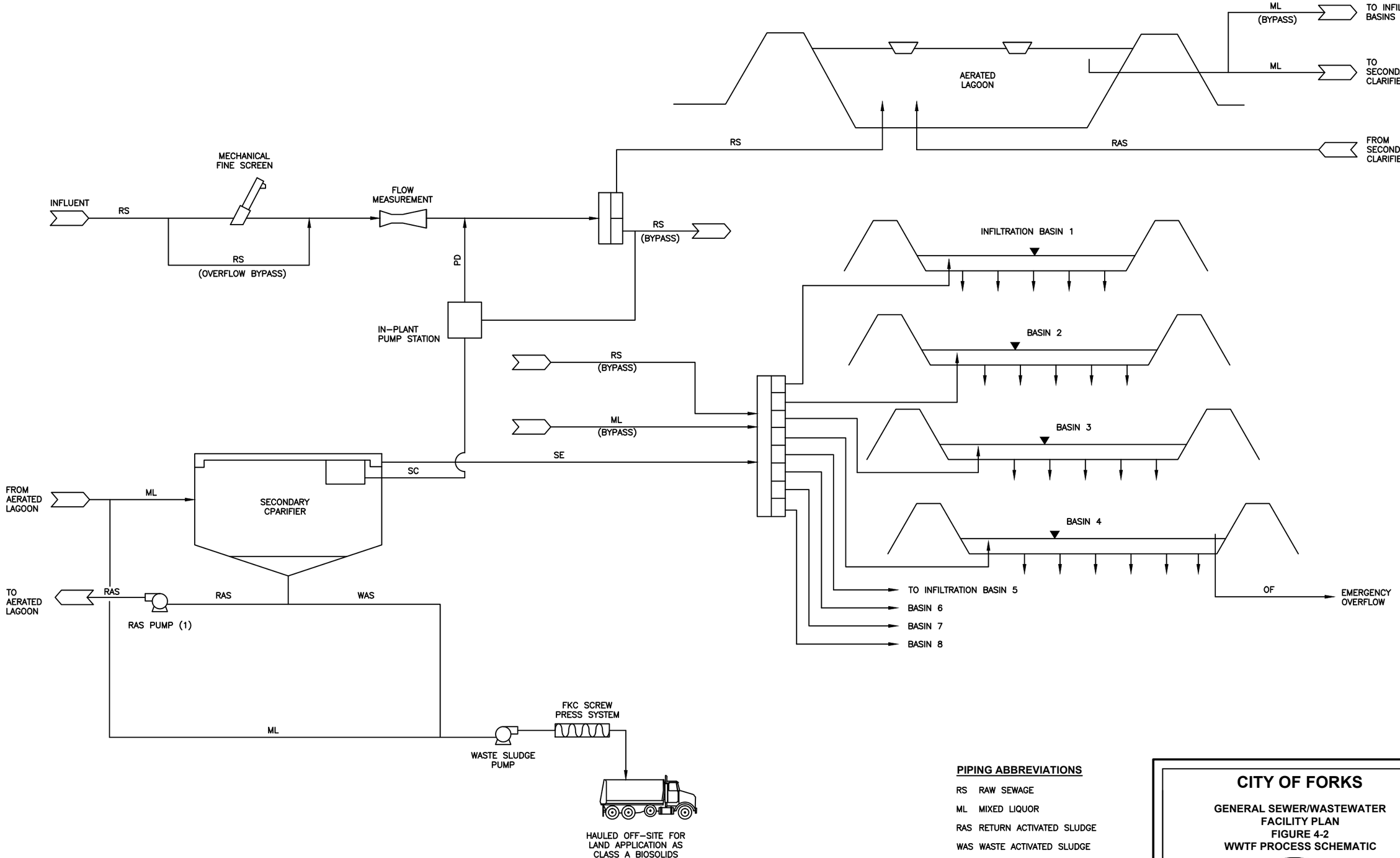
WASTEWATER TREATMENT FACILITY

The City of Forks (City) constructed the original wastewater treatment facility and sewer collection system in 1986. Prior to construction of the WWTF, all homes and businesses in the service area were served by individual septic systems. The original facility consisted of a manual bar screen with comminuter for the head works followed by a one-cell aerated lagoon with a total surface area of 0.44 acre and a total volume of 0.67 million gallons. The lagoon contents were mixed and aerated with a single floating mixer and single floating aerated, respectively. Mixed liquor from the aerated lagoon was conveyed to a secondary clarifier. The clarified secondary effluent was then discharged to eight rapid infiltration basins, which infiltrated effluent to groundwater. The activated sludge that settled out in the secondary sedimentation tank was recycled and returned to the aeration basin via the return activated sludge (RAS) pump station. A portion of the settled sludge was discharged to the waste activated sludge (WAS) pump station, which conveyed the WAS to the two on-site spray fields for land application.

Since 1986, the wastewater treatment facility has not been substantially modified with the exception of the 2003 installation of a FKC lime stabilization and heated screw press system capable of producing Class A biosolids and the installation of a mechanical fine screen in the headworks structure. Following installation of the screw press, the biosolids spray fields were abandoned, though the City continues to periodically land apply Class A biosolids on these areas.

Because the City of Forks does not discharge treated effluent to surface water, the City is not required to be permitted under the National Pollutant Discharge Elimination System; however, because the City discharges to groundwater, the City has a State Waste Discharge Permit, which was issued by the Department of Ecology. The most recent permit became effective July 1, 2007. The expiration date of the permit is June 30, 2012, though the City's coverage under this permit has been administratively extended by Ecology. The City's State Waste Discharge Permit and associated Fact Sheet are included in Appendix B.

Figures 4-2 and 4-3 show a process schematic and site plan for the WWTF, respectively. Plant process piping is shown in Figure 4-4. Influent enters the treatment facility at the headworks, which is equipped with a mechanical fine screen, a Parshall flume with an ultrasonic level transducer, and a composite sampler. Screened influent then flows to the aeration basin for biological treatment. Mixed liquor overflow from the aeration basin is settled in the clarifier. Effluent is discharged via gravity to the eight rapid infiltration basins. Return activated sludge is recycled back to the aeration basin and waste activated sludge is transferred by pump to the screw press for pasteurization and dewatering to produce Class A biosolids. A brief description of each unit process and facility component for the existing facility follows.



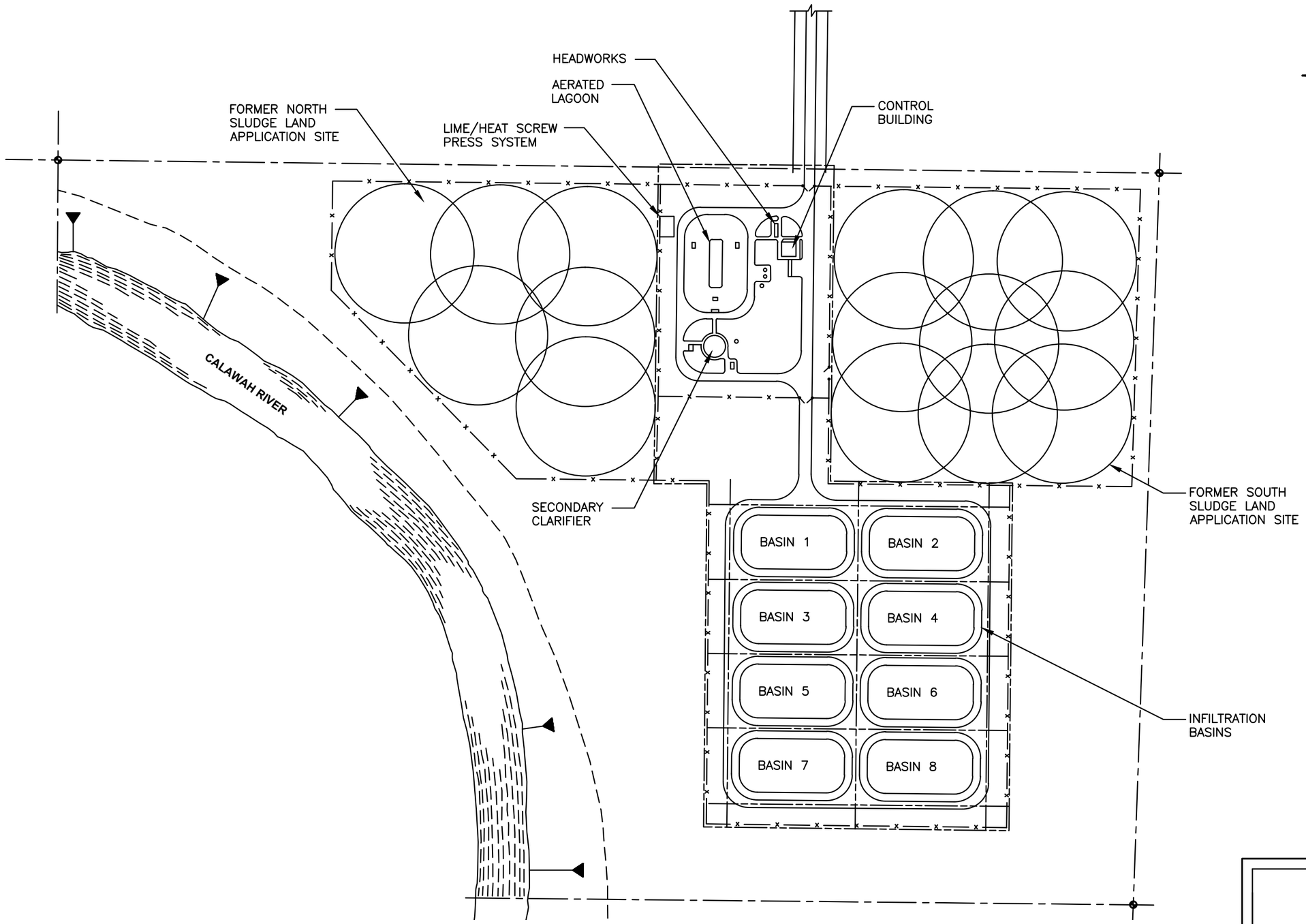
PIPING ABBREVIATIONS

RS	RAW SEWAGE
ML	MIXED LIQUOR
RAS	RETURN ACTIVATED SLUDGE
WAS	WASTE ACTIVATED SLUDGE
SC	SCUM
SE	SECONDARY EFFLUENT

CITY OF FORKS

GENERAL SEWER/WASTEWATER FACILITY PLAN
FIGURE 4-2
WWTF PROCESS SCHEMATIC

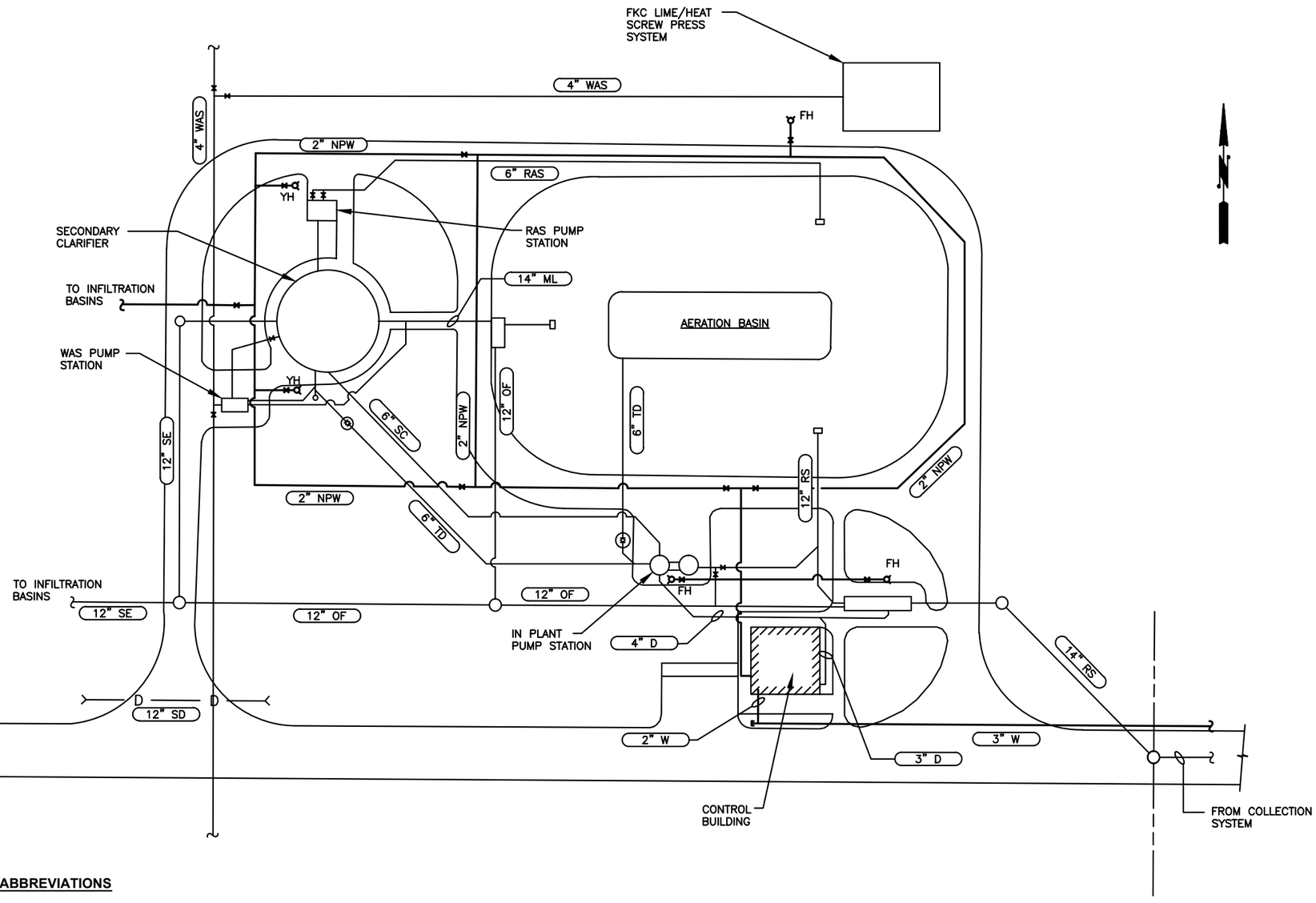
Gray & Osborne, Inc.
CONSULTING ENGINEERS



CITY OF FORKS

GENERAL SEWER/WASTEWATER FACILITY PLAN
FIGURE 4-3
WWTF SITE PLAN

Gray & Osborne, Inc.
CONSULTING ENGINEERS



PIPING ABBREVIATIONS

D	DRAIN
FE	FINAL EFFLUENT
FH	FIRE HYDRANT
ML	MIXED LIQUOR
NPW	NON–POTABLE WATER
OF	OVERFLOW
RAS	RETURN ACTIVATED SLUDGE
RS	RAW SEWAGE
SC	SCUM
SE	SECONDARY EFFLUENT
W	POTABLE WATER
WAS	WASTE ACTIVATED SLUDGE
YH	YARD HYDRANT

CITY OF FORKS

GENERAL SEWER/WASTEWATER FACILITY PLAN
FIGURE 4-4
WWTF PIPING PLAN

Gray & Osborne, Inc.
CONSULTING ENGINEERS

IN-PLANT PUMP STATION

The in-plant pump station pumps drain and sewer water to the aeration basin from a number of sources inside of the WWTF. Table 4-3 presents the design criteria for the In-Plant Pump Station.

TABLE 4-3

In-Plant Pump Station Design Criteria

In-Plant Pump Station Design	
Quantity of Pumps	2
Capacity (ea. pump)	225 gpm @ 30 ft TDH
Motor	3 hp, 480V, 3 Phase
Type	Submersible Centrifugal

The in-plant pump station receives scum from the clarifier scum box as well as drainage from the tank drains, and the control building. The pump station pumps this wastewater to the aeration basin for further treatment.

HEADWORKS

The headworks is designed for influent flow metering, screening, and sampling. The comminuter has been removed and the manual bar screen replaced with a mechanical fine screen. Influent first passes through the mechanical fine screen before entering the 6-inch Parshall flume for influent flow measurement. If the mechanical fine screen is out of service or if the influent flow exceeds the capacity of the screen, the wastewater is diverted through an opening with a slide gate to a bypass channel that bypasses the mechanical fine screen and Parshall flume. Influent is sampled using an automatic sampler that collects time proportional samples at the Parshall flume. Table 4-4 presents the design criteria for the headworks.

TABLE 4-4

Headworks Design Criteria

Flow Meter	
Quantity	1
Type	Parshall Flume
Throat Width	6"
Level Sensor	Ultrasonic
Flow Range	0 – 1.5 mgd

TABLE 4-4 – (continued)

Headworks Design Criteria

Mechanical Fine Screen	
Make and Model	Lakeside Rotamat Microstrainer Model #12MS-.0250-101
Quantity	1
Capacity	1 mgd
Screen Opening	1/4 inch
Influent Sampler	
Quantity	1
Type	24 Hour Composite Refrigerated

AERATION BASIN

The aeration basin is constructed with earth dikes and a rock covered PVC liner. The basin is 12-feet deep and holds 0.67 million gallons. Flow into the aeration basin includes raw wastewater from the headworks, RAS from the RAS pump station, plant drain and sewer wastewater from the in-plant pump station and process water from the FKC screw press. These flows are mixed in the basin with the activated sludge biomass to form mixed liquor. Mixed liquor flows out from the basin at the west end via an outlet structure. The outlet is equipped with a sluice gate and an overflow weir which, during normal operation, routes the mixed liquor to the clarifier when the sluice gate is open. When the sluice gate is closed, mixed liquor is routed to the infiltration basins as an emergency bypass through a 12-inch overflow pipe.

The primary function of the aeration basin is to provide for the removal of biological oxygen demand (BOD_5). Although not a permit requirement, the aeration basin configuration provides some degree of nitrogen removal in addition to the removal of BOD_5 from the wastestream.

One 25-horsepower floating surface aerator and one 20-horsepower floating mixer provide mixing and aeration in the aeration basin. The City has a second spare 25-horsepower floating surface aerator. As sewage loads from Forks increase over the years, more aeration will be required in the basin, and it may become necessary to replace the mixer with the second aerator.

Table 4-5 presents the design criteria for the aeration basin.

TABLE 4-5

Aeration Basin Design Criteria

Aeration Basin	
Quantity	1
Water Depth	12 feet
Volume, each ditch	0.67 million gallons
Mixer	
Quantity	1
Type	Floating
Motor	20 hp, 480V, 3 phase
Aerators	
Quantity	1 (+ 1 uninstalled spare)
Type	Floating
Motor	25 hp, 480V, 3 phase

SECONDARY CLARIFIER

The 35-foot circular secondary clarifier provides efficient and effective solids separation producing high-quality effluent. The secondary clarifier was constructed in 1986. It has a steel access walkway, feed well, sludge rake arms, overflow weirs and scum collection equipment. Mixed liquor flows into the clarifier and is separated into secondary effluent (clear treated water), scum (floatable solids), and sludge (settleable solids). Secondary effluent continuously overflows the weirs in the tank and is discharged by gravity directly into the infiltration basins. The WWTF does not currently provide disinfection of the secondary effluent.

Scum is collected from the secondary clarifier tank by a blade which skims it from the surface of the water and sweeps it into a scum box. The scum then flows to the in-plant pump station, which pumps it to the aeration basin.

Sludge is collected from the bottom of the secondary clarifier tank continuously by arms which rake the sludge to a central drain pocket or hopper. The sludge flows from this hopper to either the RAS or WAS pump station.

Table 4-6 presents the design criteria for the clarifier.

TABLE 4-6

Secondary Clarifier Design Criteria

Secondary Clarifiers	
Quantity	1
Diameter	35 feet
Side Water Depth	12 feet
Volume	86,400 gallons

RETURN ACTIVATED SLUDGE PUMP STATION

The return activated sludge (RAS) pump station was originally designed with two 5-horsepower, two-speed wet pit chopper pumps, each with a pumping capacity of 325 gallons per minute at 12 feet of head. The station currently has only one pump installed. The RAS pump station pumps activated sludge collected in the secondary clarifier to the aeration basin. The pump station is located approximately 20 feet north of the clarifier and was constructed in 1986 during construction of the original WWTF.

Table 4-7 presents the design criteria for the RAS pump station.

TABLE 4-7

RAS Pump Station Design Criteria

RAS Pump Station Design	
Quantity of Pumps	1
Type	Wet Pit Chopper
Capacity	325 gpm @ 12 ft TDH
Motor	5 hp, 480V, 3 Phase, two-speed

WASTE ACTIVATED SLUDGE PUMP ROOM

The waste activated sludge (WAS) pump station is located approximately 20 feet southwest of the clarifier and was constructed in 1986. The original chopper pump was replaced with a submersible pump. The pump station consists of one 25-horsepower constant-speed submersible centrifugal pump with a pumping capacity of 300 gallons per minute at 100 feet of head. The pump is currently manually controlled with no low level float switch.

Table 4-8 presents the design criteria for the WAS pump station.

TABLE 4-8

WAS Pump Station Design Criteria

WAS Pump Station Design	
Quantity of Pumps	1
Type	Submersible
Capacity	300 gpm @ 100 ft TDH
Motor	25 hp, 480V, 3 Phase

INFILTRATION BASINS

Secondary effluent from the WWTF is discharged from the clarifiers directly to the eight rapid infiltration basins by gravity. Effluent is distributed to each basin by four distribution boxes, each of which is equipped with two manually operated slide gates and two 12-inch gravity discharge pipes that regulate flow to two of the infiltration basins. The infiltration basins are all interconnected by 12-inch overflow pipes that allow effluent to flow between the basins. The infiltration basins are designed so that each basin can receive wastewater for 2 days and then rest for 14 days, assuming design flow and equal infiltration rates at each basin.

Table 4-9 presents the design criteria for the infiltration basins.

TABLE 4-9

Infiltration Basin Design Criteria

Infiltration Basins	
Quantity of Basins	8
Area per basin	0.44 Ac
Basin Depth	4 feet
Design Hydraulic Loading Rate	Annual Average: 21.9 inches/wk Max Month: 36.6 inches/wk

CLASS A BIOSOLIDS TREATMENT SYSTEM

The City of Forks utilizes an FKC lime stabilization and heated screw press system to process the waste activated sludge to produce Class A biosolids, which can be sold, given away, or land applied without restriction. The screw press system is housed in a building to the north of the aeration basin. Waste activated sludge (WAS) is pumped directly from the clarifier to a 12-foot-diameter molded polyethylene lime mixing tank with a capacity of approximately 6,840 gallons, where lime is added and mixed with the WAS to adjust pH. The “limed” sludge is then pumped by a transfer pump to a 6,840-gallon sludge feed

tank. The sludge is then pumped from the sludge feed tank to a flocculation tank and on to a rotary drum screen thickener. Polymer is added to the sludge just prior to entering the flocculation tank to assist flocculation. Polymer is stored in a 370 gallon, open topped polymer storage tank. Sludge flows by gravity into the screw press for simultaneous dewatering and pasteurization. Sludge is heated in the screw press by a skid mounted boiler system. The screw press removes water from the sludge by squeezing the sludge between the tapered screw shell and the screen drums. The liquid is allowed to escape through perforated screens surrounding the screw. The removed filtrate is returned to the aeration basin for treatment.

Table 4-10 presents the design criteria for the solids handling facilities.

TABLE 4-10

Solids Handling Design Criteria

Lime Mixing Tank	
Quantity	1
Volume	6,840 gallons
Sludge Feed Tank	
Quantity	1
Volume	6,480 gallons
Polymer Storage Tank	
Quantity	1
Volume	370 gallons
Screw Press	
Make and Model	FKC RST-S630N2000L
Motor Size	1 hp, 1,800 rpm
Quantity	1
Capacity	35.4 lbs/hr (dry)

DESIGN CRITERIA

The design loading criteria for the City of Forks Wastewater Treatment Facility, as presented in the 1986 WWTF design drawings, WWTF O&M Manual, and the City's current State Waste Discharge Permit, are shown in Table 4-11.

TABLE 4-11

Wastewater Treatment Facility Existing State Waste Discharge Permit Limits: Influent Design Criteria

Parameter	Value
NPDES Influent Design Criteria	
Maximum Month Flow (mgd)	0.5
Maximum Monthly Loading, BOD_5 (lb/d)	434
Maximum Monthly Loading, TSS (lb/d)	434

The City discharges to eight rapid infiltration that infiltrate treated effluent to groundwater. Because the infiltration basins are isolated, there is no sprayed effluent, the basins are surrounded by a 100-foot buffer, and public access to the basins is restricted by fencing, disinfection of the treated effluent is not required. However, quarterly monitoring and reporting of fecal coliform concentrations is required to ensure protection of groundwater quality. The permit limits for treated effluent from the WWTF are summarized in Table 4-12 below.

TABLE 4-12

WWTF State Waste Discharge Permit Limits (ST 6031)

Parameter	Technology-Based Limits	
	Average Monthly(1)	**Average Weekly(2)**
5-day Biochemical Oxygen Demand	30 mg/L, 125 lb/d(3), 85% removal of influent BOD	45 mg/L, 187 lb/d(3)
Total Suspended Solids	30 mg/L, 125 lb/d(3), 85% removal of TSS	45 mg/L, 187 lb/d(3)
pH	Shall not be outside the range of 6.0 to 9.0	
Total Ammonia (as NH_3-N)	N/A	N/A

(1) The average monthly effluent limitation is defined as the highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month.

(2) The maximum weekly effluent limitation is defined as the highest allowable weekly discharge. The weekly discharge means the discharge of a pollutant measured during a 7-day period.

(3) For pollutants with limitations expressed in units of mass, the daily discharge is calculated as the total mass of the pollutant discharged over the day. For other units of measurement, the daily discharge is the average measurement of the pollutant over the day.

CHAPTER 5

EXISTING AND PROJECTED WASTEWATER FLOWS AND CHARACTERISTICS

Adequate design of wastewater treatment and conveyance facilities requires the determination of the quantity and quality of wastewater generated from each of the contributing sources. Forks wastewater is predominately domestic in origin with lesser amounts contributed by commercial and industrial businesses and by public use facilities such as schools, parks, and municipal functions. Infiltration and inflow is contributed to the system as a result of groundwater and surface water entering the collection system during periods of high groundwater levels and rainfall, respectively, as is typical in many communities in western Washington.

DEFINITION OF TERMS

In this chapter, the existing wastewater characteristics for the service area will be analyzed and projections made for future conditions. The terms and abbreviations used in the analysis are described below in alphabetical order.

AVERAGE ANNUAL FLOW

Average annual flow is the average daily flow over a calendar year. This flow parameter is used to estimate annual operation and maintenance costs for treatment and lift station facilities.

AVERAGE DRY WEATHER FLOW

Average dry weather flow is the average wastewater flow during periods when the groundwater table is low and precipitation is at its lowest of the year. The dry weather flow period in western Washington normally occurs during June through October. During this time, the wastewater strength is highest, due to the lack of dilution with the ground and surface water components of infiltration and inflow. The higher strength coupled with higher temperatures and longer detention times in the sewer system create the greatest potential for system odors during this time. For this study, average flows for July, August, September and October are used.

BASE FLOW

Base flow is the wastewater flow generated by sewer service customers exclusive of infiltration and inflow, typically occurring and measured at the WWTF during a prolonged dry weather period with low groundwater table conditions. Base flow is estimated by reviewing water use records during the winter months when irrigation is

minimal and a majority of water is discharged to the sewer system. For this project it is assumed that 95 percent of water used is discharged as wastewater.

BIOCHEMICAL OXYGEN DEMAND (BOD)

Biochemical oxygen demand (BOD) is a measure of the oxygen required by microorganisms in the biochemical oxidation (digestion) of organic matter. BOD is an indicator of the organic strength of the wastewater. If BOD is discharged untreated to the environment, biodegradable organics will deplete natural oxygen resources and result in the development of septic (anaerobic) conditions. BOD data together with other parameters are used in the sizing of the treatment facilities and provide a measurement for determining the effectiveness of the treatment process. BOD is expressed as a concentration in terms of milligrams per liter (mg/L) and as a load in terms of pounds per day (lb/d). The term BOD typically refers to a 5-day BOD, often written BOD_5, since the BOD test protocol requires 5 days for completion. BOD_5 of a wastewater is composed of two components – a carbonaceous oxygen demand ($CBOD_5$) and a nitrogenous oxygen demand ($NBOD_5$). The use of $CBOD_5$ as a parameter for evaluating wastewater strength removes the influence of nitrogenous components, including ammonia and organic nitrogen.

CONTAMINANTS OF CONCERN

Contaminants of concern in wastewater, in addition to BOD_5 and TSS discussed elsewhere in this section, include nutrients, priority pollutants, heavy metals, and dissolved organics.

Nutrients such as nitrogen and phosphorus, along with carbon, are essential requirements for growth. When discharged to the aquatic environment, these nutrients can lead to the growth of undesirable aquatic life. When discharged in excessive amounts on land, they can also lead to the pollution of groundwater. Additionally, high concentrations of nutrients, particularly ammonia, can be toxic to aquatic life.

Priority pollutants are organic and inorganic compounds selected on the basis of their known or suspected carcinogenicity, mutagenicity, teratogenicity, or high acute toxicity. Many of these compounds are found in wastewater.

Inorganic constituents, such as calcium, sodium, and sulfate as well as heavy metals, are often present in wastewater due to commercial and industrial activities and may have to be removed if their presence will adversely affect the receiving water, or, if the wastewater is to be reused. Some heavy metals (most notably copper) can be present in wastewater due to leaching from drinking water pipes.

DOMESTIC WASTEWATER

Domestic wastewater is wastewater generated from single and multifamily residences, permanent mobile home courts, and group housing facilities such as nursing homes. Domestic wastewater flow is generally expressed as a unit flow based on the average contribution from each person per day. The unit quantity is expressed in terms of gallons per capita per day (gpcd).

EQUIVALENT RESIDENTIAL UNIT (ERU)

An equivalent residential unit (ERU) is a baseline wastewater generator that represents the average single-family residential household. An ERU can also express the average annual flow contributed by a single-family household, in units of gallons per day, or an annual average loading (of 5-day biochemical oxygen demand or total suspended solids) contributed by a single-family household, in units of pounds per day.

INFILTRATION

Infiltration is groundwater entering a sewer system by means of defective pipes, pipe joints, or manhole walls. Infiltration quantities exhibit seasonal variation in response to groundwater levels. Storm events or irrigation trigger a rise in the groundwater levels and increase infiltration. The greatest infiltration is observed following significant storm events following prolonged periods of precipitation. Since infiltration is related to the total amount of piping and appurtenances in the ground and not to any specific water use component, it is generally expressed in terms of the total land area being served. The unit quantity generally used is gallons per acre per day.

INFLOW

Inflow is surface water entering the sewer system from yard, roof, and footing drains from cross connections with storm drains and through holes in manhole covers. Peak inflow occurs during heavy storm events when storm sewer systems are taxed beyond their capacity, resulting in hydraulic backups and local ponding. Inflow, like infiltration, can be expressed in terms of gallons per capita day or gallons per acre per day.

WWTF flow records are utilized to characterize combined infiltration and inflow (I/I) in the City's existing collection system in terms of peak day, maximum month, and average annual I/I.

MAXIMUM MONTH FLOW (TREATMENT DESIGN FLOW)

Maximum month flow is the highest average monthly flow during a calendar year. In western Washington, the maximum month flow normally occurs in the winter due to the presence of more I/I. This wintertime flow is composed of the normal domestic, commercial, and public use facilities flows with significant contributions from inflow and

infiltration. The predicted maximum month flow at the end of the design period is used as the design flow for sizing treatment processes and selecting treatment equipment.

NON-RESIDENTIAL WASTEWATER

Non-residential wastewater is wastewater generated from schools, hospitals commercial activities, such as restaurants, retail and wholesale stores, service stations, and office buildings, and industrial flow (process wastewater, rinse water, and other industrial activities). Non-residential wastewater quantities for commercial and industrial wastewater are expressed in this Plan in terms of equivalent residential units (ERUs).

PEAK HOUR FLOW

Peak hour flow is the highest average hourly flow during a calendar year. The peak hour flow in western Washington usually occurs in response to a significant storm event preceded by prolonged periods of rainfall which have previously developed a high groundwater table in the service area. Peak hour flows are used in sizing the hydraulic capacity of wastewater collection, treatment, and pumping components. Peak hour flow is typically determined from treatment facility flow records and projected future flows.

SUSPENDED SOLIDS

Suspended solids are the solid matter carried in the waste stream. The total suspended solids (TSS) in a wastewater sample are determined by filtering a known volume of the sample, drying the filter paper, and measuring the increase in weight of the filter paper. TSS is expressed in the same terms as BOD_5; milligrams per liter for concentration and pounds per day for mass load. The amount of TSS in the wastewater is used in the sizing of treatment facilities and provides another measure of the treatment effectiveness. The concentration of TSS in wastewater affects the treatment facility biosolids production rate, treatment and storage requirements, and ultimate disposal requirements.

WASTEWATER

Wastewater is water-carried waste from residential, business, industry, and public use facilities, together with quantities of groundwater and surface water which enter the sewer system through defective piping and direct surface water inlets. The total wastewater flow is quantitatively expressed in gallons per day (gpd).

EXISTING WASTEWATER SERVICE POPULATION, FLOWS AND LOADINGS

WWTF records for the 36 month period from January 2011 through December 2013 were reviewed and analyzed to determine current wastewater characteristics and influent loadings. Current wastewater flows and loadings were then used in conjunction with

projected population data to determine projected future wastewater flows and loadings. Monthly DMR data for this period are provided Table 5-1.

Graphical representation of the average monthly WWTF flows for this period is shown in Figure 5-1.

TABLE 5-1

Historical WWTF Influent and Effluent Loadings (January 2011 - December 2013)

Month/ Year	Ave. Monthly Influent Flow (mgd)	Ave. Monthly Influent BOD Conc. (mg/L)	Ave. Monthly Influent BOD Loading (lb/d)	Ave. Monthly Influent TSS Conc. (mg/L)	Ave. Monthly Influent TSS Loading (lb/d)	Ave. Monthly Effluent BOD Conc. (mg/L)	Ave. Monthly Effluent BOD Loading (lb/d)	Ave. Monthly Effluent TSS Conc. (mg/L)	Ave. Monthly Effluent TSS Loading (lb/d)	Ave. Monthly BOD Removal (%)	Ave. Monthly TSS Removal (%)
Jan - 11	0.111	322	318	205	202	8	8	5	5	97	98
Feb - 11	0.114	336	307	220	202	9	8	7	6	97	97
Mar - 11	0.112	273	290	216	137	10	10	4	4	96	98
Apr - 11	0.100	288	248	211	181	10	8	9	8	97	96
May - 11	0.091	371	299	243	197	9	7	6	5	98	97
Jun - 11	0.090	393	300	252	172	6	4	7	6	99	97
Jul - 11	0.100	381	329	269	232	6	5	8	7	98	97
Aug - 11	0.098	391	323	257	211	11	9	7	6	97	97
Sep - 11	0.102	356	321	230	208	11	10	9	8	97	96
Oct - 11	0.102	428	374	270	236	7	6	7	6	98	98
Nov - 11	0.116	342	348	217	222	5	5	6	6	98	97
Dec - 11	0.108	363	322	240	212	8	7	8	7	97	96
Jan - 12	0.114	327	345	243	256	11	12	11	12	97	95
Feb - 12	0.103	302	264	267	232	6	5	5	5	98	98
Mar - 12	0.125	323	425[(1)]	226	297	7	10	6	8	98	97
Apr - 12	0.098	329	273	256	215	9	8	6	5	97	98
May - 12	0.090	383	303	272	217	15	12	9	7	96	97
Jun - 12	0.090	404	303	245	188	8	6	9	6	98	96
Jul - 12	0.095	388	312	285	229	8	7	10	8	98	97
Aug - 12	0.097	377	306	282	229	12	10	11	9	97	96
Sep - 12	0.090	385	292	251	190	7	5	8	6	98	97
Oct - 12	0.100	395	323	265	218	6	5	5	5	98	98
Nov - 12	-										

TABLE 5-1 – (continued)

Historical WWTF Influent and Effluent Loadings (January 2011 - December 2013)

Month/ Year	Ave. Monthly Influent Flow (mgd)	Ave. Monthly Influent BOD Conc. (mg/L)	Ave. Monthly Influent BOD Loading (lb/d)	Ave. Monthly Influent TSS Conc. (mg/L)	Ave. Monthly Influent TSS Loading (lb/d)	Ave. Monthly Effluent BOD Conc. (mg/L)	Ave. Monthly Effluent BOD Loading (lb/d)	Ave. Monthly Effluent TSS Conc. (mg/L)	Ave. Monthly Effluent TSS Loading (lb/d)	Ave. Monthly BOD Removal (%)	Ave. Monthly TSS Removal (%)
Dec - 12	0.111	299	359	194	221	4	5	3	3	98	99
Jan - 13	0.106	325	280	222	191	10	8	7.5	7	97	97
Feb - 13	0.097	384	312	266	219	5	4	6	2	99	99
Mar - 13	0.100	362	317	308	265	5	4	4	3	98	99
Apr - 13	0.088	438	301	285	197	5	4	3	2	99	99
May - 13	0.094	329	310	202	190	7	6	7	6	98	96
Jun - 13	0.086	351	258	199	147	5	3	4	3	99	98
Jul - 13	0.089	385	284	237	174	8	6	5	4	98	98
Aug - 13	0.088	379	290	233	178	12	10	6	4	97	98
Sep - 13	0.092	339	237	205	143	9	6	6	4	97	97
Oct - 13	0.083	331	232	193	135	5	4	4	3	98	98
Nov - 13	0.086	342	259	185	138	5	3	3	2	99	98
Dec - 13	0.088	360	276	205	159	7	5	6	5	98	97
Minimum	**0.083**	**273**	**222**	**185**	**135**	**4**	**3**	**3**	**2**	**96**	**94**
Average	**0.099**	**357**	**300**	**239**	**201**	**8**	**7**	**6**	**6**	**98**	**97**
Maximum	**0.125**	**438**	**374**	**308**	**297**	**15**	**12**	**11**	**12**	**99**	**99**

(1) March 2012 BOD_5 load of 425 lbs/d is not representative of typical facility loading and therefore not included in analysis.

Existing flows at the WWTF are further summarized in Table 5-2.

TABLE 5-2

Summary of Historical WWTF Influent Flow
(January 2011 - December 2013)

Flow Type	2011	2012	2013	Average
Average Dry Weather Flow(1)	0.101	0.096	0.090	0.095
Annual Average Flow(2)	0.104	0.101	0.091	0.099
Maximum Month Flow(3)	0.116	0.125	0.106	0.116
Peak Day Flow(4)	0.211	0.235	0.242	0.229

(1) Average Monthly Flow for July 1 through October 31.
(2) Annual Average Flow is the average flow for the year.
(3) Maximum Month Flow is the flow for the month with the highest average flow in a calendar year.
(4) Peak Day Flow is the flow for the day with the highest flow in a calendar year.

As shown in Table 5-2, the data indicate that the permitted maximum month average flow of 0.5 mgd for the existing facility has not been exceeded in the past 3 years. The average maximum month flow for this period (0.116 mgd) is only 23 percent of the permitted flow of 0.5 mgd.

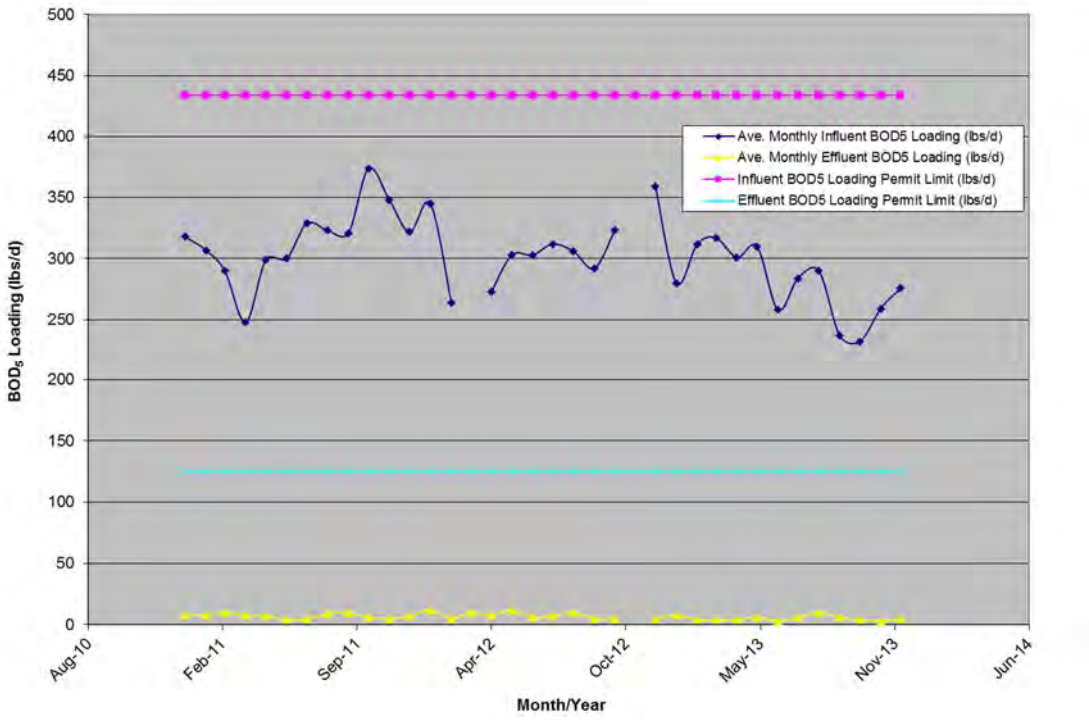


FIGURE 5-1

Historic WWTF Monthly Average Influent Flows

EQUIVALENT RESIDENTIAL UNITS

Projected wastewater flows and loading are based on historic per capita or equivalent residential unit (ERU) flows and loadings, in conjunction with the projected growth within the service area.

Wastewater system requirements are typically evaluated in terms of the number of ERUs requiring sewer service. An ERU is considered equivalent to the average wastewater flow in gallons per day from a typical single family home. Per the 2010 Census, there is an average of 2.8 people per typical single family home in the City of Forks. Commercial and industrial facilities are quantified in the context of sewer capacity as being equivalent to the number of ERUs that generate the same average amount of flow into the wastewater system.

Capacity of the wastewater treatment facility (WWTF) is typically set by the Maximum Month flow. This term refers to the average daily flow during the highest month of wastewater flow in a year, and is the design capacity identified in the facility's State Waste Discharge Permit, as issued by the Washington State Department of Ecology.

Water consumption data can often be used as a surrogate to base the sanitary wastewater flow production and can be used to develop wastewater ERUs. The wastewater ERU value is calculated based on residential winter water use, since water use for irrigation is typically negligible during the winter months and the majority of the water consumed during this period ends up at the WWTF.

Based on past experience with similar sized communities, it is estimated that 80 to 100 percent of winter water use ultimately ends up at the treatment facility. A conservative estimate for the City of Forks assumes that 95 percent of the winter water use ends up as influent to the treatment facility. The remaining 5 percent is assumed lost to winter irrigation, hydrant use, spills and evaporation.

WATER SERVICE CONNECTIONS

Table 5-3 shows the average number of active water service connections within the sewer service area by customer class for the years 2012 and 2013. As seen in the table, the majority of the water service connections are in the single-family residential customer class. Single family residential units account for approximately 72 percent of all connections.

TABLE 5-3

Active Water Service Connections by Customer Class (2012 to 2014)

Customer Class	Number of Active Service Connections[(1)]	
	May 2012 to April 2013	**May 2013 to April 2014**
Single-Family Residential	321	320
Multi-Family Residential	26	26
Commercial	100	100
Total	**447**	**446**

(1) Active Water Service Connections excluding connections with no water use.

Winter water use is used to estimate wastewater volumes entering the collection system because the amount of winter consumption typically is equal to wastewater flow except for a minor amount of water that does not enter the sewer system (such as winter irrigation, hydrant use, spills and evaporation.

Winter water consumption records for 2012 and 2013 were reviewed from the City's water utility database. Table 5-4 presents the winter water consumption in gallons per day (gpd) by customer class. The winter water usage period is considered to be from January 1 to March 31.

TABLE 5-4

Winter Water Use by Customer Class (2013 – 2014)[(1)]

Customer Class	Average Daily Winter Water Use by Customer Class (gpd)		
	2013	**2014**	**Average**
Single-Family Residential	42,860	43,080	42,970
Multi-Family Residential	9,980	10,060	10,020
Commercial	39,500	32,550	36,030
Total	**92,350**	**85,690**	**89,020**

(1) For the period January 1 to March 31.

EQUIVALENT RESIDENTIAL UNITS

The wastewater ERU value in terms of gallons per day (gpd) is calculated by dividing the winter water use for single-family residential (SFR) units (single family residential units account for approximately 72 percent of all connections) by the number of SFR service connections and multiplying by 0.95 as shown in the following equation:

$$ERU_{gpd} = \left({SFR\ Average\ Winter\ Water\ Use_{gpd}}/{SFR\ Connection}\right) X\ 95\%$$

This analysis is summarized in Table 5-5.

TABLE 5-5

Winter Water Use and Equivalent Residential Units (2013-2014)

Parameter	Year		
	2013	**2014**	**Average**
Single-Family Residential Winter Water Use (gpd)	42,860	43,080	42,970
Single-Family Residential Service Connections	321	320	321
Water ERU Value (gpd/ERU)	134	135	134
Wastewater ERU Value (gpd/ERU)(1)	**127**	**128**	**127**

(1) Wastewater ERU Value = 0.95 * Water ERU Value.

Table 5-6 summarizes current wastewater ERUs based on an analysis of winter water use by customer class using a value of 127 gpd/ERU as calculated in Table 5-5. Only water use by customers within the sewer service area is shown.

TABLE 5-6

Winter Water Use and Average Wastewater ERUs (2013 thru 2014)

Customer Type	Average Winter Water Use(1) (gpd)	Average Sewer Base Flow(2) (gpd)	Sewer ERUs(3)	% of Total ERUs
Single-Family Residential	42,970	40,820	321	48 %
Multi-Family Residential	10,020	9,520	75	11 %
Commercial	36,030	34,230	270	41 %
Total	89,020	84,570	666	100 %

(1) Average daily water use for January thru March, 2013 and 2014.
(2) Estimated to be 95 percent of Average Winter Water Use.
(3) Wastewater ERU = 95 percent of avg. winter water use per customer type ÷ 127 gpd/WW ERU.

The sewer base flow derived in the above analysis (0.085 mgd) correlates well (97 percent) with the 2013 dry weather flow as recorded at the treatment facility (0.088 mgd).

Based on the number of multifamily and commercial connections (from Table 5-3) and their respective total number of ERUs (from Table 5-6), it is calculated that the average multifamily and commercial connection accounts for approximately 2.9 and 2.7 sewer ERUs, respectively.

INFILTRATION AND INFLOW

The amount of infiltration and inflow (I/I) can be estimated on an annual average, maximum month and maximum day basis by subtracting the base wastewater flow to the WWTF, which is calculated based on water use, from the annual average, maximum month and maximum day flows recorded at the WWTF. I/I data is also used to estimate future total design flows to the WWTF. To quantify annual average and maximum month I/I, DMRs were reviewed for the period from May 2012 to April 2014. Using this DMR information, the number of ERUs per year, and the base flow determined on a per ERU basis (127 gpd/ERU) enables the calculation of I/I quantity on an annual average, maximum month, maximum day and peak hour basis. For example, annual average flow to the WWTF during the 36 month period from 2011 to 2013 was 0.099 mgd. Subtracting the average sewer base flow of 0.085 mgd during this time period (Table 5-6), results in an annual average I/I flow of 0.014 mgd. Similar calculations were performed for maximum monthly and maximum daily I/I, and the results are presented in Table 5-7.

TABLE 5-7

Estimated Average Infiltration and Inflow (2011 to 2013)

Flow Type	Influent Flow at WWTF (mgd)(1)	Base Flow (mgd)	Total I/I (mgd)(2)	Influent Flow to Base Flow Peaking Factor(3)
Average Dry Weather	0.095	0.085	0.010	1.12
Annual Average	0.099	0.085	0.014	1.16
Maximum Month	0.116	0.085	0.031	1.36
Peak Day	0.229	0.085	0.144	2.69
Peak Hour(4)	1.5	0.298(5)	1.202	5.03

(1) Table 5-2.
(2) Influent Flow at WWTF minus Average Base Flow.
(3) Ratio of the influent flow to the average base flow.
(4) 9:00 AM January 15, 2010 – Peak Hour Flow – Per WWTF Influent Chart.
(5) Peak hour base flow includes a diurnal peaking factor of 3.5 to account for daily domestic flow cycle.

INFILTRATION AND INFLOW ANALYSIS USING EPA CRITERIA

The U.S. EPA manual entitled *I/I Analysis and Project Certification* provides the following recommended guidelines for determining if infiltration and or inflow is excessive.

1. To determine if excessive *infiltration* is occurring, a threshold value of 120 gallons per capita per day (gpcd) is used. This infiltration value is

based on an average daily flow over a 7 to 14 day non-rainfall period during seasonally high groundwater conditions.

2. To determine if excessive *inflow* is present in a collection system, the U.S. EPA uses a threshold value of 275 gpcd. If the average daily flow (excluding major commercial and industrial flows greater than 50,000 gpd each) during periods of significant rainfall exceeds 275 gpcd, the amount of inflow is considered excessive.

A comparison of the EPA criteria and the City of Forks flows are summarized in Table 5-8.

TABLE 5-8

Per Capita Infiltration and Inflow Based on EPA Criteria

Parameter	EPA Criteria for Excessive I/I (gpcd)	Estimated Value (gpcd)
EPA Excessive Infiltration Criteria	120	91(1)
EPA Excessive Inflow Criteria	275	218(2)

(1) Based on average daily influent flow during period from February 17, 2010 to February 23, 2010 of 101,000 gpd. Service area population estimated to be 1,109.

(2) Highest Peak Day flow to WWTF from Table 5-2 equals 0.242 mgd. Service area population estimated to be 1,109.

The "EPA I/I Infiltration Value" for Forks is estimated at 91 gpcd. This is less than the EPA guideline of 120 gpcd and therefore Forks is not considered to have excessive infiltration by EPA criteria. The "EPA I/I Inflow Value" for Forks is estimated at 218 gpcd. This is less than the EPA guideline of 275 gpcd and therefore Forks is not considered to have excessive inflow by EPA criteria.

PROJECTED WASTEWATER FLOWS

The planning period for this General Sewer/Wastewater Facility Plan is from 2014 to 2034, coinciding with a 20-year planning interval. Current wastewater flows and loadings were used in conjunction with projected population and ERU to estimate the projected wastewater flows and loadings.

PROJECTED FUTURE FLOWS WITHIN THE EXISTING SEWER SERVICE AREA

The number of sewer ERUs within the existing sewer service area is anticipated to increase at the same rate of growth as the general population within the City of Forks, 1 percent per year, as reported in Chapter 3. This growth is expected to occur due to infill development on vacant lots, rehabilitation of abandoned lots and changes in land use to

match existing zoning. Commercial growth within the existing sewer service area is expected to occur at the same rate as residential growth.

TABLE 5-9

Projected ERU in Existing Sewer Service Area during the 20-Year Planning Period

Year	Residential ERU[(2)]	Commercial ERU	Total ERU
2014[(1)]	396	270	666
2020	420	287	707
2024	437	298	735
2034	483	329	812

(1) Existing 2014 ERUs, See Table 5-6.
(2) Includes Single-Family Residential and Multi-Family Residential ERUs.

PLANNED EXPANSIONS OF THE SEWER SERVICE AREA

To limit the reliance on septic systems within the City limits, three currently non-sewered areas have been identified by the City for expansion of the sewer service area. The expansion areas are shown in Figure 5-2 and addressed separately below.

Robin Hood Expansion

Existing Connections

The Robin Hood Expansion (Figure 5-2) is approximately 98 acres located to the northwest of the existing sewer service area and primarily zoned moderate density residential (R-3) with some commercial and light industrial areas. Per the City's zoning code, minimum lot sizes within the R-3 zone are restricted to 13,500 square feet, or as dictated by the Washington State Department of Health, due to the use of private septic systems. Multi-family dwelling units within the zone are restricted to a minimum of 3,000 square feet per dwelling unit or approximately 4 units for each 13,500 square foot lot. It is estimated that approximately 5 percent of the existing residential lots are developed multi-family. A summary of the existing ERUs is shown in Table 5-10.

Calawah River

ROBIN HOOD EXPANSION AREA

TRILLIUM AVENUE EXPANSION AREA

BOGACHIEL WAY EXPANSION AREA

N

0 400 800 1,600 Feet

LEGEND:

- CLEANOUT
- MANHOLES
- PUMP STATION
- 6" OR LESS
- 8"
- 10"
- 12"
- 15"
- UGA
- CITY LIMITS
- SEWER SERVICE AREA
- PARCELS

SEWER AREA ZONING

- High Density Commercial - C3
- High Density Commercial / High Density Residential - OL6
- High Density Residential - R4
- Low Density Commercial / High Density Residential - OL1
- Low Density Commercial / Moderate Density Residential - OL2
- Moderate Density Commercial / High Density Residential - OL4
- Moderate Density Commercial / Moderate Density Residential - OL5
- Moderate Density Residential - R3
- Public Land (Open Space, Public Buildings) - PL

FUTURE SEWER AREA ZONING

- General Industrial - I
- Moderate Density Commercial - C2
- Moderate Density Commercial / High Density Residential - OL4
- Moderate Density Commercial / Moderate Density Residential - OL5
- Moderate Density Residential - R3

CITY OF FORKS

GENERAL SEWER/WASTEWATER FACILITY PLAN
FIGURE 5-2
EXPANSION AREAS

Gray & Osborne, Inc.

L:\Forks\13543 Sewer Comp Plan\GIS\fig 5.4 expansion area.mxd

TABLE 5-10

Robin Hood Expansion Area Existing ERU

Zone	Existing Connections	Existing ERU
Single-Family Residential	196(1)	196
Multi-Family Residential	10(2)	29(3)
Commercial/Light Industrial	4	11(4)
Total	**210**	**236**

(1) Based on a residential lot count of 206. Assumes 95 percent residential (0.95*206 = 196).
(2) Based on a residential lot count of 206. Assumes 5 percent multi-family (0.05*206 = 10).
(3) Each multi-family connection equals 2.9 ERU (as discussed following Table 5-6).
(4) Light industrial assumed to be equal to Commercial. Each connection equals 2.7 ERU (as discussed following Table 5-6).

Future Connections

The number of existing sewer ERUs within the Robin Hood expansion area is projected to increase at the same rate of growth as the general population within the City of Forks, 1 percent per year, as determined in Chapter 3. This growth is expected to occur due to infill development on vacant lots, rehabilitation of abandoned lots and changes in land use to match existing zoning. Commercial/Industrial growth within the expansion service area is expected to occur at the same growth rate as residential growth.

Based on the above assumptions, Table 5-11 summarizes the future connections to the sewer system.

TABLE 5-11

Robin Hood Expansion Area Projected ERU during the 20-Year Planning Period

Year	Residential ERU(2)	Commercial ERU	Total ERU
2014(1)	225	11	236
2020	238	12	250
2024	248	12	260
2034	274	14	288

(1) Existing 2014 ERU, See Table 5-10.
(2) Includes single-family and multi-family connections.

Bogachiel Way Expansion

Existing Connections

The Bogachiel Way expansion (Figure 5-2) is located towards the southwest of the existing sewer service area. The expansion area is approximately 100 acres with 78 acres zoned moderate density residential (R3) and 22 acres zoned moderate density commercial/moderate density residential (OL-5).

Based on a count of the lots within the R-3 zoned area, there are 147 developed R-3 lots. It is estimated by the City that approximately 5 percent of these lots are currently developed multifamily.

There are currently 28 lots within the OL-5 zoned area of the Bogachiel Way Expansion. For planning purposes, it is assumed that 50 percent of these lots are developed as residential lots and 50 percent are developed as commercial lots. As with the Robin Hood Expansion area, each commercial connections is assumed to be equal to 2.7 ERU. Of the residential OL-5 lots, 5 percent are estimated to be Multifamily residential. Each multifamily connection is equivalent to 2.9 ERU.

Table 5-12 summarizes the expansion area zoning and existing ERU.

TABLE 5-12

Bogachiel Way Expansion Area Zoning and Existing ERU

Zone	Existing Connections	Existing ERU
Single-Family Residential (R-3)	140(1)	140
Multi-Family Residential (R-3)	7(2)	20(3)
Commercial (OL-5)	14(4)	38(5)
Single-Family Residential (OL-5)	13(6)	13
Multi-Family Residential (OL-5)	1(7)	3(3)
Total	**175**	**214**

(1) Based on an R-3 residential lot count of 147. Assumes 95 percent single-family residential (0.95*147 = 140).
(2) Based on an R-3 residential lot count of 147. Assumes 5 percent multi-family (0.05*147 = 7).
(3) Each multi-family connection equals 2.9 ERU (as discussed following Table 5-6).
(4) Based on lot count of 28. Assumes 50 percent residential (0.5*28 = 14)
(5) Each Commercial connection equals 2.7 ERU (as discussed following Table 5-6).
(6) Based on an OL-5 lot count of 14 (50% of 28). Assumes 95 percent single-family residential (0.95*14=13)
(7) Based on an OL-5 lot count of 14 (50% of 28). Assumes 5 percent multi-family (0.5*14 =1)

Future Connections

The number of existing sewer ERUs within the Bogachiel Way expansion area is projected to increase at the same rate of growth as the general population within the City of Forks; 1 percent per year, as determined in Chapter 3. This growth is expected to occur due to infill development on vacant lots, rehabilitation of abandoned lots and changes in land use to match existing zoning. Commercial growth within the expansion service area is expected to occur at the same growth rate as residential growth.

Based on the above assumptions, Table 5-13 summarizes the future connections to the treatment facility.

TABLE 5-13

Bogachiel Way Expansion Area Projected ERU during the 20-Year Planning Period

Year	Residential ERU(2)	Commercial ERU	Total ERU
2014(1)	176	38	214
2020	187	40	227
2024	194	42	236
2034	215	46	261

(1) Existing 2014 ERU, See Table 5-12.
(2) Includes Single-Family and Multi-Family Residential Connections.

Trillium Avenue Expansion

Existing Connections

The Trillium Avenue expansion (Figure 5-2) is located towards the northeast of the existing sewer service area. The expansion area is approximately 49 acres with 39 acres zoned moderate density residential (R-3) and 10 acres zoned moderate density commercial/high density residential (OL-4).

Based on a count of the lots within the R-3 zoned area, there are 75 R-3 lots. The City estimates that 5 percent of these lots are currently developed for multifamily use.

There are currently 28 lots within the OL-4 zoned area of the Trillium Avenue Expansion. For planning purposes, it is assumed that 50 percent of these lots are residential and 50 percent are commercial. As with the previously discussed expansion areas, each of the commercial connections is assumed to be equal to 2.7 ERU. Of the residential OL-4 lots, 5 percent are estimated to be Multifamily residential. Each multifamily connection is equivalent to 2.9 ERU.

Table 5-14 summarizes the expansion area zoning and existing ERU.

TABLE 5-14

Trillium Avenue Expansion Area Zoning and Existing ERU

Zone	Existing Connections	Existing ERU
Single-Family Residential (R-3)	71(1)	71
Multi-Family Residential (R-3)	4(2)	12(3)
Commercial (OL-5)	14(4)	38(5)
Single-Family Residential (OL-5)	13(6)	13
Multi-Family Residential (OL-5)	1(7)	3(3)
Total	**103**	**137**

(1) Based on an R-3 residential lot count of 75. Assumes 95 percent single-family residential (0.95*147 = 140).
(2) Based on an R-3 residential lot count of 75. Assumes 5 percent multi-family (0.05*147 = 7).
(3) Each average multi-family connection equals 2.9 ERU (as discussed following Table 5-6).
(4) Based on lot count of 28. Assumes 50 percent commercial (0.5*28 = 14).
(5) Each Commercial connection equals 2.7 ERU (as discussed following Table 5-6).
(6) Based on an OL-5 lot count of 14 (50% of 28). Assumes 95 percent single-family residential (0.95*14=13).
(7) Based on an OL-5 lot count of 14 (50% of 28). Assumes 5 percent multi-family (0.5*14 =1).

Future Connections

The number of existing sewer ERUs within the Trillium Avenue expansion area is projected to increase at the same rate of growth as the general population within the City of Forks, 1 percent per year, as determined in Chapter 3. This growth is expected to occur due to infill development on vacant lots, rehabilitation of abandoned lots and changes in land use to match existing zoning. Commercial growth within the expansion service area is expected to occur at the same growth rate as residential growth.

Based on the above assumptions, Table 5-15 summarizes the future connections to the treatment facility.

TABLE 5-15

Trillium Avenue Expansion Area Projected ERU during the 20-Year Planning Period

Year	Residential ERU[2]	Commercial ERU	Total ERU
2014[1]	99	38	137
2020	105	40	145
2024	109	42	151
2034	121	46	167

(1) Existing 2014 ERU, See Table 5-14.
(2) Includes Single Family and Multi-Family Residential Connections.

ERU SUMMARY

The number of ERU calculated in the above analyses reflects the 20-year build-out conditions within their representative areas. To estimate the number of ERUs served by the treatment facility at the 6-year and 10-year planning stage, linear growth rates are assumed. ERUs in both the existing and future sewer service areas are projected to grow linearly at 1 percent over the 20-year planning period of this Plan from 2014 to 2034. The ERUs associated with the existing sewer service area are assumed to connect to the sewer system at the rate of growth. The ERUs associated with the expansions areas are assumed to begin connecting to the sewer system beginning in the year 2020 and connect at a linear rate over the 14 year period of time to 2034. It is assumed that all expansion area ERUs will be connected by 2034.

Table 5-16 summarizes the projected ERUs for the 6, 10 and 20 year planning period based on the above assumptions.

TABLE 5-16

Current and Projected ERU and Flows

Zone	Projected ERU			
	Current	Projected 6 year (2020)	Projected 10 year (2024)	Projected 20 year (2034)
Existing Sewer Service Area[1]	666	710	739	812
Robin Hood Expansion[2]	0	0	82	288
Bogachiel Way Expansion[2]	0	0	75	261
Trillium Avenue Expansion[2]	0	0	48	167
Total	**666**	**710**	**944**	**1,528**

(1) Projected ERU = (2034 ERU minus Current ERU)/20 years* No. of years + existing ERU.
(2) Projected ERU = (2034 ERU minus Current ERU)/14 years* No. of years + existing ERU. Connections begin in year 2020.

The following is the basic formula used to estimate the future design flows at the WWTF:

$$\boldsymbol{Projected\ Flow = (Projected\ ERU * Base\ Flow\ per\ ERU) * Peaking\ Factor}$$

Table 5-17 summarizes the projected flows to the WWTF for the 6, 10 and 20 year planning period.

TABLE 5-17

Current and Projected WWTF Flows

Design Flow	Projected Flows (mgd)			
	Current	Projected 6 Year (2020)	Projected 10 Year (2024)	Projected 20 Year (2034)
Base Flow(1)	0.085	0.090	0.120	0.194
Annual Average(2)	0.099	0.105	0.139	0.225
Maximum Month(3)	0.125	0.133	0.176	0.285
Peak Day(4)	0.242	0.257	0.342	0.553
Peak Hour(5)	0.427	0.453	0.513	0.976

(1) Total Base Flow excluding I/I = total ERUs * 127 gpd/ERU.
(2) Projected Base flow * 1.16 (Annual Average Peaking Factor from Table 5-7).
(3) Projected Base flow * 1.47 (Maximum Month Peaking Factor from Table 5-7).
(4) Projected Base flow * 2.85 (Peak Day Peaking Factor from Table 5-7).
(5) Projected Base flow * 5.03 (Peak Hour Peaking Factor from Table 5-7).

EXISING AND PROJECTED WASTEWATER LOADING

EXISTING BOD_5 LOADING

Monthly average influent BOD_5 loadings ranged from 222 lb/day to 374 lb/day for the 36-month period of analysis as shown in Table 5-1. The permitted average influent BOD_5 design loading of 434 lb/day was not exceeded during this time period. The average and maximum monthly influent BOD_5 concentrations during the period of analysis were 357 mg/L and 438 mg/L respectively. The maximum month BOD_5 loading (374 lb/d) to the facility occurred during the month of October 2011. The March 2012 loading of 425 lb/d was not used in this analysis as this value is not considered representative of the influent at the treatment facility. The service area population at this time is estimated to be approximately 1,109 people. This BOD_5 loading and population translates to a maximum month BOD_5 loading of 0.34 lb per capita per day (lb/cap/d). This value is approximately 75 percent higher than the typical Maximum Month design value (0.2 lb/cap/d) recommended by the Washington State Department of Ecology (Ecology) in the 2008 *Criteria For Sewage Works Design* (Orange Book) for design use when historical data is not available. The high per capita BOD_5 loading is likely a result of the hospital, schools, restaurants, and other commercial entities, particularly those

affected by tourism, that typically generate higher strength wastewater and originate from sources other than the resident population. The average monthly influent BOD_5 loading to the facility during this time period was 300 lb/day. This BOD_5 value and population translates to an average BOD_5 loading of 0.27 lb/cap/d. The ratio of maximum month to annual average BOD_5 loading is 1.25. The ratio of the annual average to maximum month loading is used in the development of future loadings to the treatment facility.

The annual average and maximum month BOD_5 loadings per ERU, based on the current number of ERUs (666) is 0.45 lb/d/ERU and 0.56 lb/d/ERU respectively.

Historic BOD_5 loading is summarized in Figure 5-3.

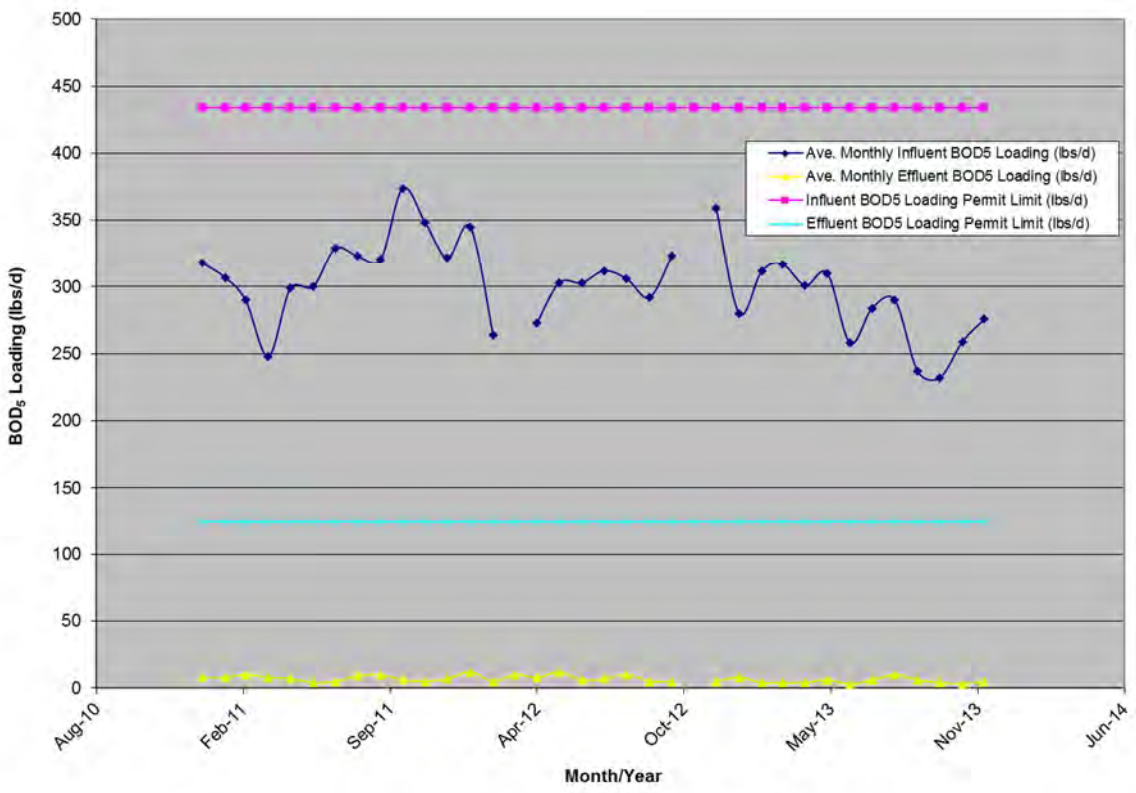


FIGURE 5-3

Historic WWTF Monthly Average BOD_5 Loadings

EXISTING TOTAL SUSPENDED SOLIDS LOADING

Monthly average influent TSS loadings ranged from 135 lb/day to 297 lb/day for the 36-month period of analysis as shown in Table 5-1. The permitted average influent TSS design loading of 434 lb/day was not exceeded during this time period. The average and maximum influent TSS concentrations during the period of analysis was 239 mg/L and 308 mg/L respectively. The maximum month TSS loading to the facility (297 lb/d)

occurred during the month of March in 2012. The service area population at this time is estimated to be approximately 1,109. This TSS loading and population translates to a maximum month TSS loading of 0.27 lb per capita per day (lb/cap/d). This value is approximately 40 percent greater than the typical Maximum Month design value (0.2 lb/cap/d) recommended in the Ecology Orange Book, for design use when historical data is not available. The high per capita TSS loading is likely a result of the hospital, schools, restaurants, and other commercial entities, particularly those affected by tourism, that typically generate higher strength wastewater and originate from sources other than the resident population. The average monthly influent TSS loading to the facility during this time period was 201 lb/day. This TSS value and population translates to an average TSS loading of 0.18 lb/cap/d. The annual average TSS loading per ERU is 0.3 lb/d/ERU, based on the current number of ERUs (666). The maximum month loading per ERU is 0.45 lb/d/ERU. The annual average loading and the ratio of the maximum month to annual average loading (1.48) is used in the development of future loadings to the treatment facility.

Historic TSS loading is summarized in Figure 5-4.

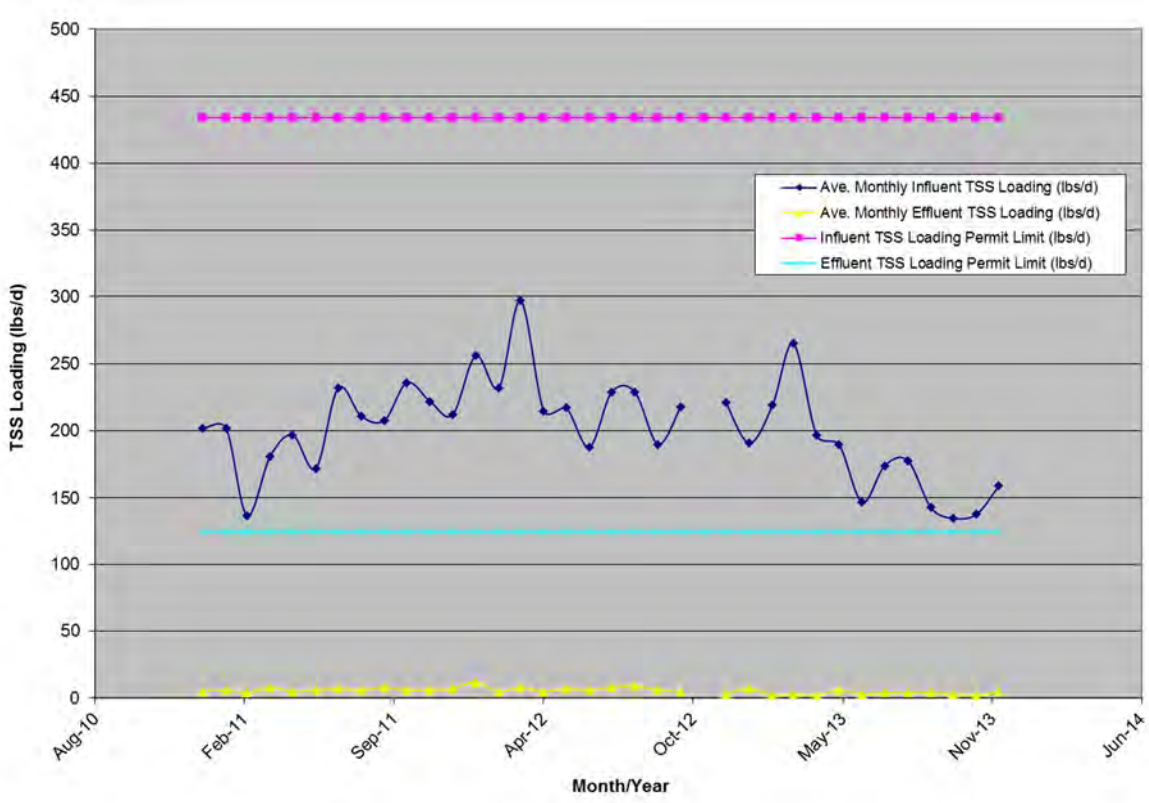


FIGURE 5-4

Historic WWTF Monthly Average TSS Loadings

EXISTING AMMONIA (TKN) LOADING

Influent ammonia and TKN are not measured at the treatment facility. Consequently, typical values for domestic wastewater are used in the analysis. Typical concentration of ammonia as NH_3-N in raw wastewater is approximately 15 percent of influent BOD_5. With an influent BOD_5 concentration of 374 mg/L, as noted previously, the NH_3-N concentration is estimated to be approximately 56 mg/L. Annual average loading and maximum month loading are calculated from the annual average and maximum month flows respectively using the following equation.

$$Loading_{(lb/d)} = flow_{(mgd)} * concentration_{(mg/L)} * 8.34$$

Using the above equation, the current annual average and maximum month TKN loadings to the facility are 46 lb/d and 58 lb/d.

PROJECTED FUTURE WASTEWATER LOADING

Future treatment facility annual average BOD_5 and TSS loading are estimated by multiplying the projected number of future ERUs by the historical average loading per ERU. Future maximum month BOD_5 and TSS loadings are estimated by multiplying by the maximum month to annual average ratio.

Table 5-18 provides a summary of projected future treatment facility loadings.

TABLE 5-18

Current and Projected Loadings

Criteria	Projected Current (2014)	Projected 6 year (2020)	Projected 10 year (2024)	Projected 20 year (2034)
Total ERU(1)	666	707	941	1,528
Annual Average BOD_5 (lb/d)(2)	300	318	423	688
Maximum Month BOD_5 (lb/d)(3)	374	398	529	860
Annual Average TSS (lb/d)(4)	201	212	282	458
Maximum Month TSS (lb/d)(5)	297	314	418	678
Annual Average TKN (lb/d)(6)	46	49	65	105
Maximum Month TKN (lb/d)(7)	58	62	82	133

(1) Table 5-16.
(2) Projected Value = 0.45 lb/d/BOD_5/ERU * ERU.
(3) Projected Value = 0.45 lb/d/BOD_5/ERU * ERU * MM:AA peaking factor (1.25).
(4) Projected Value = 0.3 lb/d/TSS/ERU * ERU.
(5) Projected Value = 0.3 lb/d/TSS/ERU * ERU * MM:AA peaking factor (1.48).
(6) Projected Value = Calculated based on 36 mg/L using Annual Average Flow.
(7) Projected Value = Calculated based on 36 mg/L using Maximum Month Flow.

CHAPTER 6

WASTEWATER COLLECTION SYSTEM

INTRODUCTION

The purpose of this chapter is identify and provide cost estimates for recommended improvements and expansions to the City of Forks wastewater collection system to remain in regulatory compliance, accommodate growth projections and/or reduce the number of on-site septic systems. Recommendations for improvements in collection system management in order to reduce infiltration and inflow and protect the investment in the collections system are also provided.

COLLECTION SYSTEM

The existing collection system was described in Chapter 4. An analysis of the infiltration and inflow for the existing collection system was provided in Chapter 5. Conclusions from these chapters are summarized in the following paragraphs. Detailed cost estimates for all projects are included in Appendix C.

MILL CREEK PUMP STATION

Condition

The Mill Creek pump station pumps sewage from the small basin on the southwest side of Mill Creek along Highway 101. The pump station location is shown in Figure 4-1. The pump station was installed in 1986 and has had minimal upgrades since its installation. Although the wet well structure appears in good condition, the pumps are in poor condition and are no longer reliable. The retrieval systems for the pumps are corroded hindering maintenance on the pumps. It is recommended that the pumps, retrieval system and control panel be replaced.

Capacity

The station consists of two 5-horsepower submersible pumps each with a capacity of 350 gpm. The collection basin served by this pump station is small and the existing pumps have sufficient capacity to convey the collected flows to the gravity system.

Recommendations

It is recommended that the pump station be improved with new pumps, guide rails and retrieval mechanism. It is also recommended that a new control panel be installed for the station. The estimated cost of the pump station improvements is $80,000.

GRAVITY COLLECTION SYSTEM

Condition

The majority of the collection system was installed in 1986 as part of a utility local improvement district. The system has not had significant expansions since its original installation. City staff is not aware of areas that experience surcharging during high flow periods. The system is comprised of PVC piping. At the current age of the pipes, roughly 30 years old, the anticipated life span of the pipe network exceeds the 20-year planning period.

Capacity

The existing pipe network consists of several 8-inch-diameter collection systems and one 10-inch-diameter collector system, each serving a small subbasin within the sewer service area. All collector systems discharge flows to a 12-inch truck line that runs from the northeast to the southwest through the sewer service area. The 12-inch trunk line discharges to a 15-inch trunk line that discharges to the WWTP. Per the 1986 record drawings, all pipes have been installed at slopes greater than or equal to the minimum slopes recommended in the 2008 Ecology *Criteria for Sewage Works Design*.

The 8-inch collector systems have an estimated capacity of 0.58 mgd at the allowable minimum slope of 0.004 ft/ft. The total projected peak hour flow at the end of the existing 12-inch trunk line is approximately 0.63 mgd. The 8-inch collector systems have adequate capacity to convey peak hour flows from their contributing basins to the 12-inch trunk line.

The 10-inch collector system serves the southern portion of the existing sewer service area from the Mill Creek pump station discharge to the connection to the 12-inch trunk line at 2nd Avenue and D Street. At the minimum allowable slope (0.0028 ft/ft) this 10-inch line has a capacity of 0.88 mgd. This exceeds the projected peak hour flow for flows generated within the entire existing collection area. The 10-inch collector system has adequate capacity to convey flows from its contributing basin to the 12-inch trunk line.

At minimum slopes, the 12-inch and 15-inch trunk lines have capacities of 1.3 mgd and 1.9 mgd respectively. These capacities are in excess of the projected 2034 peak hour flow to the treatment plant. The 12-inch and 15-inch trunk lines have sufficient capacity to convey peak hour flows to the WWTP.

Recommendations

There are no recommended improvements for the collection system.

COLLECTION SYSTEM OPERATIONS AND MAINTENANCE

To keep the sewer system in optimal condition requires the collective efforts of the City operations staff, City administration, and the City Council, The City of Forks has operations and maintenance procedures and routines that are used to keep the collection system functioning. In evaluating the appropriateness and effectiveness of these procedures and routines, the City can use the draft Capacity Management Operation and Maintenance (CMOM) rules developed by the Environmental Protection Agency as a guide. EPA developed these proposed rules to help reduce occasional unplanned sanitary sewer overflows (SSOs) that can occur from sewer collection systems. The proposed rules were issued in draft form in 2003 but to date have not been adopted. Although it is uncertain when or if final rules will be issued, the CMOM rules provide a model the City can use to evaluate the develop maintenance programs for the collection system.

Each of the draft CMOM rules is presented below along with a brief discussion of how the City could address each one.

1. **Meet general sewer system performance standards including up to date system maps, information management systems, and odor control requirements.**

   The City has an up-to-date sewer base map in GIS to track maintenance and repair. No odor control systems are located within the system, and no odor control complaints have been identified.

2. **Maintain program documentation including the goals, organization, and legal authority of the organization operating the collection system.**

   The City has well defined lines of authority for the operation of the collections system. The City should develop goals for maintaining the collection system.

3. **Develop an overall response plan that can respond to releases in less than 1 hour and is demonstrated to have sufficient personnel and resources.**

   The City should develop a formal response plan in order to respond to releases in a timely manner.

4. Plan for system maintenance, evaluation, and replacement requirements mandating that the collection system be cleaned on scheduled bases, regularly video inspected, and develop a short- and long-term program for pipeline replacement and rehabilitation.

The City currently conducts routing maintenance on the collection system in the form of yearly manhole inspections and washdowns. It is recommended that the City develop a regular schedule for television inspection and cleaning of the pipe network.

5. Plan for controlling Fats, Oils, and Grease (FOG) that impact incidences of SSOs.

The City currently encourages the use of grease traps to control fats, oils and grease. The traps are inspected annually by the building inspector. The use of grease traps is not covered in a City Ordinance. It is recommended that the City consider adoption of a pretreatment ordinance for FOG. Additionally, the City should incorporate an educational element into the existing program to assist existing and future customers in understanding the cost and system performance impacts of FOG.

6. Develop a capacity assurance and management plan with flow meters to model infiltration and Inflow (I/I) and system capacity.

Influent flow measurement is recorded at the headworks of the WWTP. I/I in the system is not deemed excessive based on the EPA criteria and the removal of I/I sources is not recommended at this time. Prior to planning future sewer main replacement or I/I removal projects, the City should evaluate the collection system using portable flow meters to identify any locations of significant I/I.

7. Develop a self-audit program to evaluate and adjust performance.

Using historical plant flow records, the City is capable of determining the success of any pipeline replacement or rehabilitation program. The City should implement a program for compiling and evaluating these records and develop a system for maintenance based on identified problem areas.

8. Develop a program to communicate information on problems, costs, and improvements to the public and decision makers.

The City consistently updates sewer and facility plans to identify needs, develop costs for improvements and inform the decision makers. The City Council conducts regularly scheduled meetings where sewer issues can be discussed. The City should continue to periodically provide information

to the public regarding issues with the sewer system and explain the City's short- and long-term response to these issues.

EXPANSION AREAS.

If the City moves forward with the expansion of the sewer service area to include the three proposed basins, new collection systems will need to be constructed in order to connect the expansion areas to the existing sewer system. The proposed basins include:

- Robin Hood Basin, located northwest of the city center and centered around Terra Eden Loop;

- Bogachiel Way basin, located southeast of the city center near the intersection of Bogachiel Way and 7th Avenue;

- Trillium Avenue basin, located northeast of the city center near the intersection of Calawah Way and Trillium Avenue.

Subbasins within each expansion area were defined using existing topography and rights-of-way to maximum the utilization of gravity systems.

COLLECTION SYSTEM ALTERNATIVE ANALYSIS

Three alternative collection systems were considered in this analysis. A brief description of each alternative, along with the associated project costs, are presented below.

- Gravity Collection System Alternative: Provide gravity sewer service to all homes within the three expansion areas.

  Estimated Alternative Project Cost: $9,825,000

- STEP Collection System Alternative: Provide STEP system with duplex pumps and pressure mains to serve all properties within the three expansion areas.

  Estimated Alternative Project Cost: $12,168,000

- Grinder Pump Collection System Alternative: Provide duplex grinder pump systems and pressure mains to serve all properties within the three expansion areas.

  Estimated Alternative Project Cost: $12,681,000

Typically, if topography allows, gravity systems are the most economic method of sewage collection and conveyance, both in terms of capital costs and operation and

maintenance costs. This is especially true if construction does not require excessively deep pipe depths and soil conditions are amenable to trenching. Another factor influencing the design of collection systems is the density of the proposed connections. Gravity collection systems become more attractive as connection density increases. Where connections are few and relatively far apart, the increased costs of individual septic tanks and pumps that accompany STEP and grinder systems, can be offset by the lower cost of a smaller diameter pipe network and shallower trenches. With the exception of the Bogachiel West subbasin expansion area, all proposed expansion areas can be served entirely by gravity systems. The southwest corner of the Bogachiel West subasin slopes to the southwest, away from the existing gravity system. To provide service to this area a 60 gpm lift station is included in the gravity system alternative. The lift station would pump the flow from this area to the proposed gravity system within the basin.

Table 6-1 summarizes the project costs for the three alternative collection systems. Detailed project cost estimates are provided in Appendix C. Costs shown for STEP and Grinder options do not include the abandonment of existing septic systems or potential upgrades to the property owner's electrical systems to support the pumps.

TABLE 6-1

Collection System Alternatives Cost Estimate Summary

Collection System Area	Gravity System Project Costs	STEP System Project Costs	Grinder System Project Costs
Robin Hood East Basin	$1,629,000	$2,213,000	$2,540,000
Robin Hood West Basin	$1,494,000	$2,194,000	$2,535,000
Bogachiel West Basin	$3,066,000	$2,585,000	$2,904,000
Bogachiel East Basin	$1,373,000	$2,646,000	$1,834,000
Trillium North Basin	$1,343,000	$1,375,000	$1,550,000
Trillium South Basin	$920,000	$1,155,000	$1,318,000
Total	$9,825,000	$12,168,000	$12,681,000

These costs indicate that a gravity collection system will be the least costly means of providing sewer service to every expansion area except for the Bogachiel West subbasin. We recommend that all expansions to the collection system be gravity based. Gravity sewer systems are easily expanded to meet future growth. The Bogachiel West subbasin is zoned moderate density residential. To the south of this basin the zoning is moderate density commercial/moderate density residential. Given the zoning to the south, sewer expansion into this area would seem likely at some point in the future. The proposed lift station in the gravity alternative would provide a connection for expansion into the area to the south of the Bogachiel West subbasin. It is therefore recommended that gravity sewer systems be provided in all proposed expansion areas.

For the purpose of this report, each basin's proposed new gravity collection system was laid out using minimum pipe slopes in accordance with the 2008 DOE *Criteria for Sewer Works Design*. Maximum manhole spacing was set at 500 linear feet and manholes are assumed to be 48-inch-diameter precast structures. Connection to the existing collection system in each subbasin was at an existing manhole. Each system was also sized and oriented to accommodate additional future connections, where applicable. Side sewer residential and commercial connections are assumed to be made using 4-inch or 6-inch polyvinylchloride (PVC) pipe. For cost estimating purposes, all wastewater collection mains are assumed to be located in existing rights-of-way.

2014 dollar cost estimates for the proposed collection system expansions include mobilization/demobilization, materials, installation, sales tax (8.5%), contingency (20%), and engineering and administrative costs (25%). The assumed Engineering News-Record (ENR) construction cost index value was 10,164. Project costs are indicated below, and detailed cost estimates for each subbasin's collection system are included in Appendix C. The installation and connection of side sewers on individual properties is not included in the cost estimate and is assumed to be paid for by the property owner.

The proposed new collection basins and system connection are shown in Figure 6-1 and are described individually below.

ROBIN HOOD DRAINAGE BASIN

Robin Hood East

The Robin Hood East subbasin includes developments west of 3rd Avenue West, south of Converse Way, east of Sherwood Avenue, and north of East Division Street. The proposed system includes 6,300 LF of 8-inch PVC sewer pipe and generally flows east and south. The new system includes 23 new manholes. Connection to the existing collection system will occur at Manhole #88 south of the intersection of Terra Eden Road and Rain Drop Place. The Sherwood Avenue and Klahndike Boulevard sewer main plan and profile is shown in Figure 6-2.

The estimated project cost in 2014 dollars for the new Robin Hood East collection system is $1,630,000.

Robin Hood West

The Robin Hood West subbasin includes development west of Sherwood Avenue and north of Nottingham Way. The proposed system includes 5,500 LF of 8-inch PVC sewer pipe and generally flows east and south. The new system includes 22 new manholes. Connection to the existing collection system will occur at Manhole #86 near the eastern extent of Nottingham Way. The Robin Hood Loop sewer main plan and profile is shown in Figure 6-3.

The estimated project cost in 2014 dollars for the new Robin Hood West collection system is $1,494,000.

BOGACHIEL DRAINAGE BASIN

Bogachiel East

The Bogachiel East subbasin includes development east of 7th Avenue, residences immediately north and south of G Street in the south, west of South Forks Avenue, and south of West E Street. The proposed system includes 5,940 LF of 8-inch PVC sewer pipe and generally flows east and north. The new system includes 15 new manholes. Connection to the existing collection system will occur at Manhole #93 near the intersection of Bogachiel Way and 7th Avenue. The G Street and 7th Avenue sewer main plan and profile is shown in Figure 6-4.

The estimated project cost in 2014 dollars for the new Bogachiel East collection system is $1,343,000.

Bogachiel West

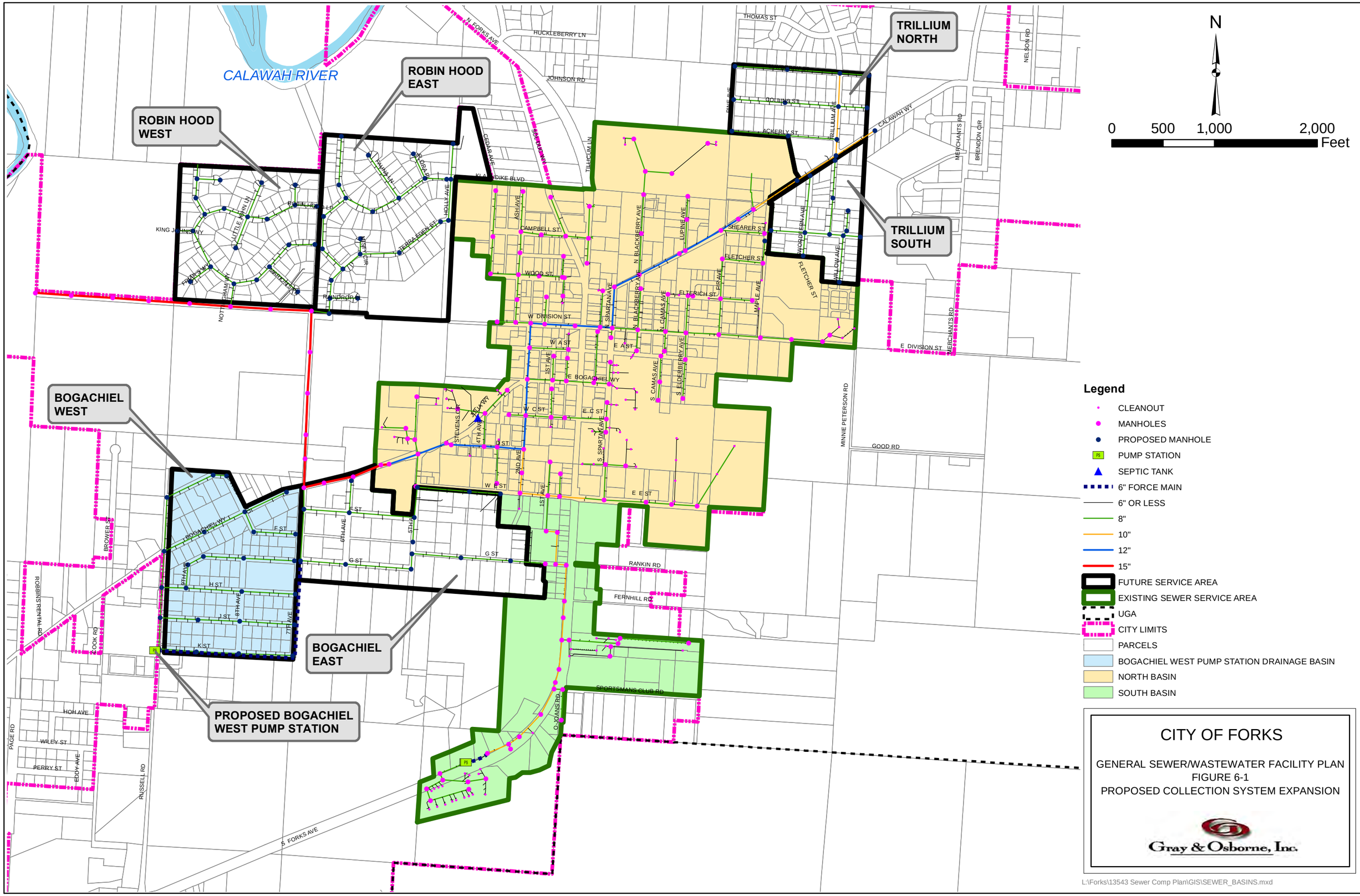
The Bogachiel West subbasin includes development east of Russell Road, west of 7th Avenue, north of K Street, and south of the Danielson Road Loop and Bogachiel Way. The proposed system includes 9,220 LF of 8-inch PVC sewer pipe and generally flows east and south. There are 98 existing private residential connections in this subbasin. The new system includes 25 new manholes. The Russell Road and Bogachiel Way sewer main plan and profile is shown in Figure 6-5.

Topography in this subbasin slopes south and away from the collection system main within the Bogachiel Way right-of-way. In order to maintain a minimum cover over the proposed sewer pipe, it is necessary to drain the wastewater south to a proposed pump station. Wastewater will flow to the pump station, then be pumped through 2,120 linear feet of 6-inch-diameter ductile iron force main east along K Street and north along 7th Avenue before connecting to proposed Manhole #194 at the intersection of 7th Avenue and G Street. The proposed Bogachiel West Pump Station is described in the next section.

The estimated project cost in 2014 dollars for new Bogachiel West collection system is $3,066,000. The cost estimate includes both the proposed pump station and 6-inch ductile iron force main as well as the gravity collection system.

Bogachiel Pump Station

The proposed Bogachiel Pump Station is a submersible grinder pump station and was assumed to be located near the intersection of Russell Road and K Street. The feasibility of use of this location must be reassessed prior to final design, and any adjustments to


CALAWAH RIVER
ROBIN HOOD WEST
ROBIN HOOD EAST
TRILLIUM NORTH
TRILLIUM SOUTH
BOGACHIEL WEST
BOGACHIEL EAST
PROPOSED BOGACHIEL WEST PUMP STATION
N
0 500 1,000 2,000 Feet
Legend
CLEANOUT
MANHOLES
PROPOSED MANHOLE
PUMP STATION
SEPTIC TANK
6" FORCE MAIN
6" OR LESS
8"
10"
12"
15"
FUTURE SERVICE AREA
EXISTING SEWER SERVICE AREA
UGA
CITY LIMITS
PARCELS
BOGACHIEL WEST PUMP STATION DRAINAGE BASIN
NORTH BASIN
SOUTH BASIN
CITY OF FORKS
GENERAL SEWER/WASTEWATER FACILITY PLAN
FIGURE 6-1
PROPOSED COLLECTION SYSTEM EXPANSION
Gray & Osborne, Inc.
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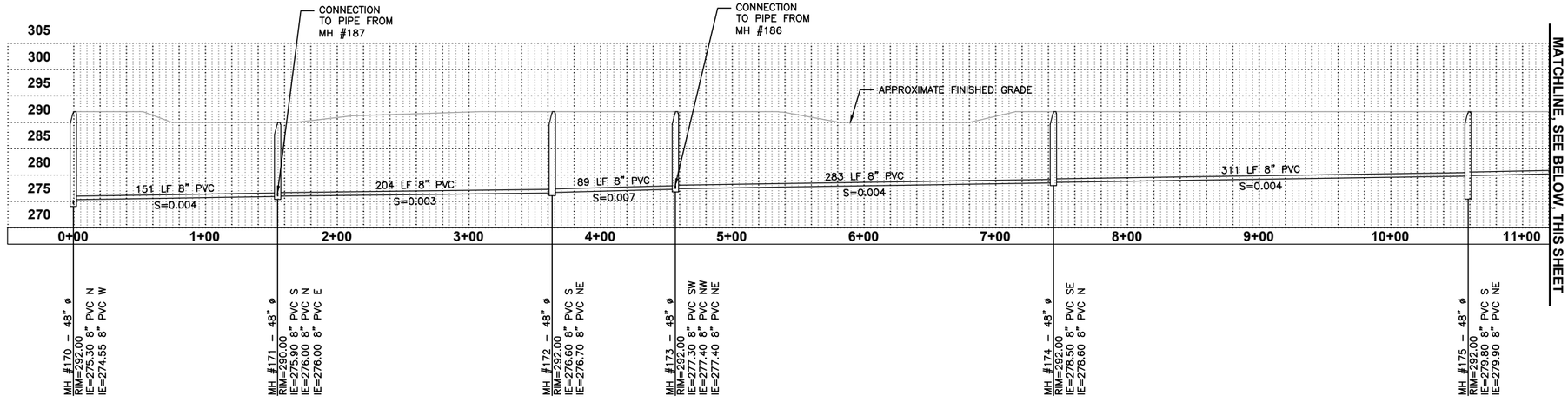
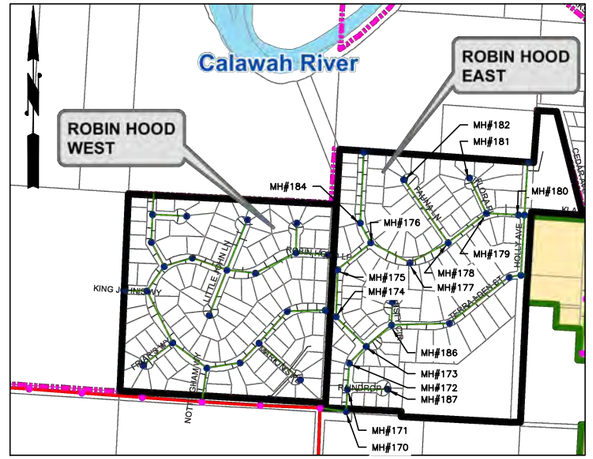


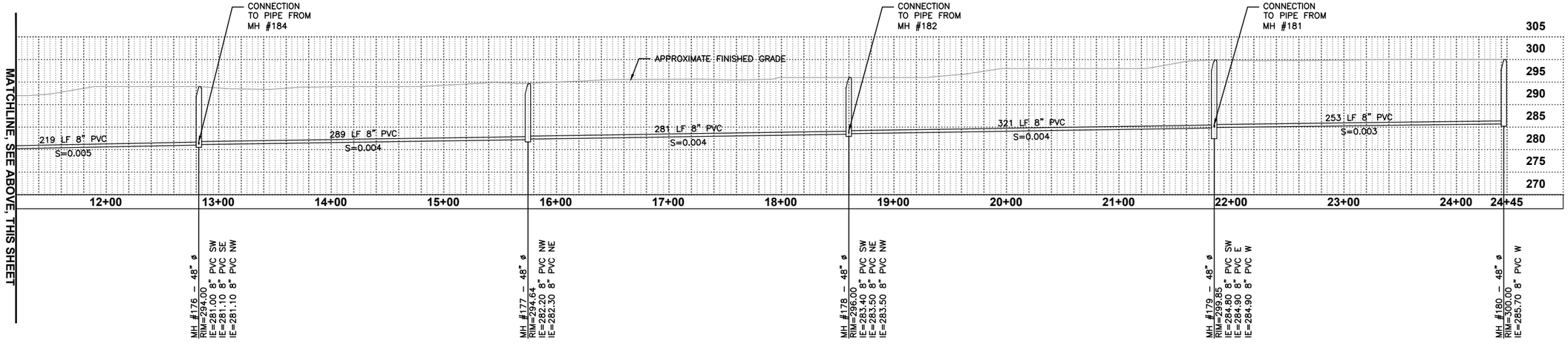
PROFILE

SCALE: 1" = 100' HORIZONTAL
1" = 5' VERTICAL



LOCATION MAP

NOT TO SCALE



PROFILE

SCALE: 1" = 100' HORIZONTAL
1" = 5' VERTICAL

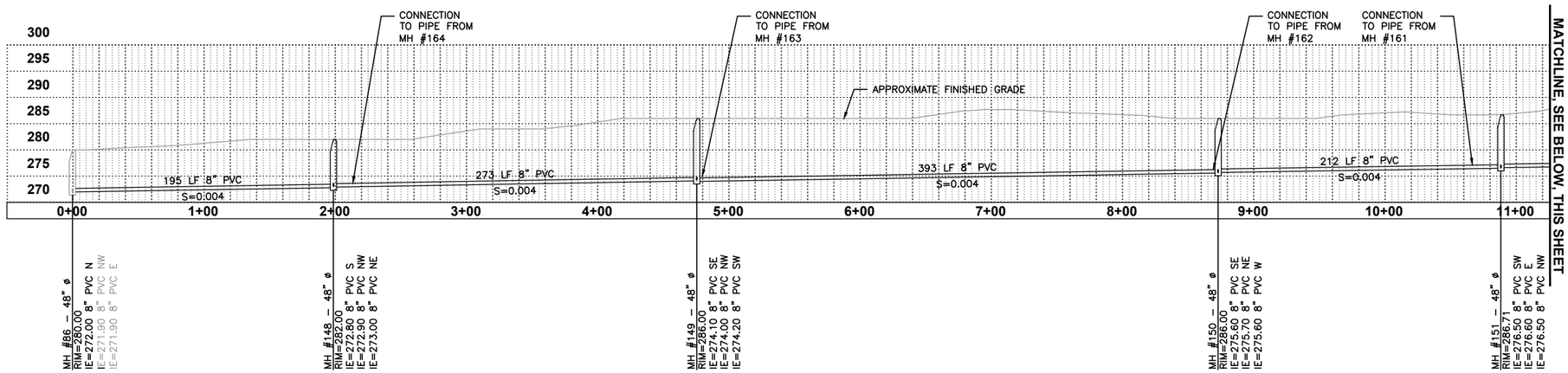
NOTE:

PROPOSED FACILITIES SHOWN IN BOLD TYPE.
EXISTING FACILITIES SHOWN SHADED BACK.

CITY OF FORKS

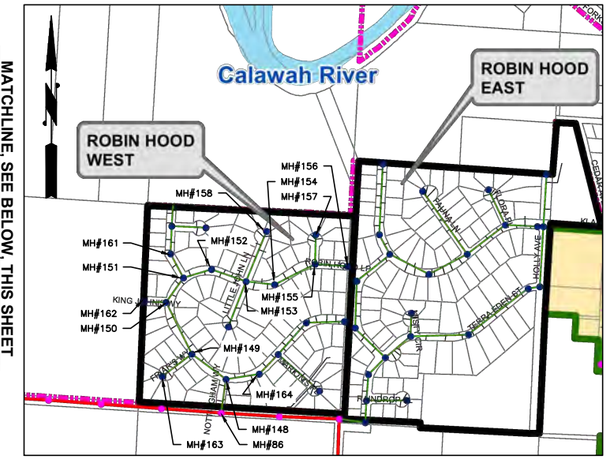
GENERAL SEWER/WASTEWATER
FACILITY PLAN
FIGURE 6-2
ROBIN HOOD EAST SEWER MAIN
PLAN AND PROFILE

Gray & Osborne, Inc.
CONSULTING ENGINEERS



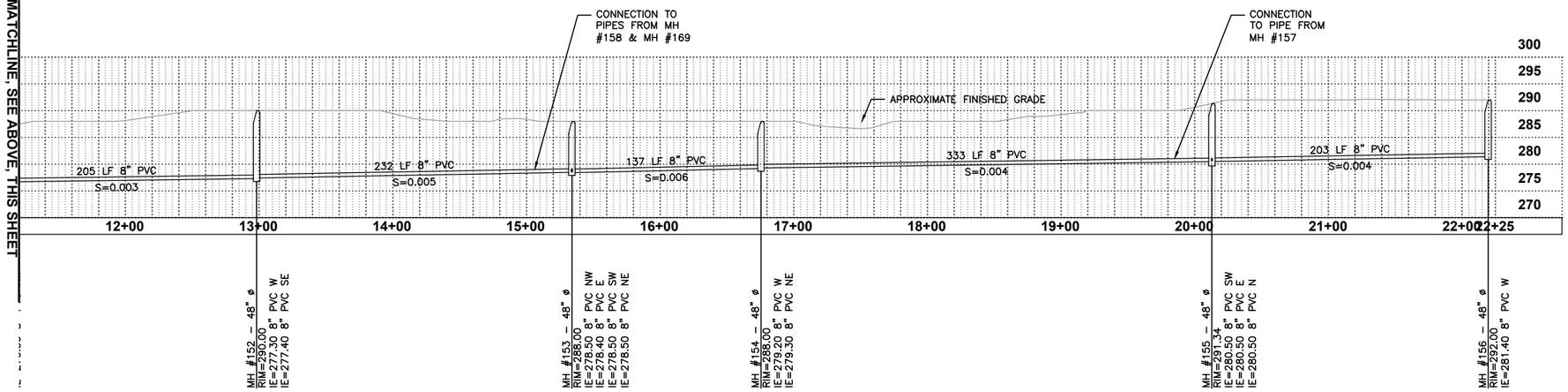
PROFILE

SCALE: 1" = 100' HORIZONTAL
1" = 5' VERTICAL



LOCATION MAP

NOT TO SCALE



PROFILE

SCALE: 1" = 100' HORIZONTAL
1" = 5' VERTICAL

NOTE:

PROPOSED FACILITIES SHOWN IN BOLD TYPE.
EXISTING FACILITIES SHOWN SHADED BACK.

CITY OF FORKS

GENERAL SEWER/WASTEWATER
FACILITY PLAN
FIGURE 6-3
ROBIN HOOD WEST SEWER
MAIN PLAN AND PROFILE

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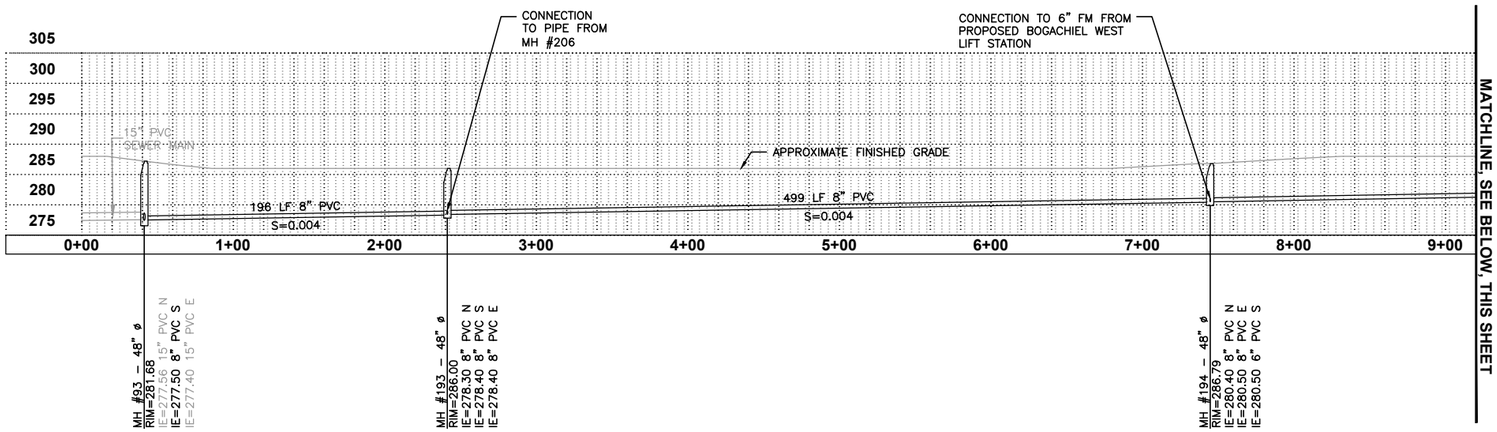
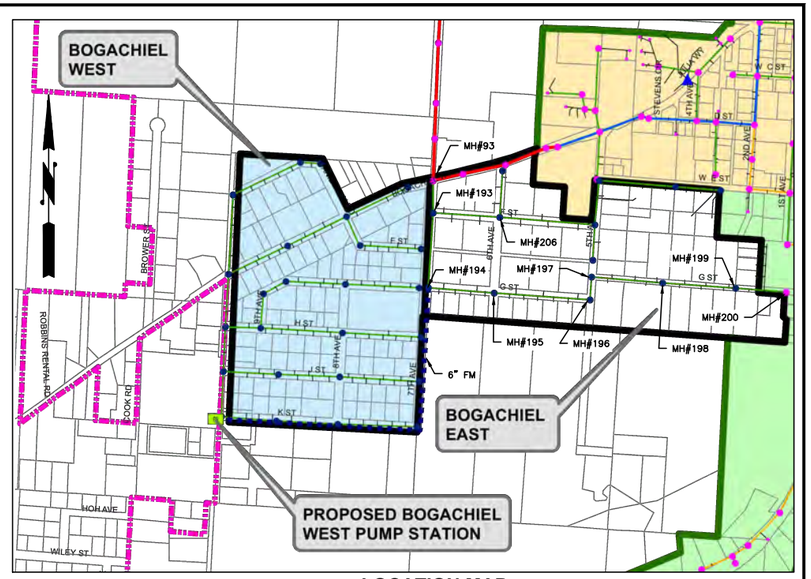


PROFILE

SCALE: 1" = 100' HORIZONTAL
1" = 5' VERTICAL



LOCATION MAP

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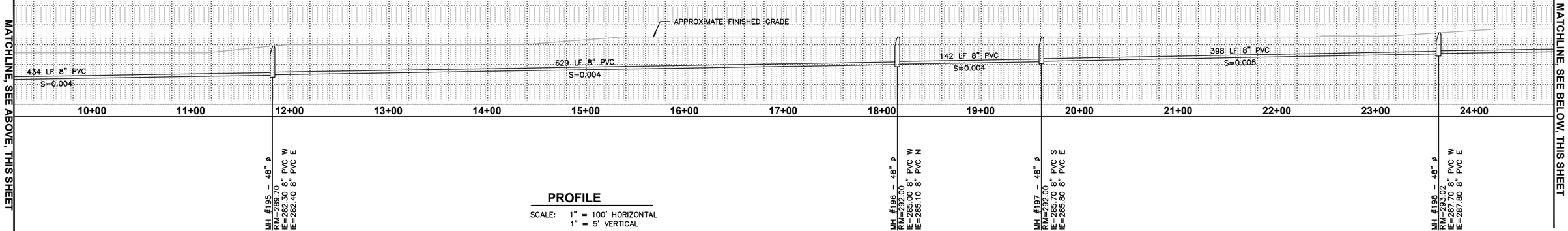
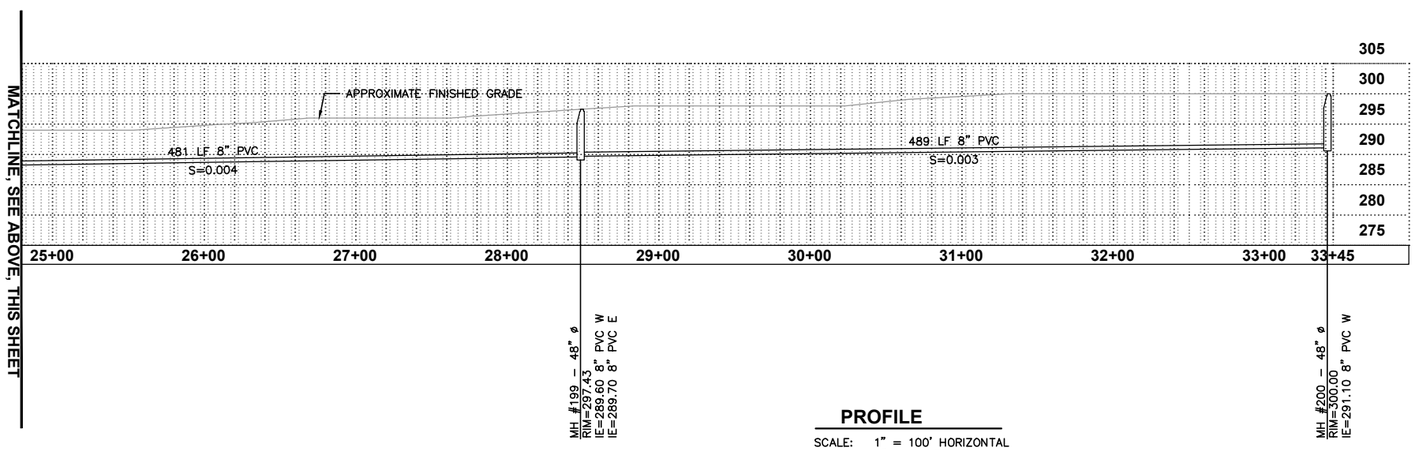


PROFILE

SCALE: 1" = 100' HORIZONTAL
1" = 5' VERTICAL



PROFILE

SCALE: 1" = 100' HORIZONTAL
1" = 5' VERTICAL

NOTE:

PROPOSED FACILITIES SHOWN IN BOLD TYPE.
EXISTING FACILITIES SHOWN SHADED BACK.

CITY OF FORKS

GENERAL SEWER/WASTEWATER
FACILITY PLAN
FIGURE 6-4
BOGACHIEL EAST SEWER MAIN
PLAN AND PROFILE

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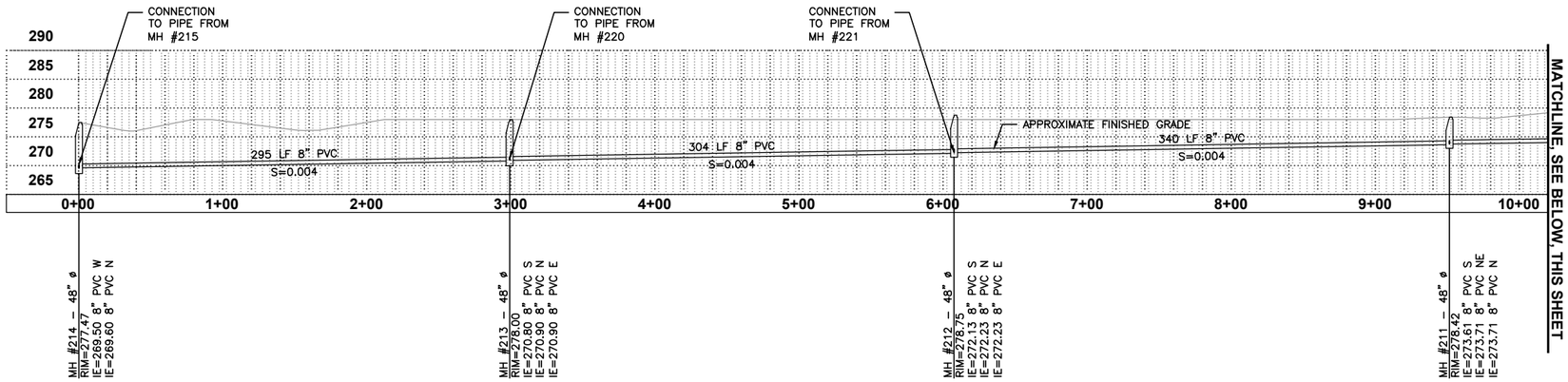
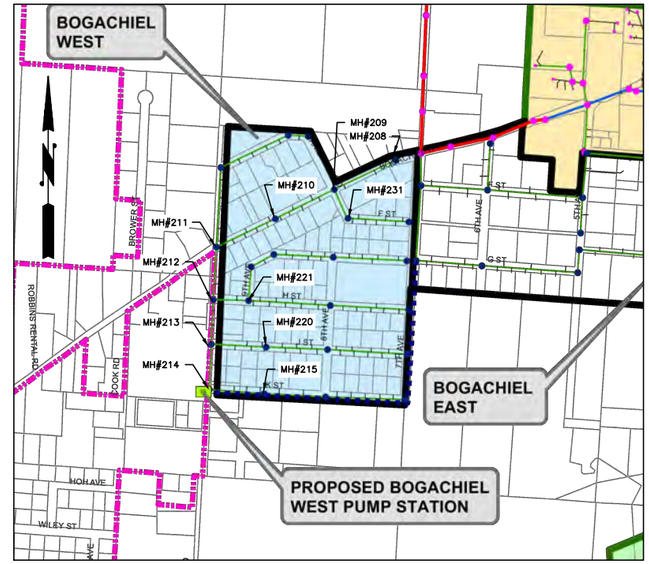


PROFILE

SCALE: 1" = 100' HORIZONTAL
1" = 5' VERTICAL



LOCATION MAP

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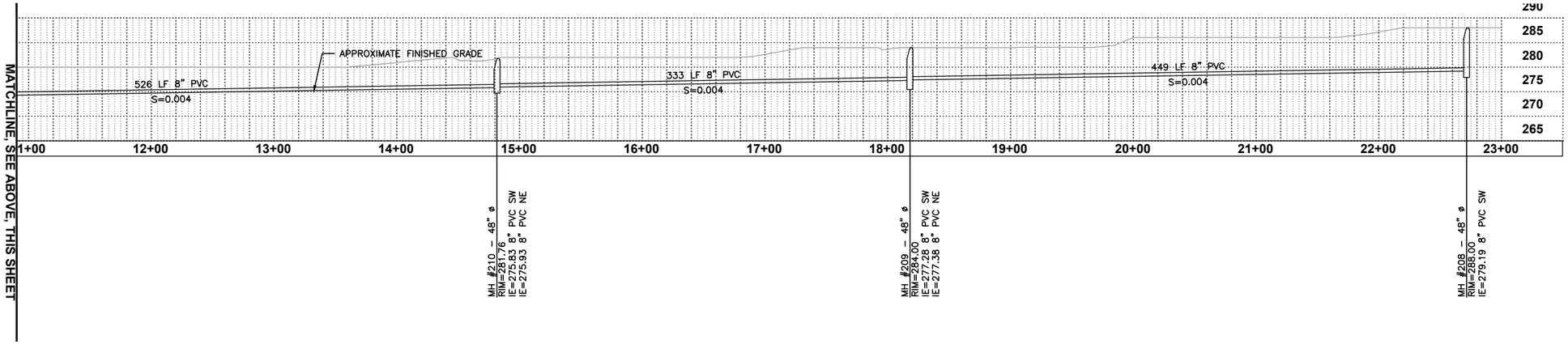


PROFILE

SCALE: 1" = 100' HORIZONTAL
1" = 5' VERTICAL

NOTE:

PROPOSED FACILITIES SHOWN IN BOLD TYPE.
EXISTING FACILITIES SHOWN SHADED BACK.

CITY OF FORKS

GENERAL SEWER/WASTEWATER FACILITY PLAN
FIGURE 6-5

BOGACHIEL WEST SEWER MAIN
PLAN AND PROFILE

Gray & Osborne, Inc.
CONSULTING ENGINEERS

this location will impact connection details and overall project costs for the pump station. The pump station was designed to accept wastewater from the entire existing Bogachiel West subbasin as well as potential future connections east and south of 7th Avenue. Pump station design criteria are listed in Table 6-1 below.

TABLE 6-2

Bogachiel West Pump Station Design Criteria

Parameter	Design Criteria
WW Production Projections	
Projected 2034 ERU within Basin(1)	120
Wastewater Production (gpd/ERU)(2)	127
Peak Hour Peaking Factor(3)	4.0
Projected Buildout Max Month Flows (gpd)(4)	23,000
Projected Buildout Peak Hour Flows (gpd)(5)	61,000
Pump Station Design Criteria	
Type	Exterior, submersible wet well w/separate valve control
Peak Hour Design Influent Flow (gpm)	50
Wet Well Diameter (feet)	6
Wet Well Depth (feet)	13
Control Scheme	Lead - Lag; High-alarm autodialer
No. of Pumps	2
Pump Type	Submersible Grinder
Design Point	260 gpm @ 37 ft head
Pump Load (hp, each)	5
Minimum Force Main Velocity (ft/sec)	3

(1) Projected 2034 ERU based on a linear growth rate of 1 percent annually to the existing lot count (98) over 20 years.
(2) Table 5-5.
(3) From Figure C1-1, 2008 Ecology *Criteria for Sewage Works Design.*
(4) Base Flow (127 * ERU) * Maximum Month peaking factor (1.47)
(5) Base Flow (127 * ERU) * Peak Hour Peaking Factor (4).

Projected wastewater flows for the pump station were based on the analysis presented in Chapter 5. Current ERU were determined by a count of existing lots within the basin. The pump is sized to provide a velocity (3 ft/second) sufficient to prevent the deposition of solids in the force main.

The station includes a cast-in-place concrete wet well, separate below-grade valve control vault, and a separate covered free-standing control station. Two submersible grinder pumps are proposed, and these pumps will operate in a lead-lag scheme based on a set of level floats located within the wet well. The pumps will be installed using guiderails so

that they can be raised to ground level for maintenance or repair, minimizing the need to enter the wet well. A proposed pump station design is shown in Figure 6-6.

The addition of odor control facilities are not included with this proposed design, but may be desired or required based on the proximity to private residences. Odor control equipment can be added to the pump station design at an additional cost. Odor control may also be required at the proposed force main discharge manhole (#194).

If not mixed or exposed to oxygen, wastewater in force mains can become anaerobic. Anaerobic wastewater will produce hydrogen sulfide, which is then oxidized to sulfuric acid which can degrade concrete structures. Degradation of concrete structures can occur after water has been pumped long distances in a force main before being discharged in a manhole. Corrosion control measures for protection of manholes may be required at the proposed force main connection at Manhole #194 but are not included in the proposed design.

TRILLIUM AVENUE DRAINAGE BASIN

Trillium North

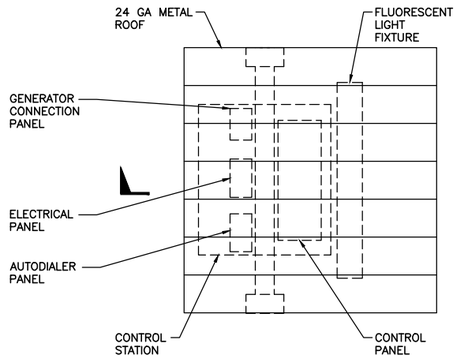
The Trillium North subbasin is bounded by Calawah Way to the south, Pine Avenue to the west and covers the full extent of Mayberry and Collins Streets to the north and east. The proposed system includes 3,560 LF of 8-inch PVC sewer pipe, and 2,200 LF of 10-inch sewer pipe. Wastewater generally flows east and south. There are 54 private side sewer services that will include 53 residential and one commercial connections. The new system includes 14 new manholes. Connection to the existing collection system will occur at Manhole #22 near the intersection of Calawah Way and Maple Street. The Trillium Avenue sewer main plan and profile is shown in Figure 6-7.

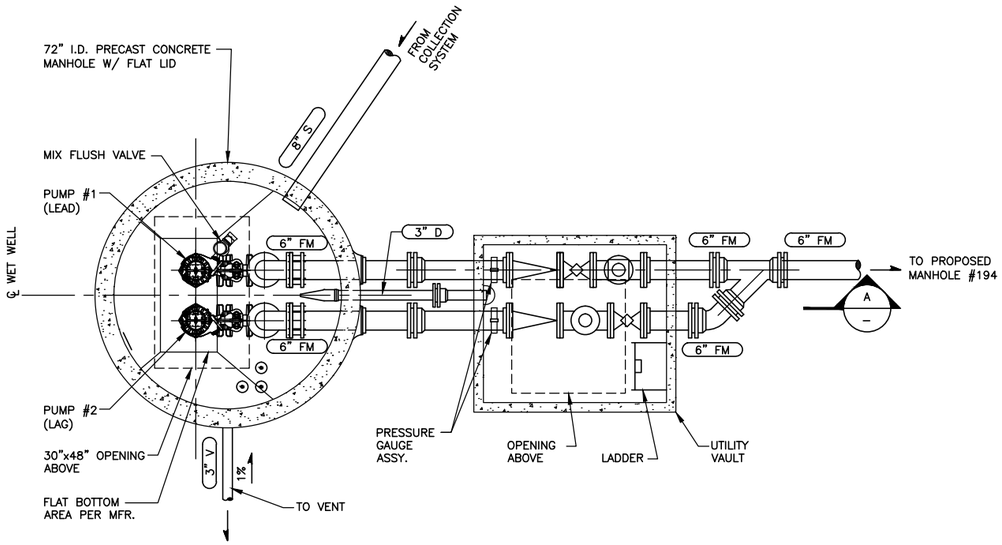
The estimated project cost in 2014 dollars for the Trillium North collection system is $1,343,000.

Trillium South

The Trillium South subbasin is bounded by Maple Avenue to the west and covers the full extent of Shearer Street to Calawah Way in the north and East Division Street to the south. The proposed system includes 3,560 LF of 8-inch PVC sewer pipe and generally flows east. There are 50 private residential service connections within this subbasin. The new system also includes 14 new manholes. Connection to the existing collection system will occur at Manhole #20A near the intersection of Maple Street and Shearer Street. The Shearer Avenue and Trillium Avenue sewer main plan and profile is shown in Figure 6-8.

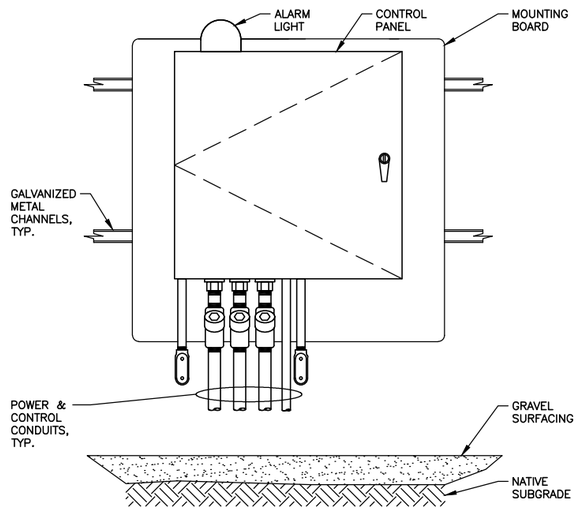
The estimated project cost in 2014 dollars for the Trillium South collection system design is $920,000.





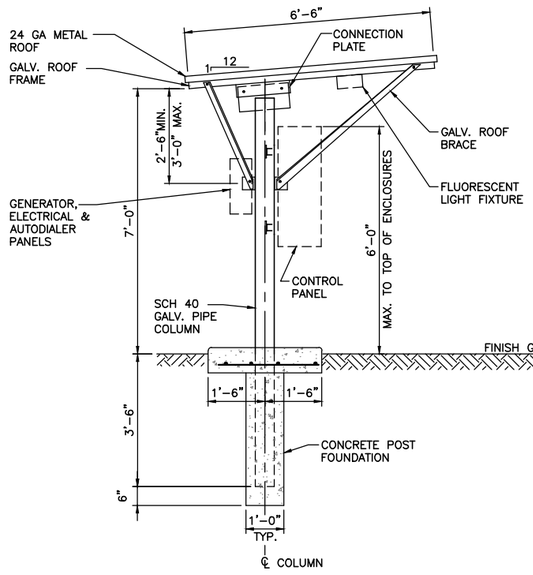
LIFT STATION PLAN

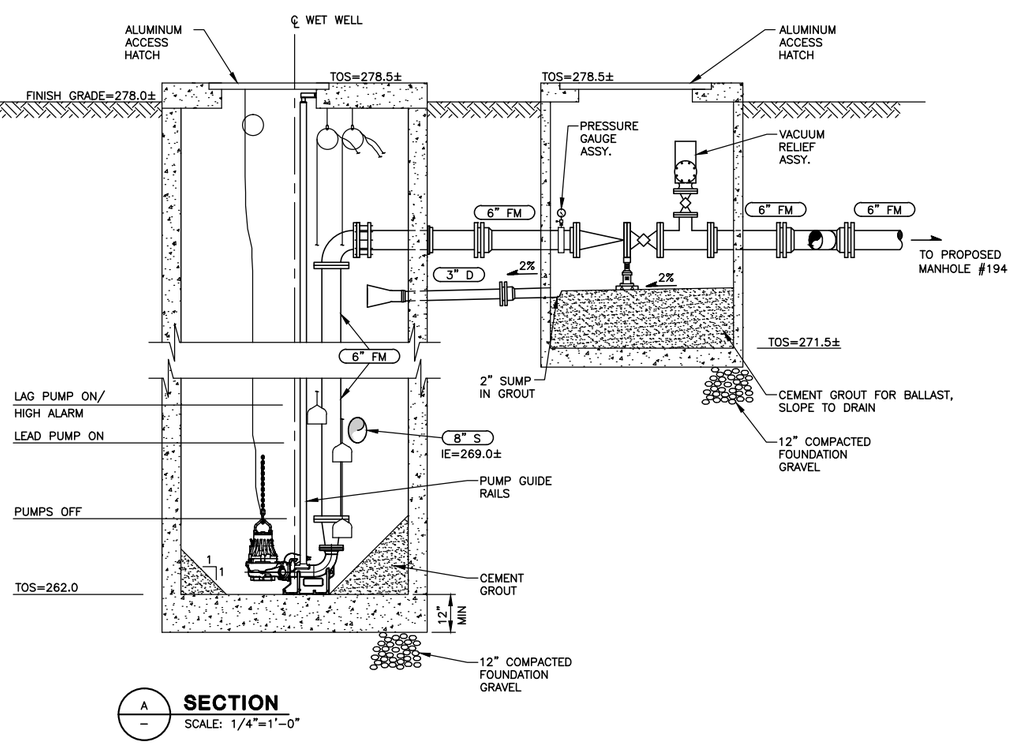
SCALE: 1/4"=1'–0"



CONTROL STATION FRONT ELEVATION

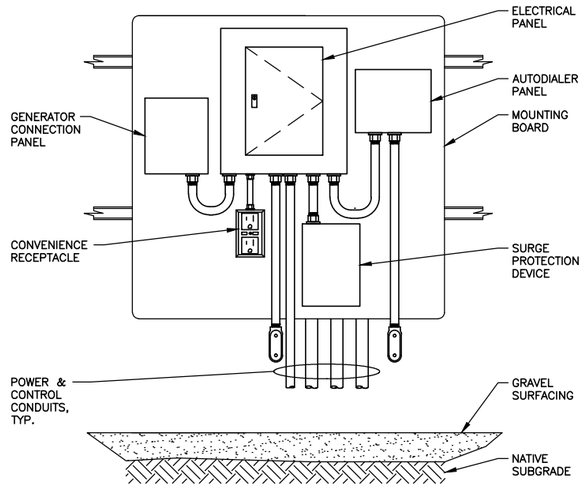
NOT TO SCALE





A/– **SECTION**

SCALE: 1/4"=1'–0"



CONTROL STATION REAR ELEVATION

NOT TO SCALE

CITY OF FORKS

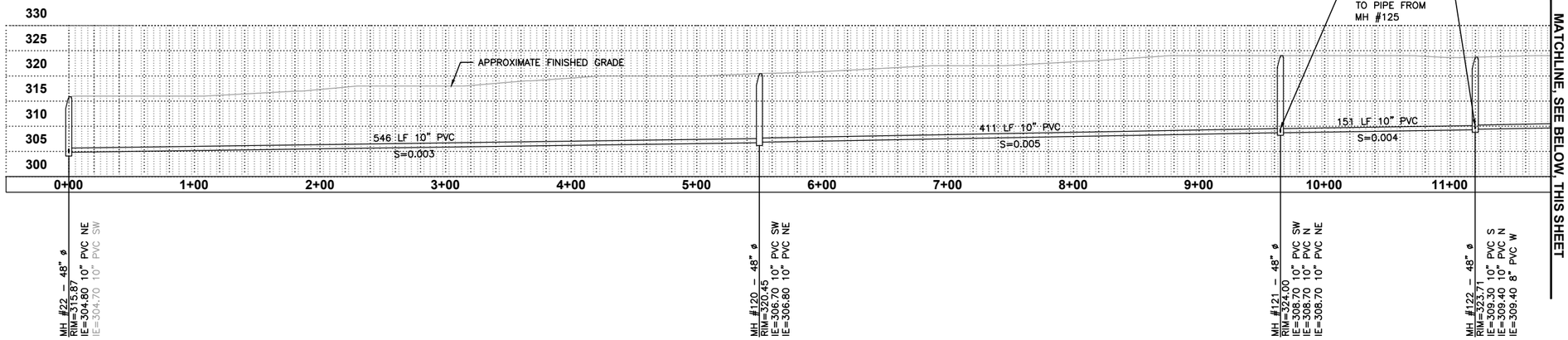
GENERAL SEWER/WASTEWATER FACILITY PLAN

FIGURE 6-6

BOGACHIEL WEST LIFT STATION PLAN, SECTION, & CONTROL STATION ELEVATION

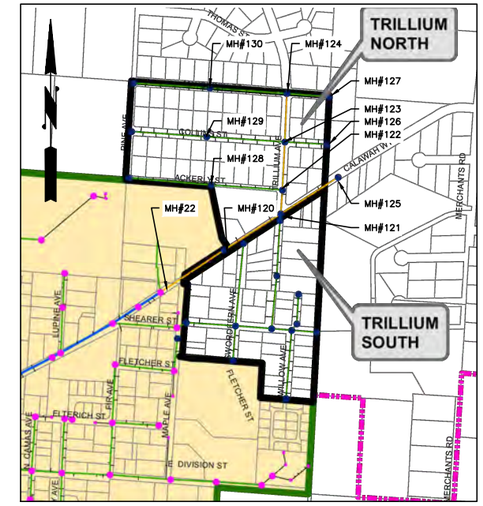
Gray & Osborne, Inc.

CONSULTING ENGINEERS



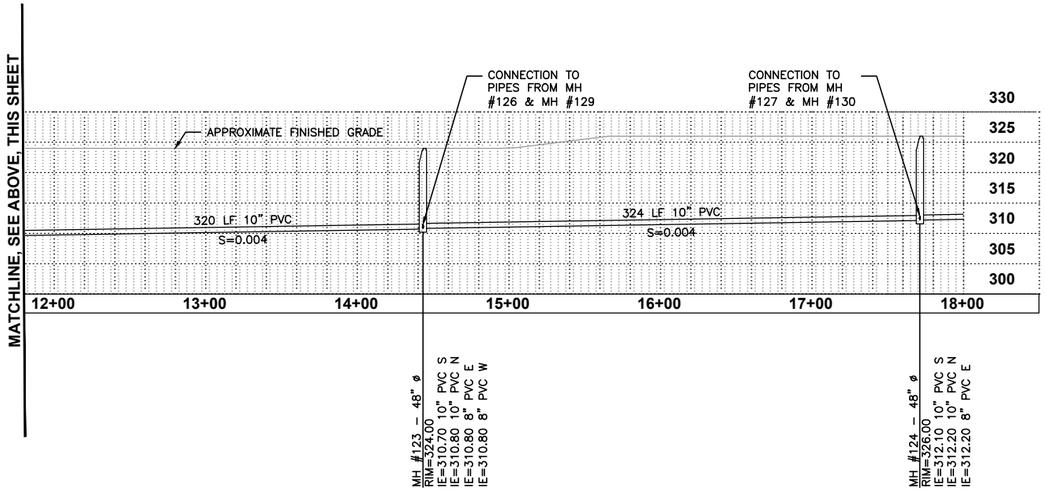
PROFILE

SCALE: 1" = 100' HORIZONTAL
1" = 5' VERTICAL



LOCATION MAP

NOT TO SCALE



PROFILE

SCALE: 1" = 100' HORIZONTAL
1" = 5' VERTICAL

NOTE:

PROPOSED FACILITIES SHOWN IN BOLD TYPE.
EXISTING FACILITIES SHOWN SHADED BACK.

CITY OF FORKS

GENERAL SEWER/WASTEWATER
FACILITY PLAN
FIGURE 6-7
TRILLIUM NORTH SEWER MAIN
PLAN AND PROFILE

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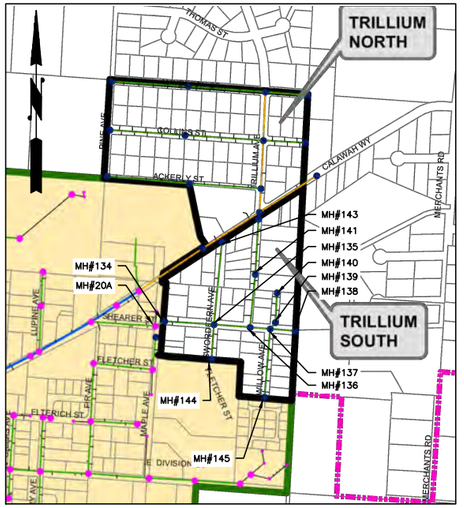
CONSULTING ENGINEERS



LOCATION MAP

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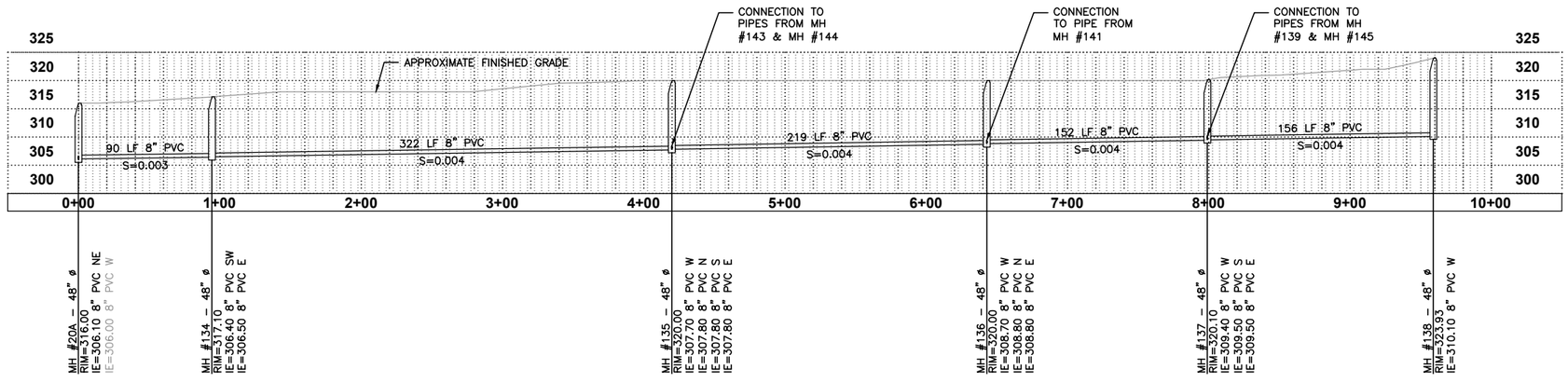

PROFILE

SCALE: 1" = 100' HORIZONTAL
1" = 5' VERTICAL

NOTE:

PROPOSED FACILITIES SHOWN IN BOLD TYPE.
EXISTING FACILITIES SHOWN SHADED BACK.

CITY OF FORKS

GENERAL SEWER/WASTEWATER FACILITY PLAN

FIGURE 6-8

TRILLIUM SOUTH SEWER MAIN PLAN AND PROFILE

Gray & Osborne, Inc.
CONSULTING ENGINEERS

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SUMMARY OF COLLECTION SYSTEM RECOMMENDATIONS

Table 6-2 summarizes the recommended improvements to the existing collection system and necessary projects associated with the inclusion of the expansion areas into the sewer service area.

TABLE 6-3

Summary of Recommended Collection System Projects

Project	Cost[(1)]
Mill Creek Pump Station	$80,000
Robin Hood East Collection System	$1,630,000
Robin Hood West Collection System	$1,496,000
Bogachiel East Collection System	$1,374,000
Bogachiel West Collection System[(2)]	$3,069,000
Trillium North Collection System	$1,344,000
Trillium South Collection System	$920,000

(1) See Appendix C for detailed cost estimates.
(2) Includes Cost of new pump station and force main.

FUTURE COLLECTION SERVICE EXPANSION

Cities within Growth Management Act planning counties, such as Clallam County, are required to provide a plan to provide services, including sewer, to the extents of the Urban Growth Area boundaries. The City of Forks has a sparsely populated large Urban Growth Area consisting primarily of large parcels. At this time it is not economically feasible to include expansion of the collection system to the boundaries of the UGA given the expanse of the boundary and the limited number of new connections to which service would be provided. Any additional expansion to the collection system, beyond that discussed previously in this chapter, would occur outside of the planning duration of this Plan. The following discussion provides a brief description of a future extension of the collection system to the UGA boundary.

The City of Forks sits roughly in the center of the UGA boundary. Extensions of the existing system to the north, east and southwest would be required to provide service to the entire UGA. Figure 6-9 shows a potential layout of the extensions required. As shown in the figure, the system is comprised primarily of 8- and 12-inch gravity sewer pipe, connecting to the current 15-inch trunk line to the wastewater treatment facility. Due to the topography in the area an additional 7 lift stations would be required to provide connections to the existing gravity system from the outer areas of the UGA boundary. The estimated cost to provide sewer service to the extents of the UGA boundary is approximately $34,000,000. A detailed planning level cost estimate is included in Appendix C.

SOL DUC L.S.

RIVIERA L.S.

ELK VALLEY L.S.

ROBIN HOOD L.S.

PROPOSED BOGACHIEL PUMP STATION

S. BOGACHIEL L.S.

S. FORKS L.S.

VALLEY VIEW L.S.

RAINY RANCH RD

HAMMER WY

WHITCOMB-DIMMEL RD

ELDRIDGE RD

HIGHWAY 101

INDUSTRIAL CT

RAYONIER MAINLINE

WARREN RD

ANDERSONVILLE RD W

RIVIERA DR

WOODPECKER LN

MERCHANTS RD

CHUCKANOLE WY

THOMAS ST

BIG PINE WY

OAKMEADOW DR

TERRACE DR

SILVER CREEK WY

PINE AVE

ROCKBERRY AVE

W DIVISION ST

W EST ST

W G ST

W F ST

W E ST

W D ST

W C ST

W B ST

W A ST

S EUCLID AVE

S SPRUCE AVE

S PINE AVE

S FORKS AVE

BREWSTER RD

NEESEN RD

PALMER RD

RIATA RD

CALAWAH WY

LEPPELL RD

TWO COUSINS LN

PRAIRIE DR

SPRUCE DR

BOURM RD

ELK CORNER RD

ELK CREEK DR

ELK CREEK RIDGE

SITKUM-SOL DUC RD

E DIVISION ST

KING RANCH RD

MINNIE PETERSON RD

GOOD RD

SPORTSMANS CLUB RD

MILL CREEK RD

HOH AVE

ROSELLE RD

BOGACHIEL WY

SAGE RD

BEDFORD

PIT LN

VALLEY VIEW DR

Line_generic

HIGHWAY 101

N

0 1,200 2,400 4,800 Feet

LEGEND:

PROPOSED FACILITIES

- PROPOSED LIFT STATION
- 4" D.I. FORCEMAIN
- 2" D.I. FORCEMAIN
- PRIMARY 12" PVC SEWER TRUNKLINE
- SECONDARY 8" PVC SEWER SERVICE LINE

EXISTING FACILITIES

- CLEANOUT
- MANHOLES
- PUMP STATION
- SEPTIC TANK
- 6" OR LESS
- 8"
- 10"
- 12"
- 15"
- UGA
- FUTURE SERVICE AREA
- CITY LIMITS
- EXISTING SEWER SERVICE AREA
- PARCELS

CITY OF FORKS

GENERAL SEWER/WASTEWATER FACILITY PLAN
FIGURE 6-9
FUTURE UGA SEWER SERVICE EXPANSION

Gray & Osborne, Inc.
CONSULTING ENGINEERS

L:\Forks\13543 Sewer Comp Plan\GIS\UGA SEWER SERVICE MAP.mxd

CHAPTER 7

WWTF EVALUATION

GENERAL

This chapter evaluates the existing WWTF with respect to capacity, reliability, and redundancy, and identifies recommended improvements to the WWTF to accommodate the design criteria as outlined in Chapter 5.

The City of Forks owns and operates the wastewater treatment facilities that serve the sewer service area. The treatment facilities include a mechanical fine screen, aerated lagoon, secondary clarifier, return/waste activated sludge pumping station, effluent pumping station and infiltration basin. The solids treatment facilities include waste sludge pumping from the RAS/WAS pump station and Class A biosolids production using an FKC lime heat stabilization screw press system.

PROJECTED WASTEWATER FLOWS AND LOADINGS

The evaluation of the process units in this chapter is based on the current permitted flows and the projected loadings developed in Chapter 5. The existing permitted flow of 0.5 mgd exceeds the 2034 projected flow 0.285 mgd. The permitted flow of 0.5 mgd has been used to evaluate the treatment capacity of the plant. This provides the City with additional capacity if inflow and infiltration become greater than expected in the future. Table 7-1 is a summary of the design flows and loadings for the year 2034.

TABLE 7-1

2034 Projected Design Wastewater Flows and Loadings

Flow or Loading	Projected Design Value[(1)]
Average Annual Flow (mgd)	0.225
Maximum Month Flow (mgd)	0.50[(2)]
Maximum Day Flow (mgd)	0.553
Peak Hour Flow (mgd)	0.976
Current Permitted Flow (mgd)	0.50
Annual Average BOD_5 Loading (lb/d)	688
Maximum Month BOD_5 Loading (lb/d)	860
Annual Average TSS Loading (lb/d)	458
Maximum Month TSS Loading (lb/d)	678
Annual Average TKN Loading (lb/d)	105
Maximum Month TKN Loading (lb/d)	133

(1) From Tables 5-17 and 5-18.

(2) The current permitted MM flow of 0.5 mgd is used as the design value. Projected MM 2034 flow is 0.285 mgd.

PERMIT LIMITS

The City's State Waste Discharge permit (ST 6031) was issued in 2007 and expired in 2012, though the City's coverage under this permit has been administratively extended by Ecology. Table 7-2 presents the effluent permit limits for the City's WWTF based on this permit.

TABLE 7-2

City of Forks WWTF State Waste Discharge Permit (ST 6031)
Design Criteria and Effluent Permit Limits

Parameter	Average Monthly	Average Weekly
Design Criteria		
Flow	0.50 mgd	NA
BOD_5	434 lb/day	NA
TSS	434 lb/day	NA
Effluent Permit Limits		
pH	Daily minimum is equal to or greater than 6 and the daily maximum is less than or equal to 9	
BOD_5	30 mg/L, 125 lb/day, 85% removal of influent BOD	45 mg/L, 187 lb/day
TSS	30 mg/L, 125 lb/day, 85% removal of influent TSS	45 mg/L, 187 lb/day

(1) The average monthly effluent limitation is defined as the highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month.

(2) The maximum weekly effluent limitation is defined as the highest allowable weekly discharge. The weekly discharge means the discharge of a pollutant measured during a 7-day period.

(3) For pollutants with limitations expressed in units of mass, the daily discharge is calculated as the total mass of the pollutant discharged over the day. For other units of measurement, the daily discharge is the average measurement of the pollutant over the day.

The projected 2034 maximum month influent flow to the WWTF (0.285 mgd) remains within the existing design criteria for the facility (0.5 mgd). The projected BOD_5 and TSS loading to the facility of 860 lb/d and 678 lb/d respectively, as shown in Table 7-1, exceed the current design criteria of the WWTF.

EXISTING OPERATION

The wastewater flow by gravity to the WWTF where it first flows through the mechanical fine screen which screens out rags and other inert objects. A Parshall flume downstream of the screen measures the influent flow. At the Parshall flume, a time based sampler collects composite wastewater samples for laboratory analysis.

The screened wastewater is mixed with return activated sludge (RAS) in the aerated lagoon for the biological conversion of organic material in the wastewater into biological cells and metabolic end products. A single surface floating aerator provides oxygen for this process. A single floating mixer is employed to keep particles in suspension.

Flows from the aerated lagoon are conveyed to the secondary clarifier via gravity. The secondary clarifier provides a quiescent environment where settleable secondary solids are removed from the treated wastewater. Secondary effluent is discharged by gravity to effluent infiltration basins without disinfection.

Automated samplers collect composite samples for laboratory analysis on a time based interval of the influent at the headworks and the effluent at the discharge from the secondary clarifier.

The facility's sludge treatment process begins with the pumping of the waste activated sludge from the clarifiers to a mixing tank where lime is mixed with the sludge. The limed-sludge is then pumped to a sludge feed tank. From the sludge feed tank, the limed sludge is pumped to a flocculation tank where it is mixed with polymer. The sludge is then processed through the heated screw press creating Class A biosolids.

PLANT EVALUATION AT PROJECTED DESIGN CRITERIA

In the following sections the capacities of major WRF components 2034 projected flows and loadings are evaluated and, where applicable, compared to accepted design criteria, such as published in Ecology's *Criteria for Sewage Works Design (1998),* WEF Manual of Practice #8, and Wastewater Engineering (Metcalf and Eddy, 4th Edition, 2003). This evaluation is summarized in Table 7-3.

TABLE 7-3

Comparison of Component Design Criteria and Projected Flows and Loadings

Component/Parameter	Capacity/Criteria	Reference[(1)]	2034 Operating Conditions (meets criteria?)
Mechanical Fine Screen	1.0 mgd	Manufacturer	0.98 mgd (yes)
Aerated Lagoon Solids Retention Time (SRT)	0.50[(2)]		
Secondary Clarifier (Surface Overflow Rate at MMF)	400 – 700 gpd/sf 300 – 1,000 gpd/sf	Ecology, 2008 WEF, 2006	520 gpd/sf (yes)
(Surface Overflow Rate at PHF)	1,000 – 1,200 gpd/sf	WEF, 2006	1,008 gpd/sf (yes)

Secondary Clarifier (Solids Loading Rate at MMF) (Solids Loading Rate at PHF)	0.8 – 1.2 lb/sf/hr 0.833 – 1.25 lb/sf/hr 1.6 lb/sf/hr	M&E, 2003 WEF, 2006 M&E, 2003	0.8 lb/sf/hr (yes) 1.2 lb/sf/hr (yes)

(1) References include Water Environment Federation (WEF), Washington State Department of Ecoclogy (Ecology) and Matcalf and Eddy (M&E).

(2) The current permitted MM flow of 0.5 mgd is used as the design value. Projected MM 2034 flow is 0.285 mgd.

HEADWORKS

Process Description

Raw wastewater enters the headworks channel and flows through a mechanical fine screen with ¼-inch openings and a hydraulic capacity of 1.0 mgd. Downstream of the fine screen, the wastewater enters a Parshall flume equipped with an ultrasonic level sensor used to measure flow. A composite sampler is programmed to take samples of the influent wastewater at the Parshall flume on a time interval basis. The structure includes a bypass channel to allow bypass flow around the fine screen during screen maintenance. Excess wastewater is diverted to the bypass channel if influent flow exceeds the capacity of the fine screen. Existing headworks design criteria is provided in Chapter 4.

Structural Condition

The headworks concrete structure is in good condition with no noticeable cracks or spalling of the concrete structure.

Mechanical Condition

The Lakeside microstrainer screen was originally purchased by Braselton, Georgia in 1997. The City acquired it used in 2008. The fine screen is currently operating satisfactorily, however, the level of maintenance provided on the unit by the previous owner is unknown and the City has expressed concerns regarding the remaining life span of the screen.

The bypass channel does not have a means to screen the wastewater. A coarse bar screen installed in the bypass channel to limit the debris entering the aerated lagoon during maintenance on the fine screen or during high flow events when the bypass channel is in use would be beneficial.

The Parshall flume and ultrasonic sensor are adequate for this installation.

The influent sampler is adequate for this installation.

Capacity

The existing headworks has sufficient capacity to treat the projected 2034 peak hour flow.

The fine screen has a capacity of 1.0 mgd, which is greater than the projected 2034 design peak hour flow of 0.976 mgd.

At a flume water depth of 10-inches, the 6-inch Parshall flume has a capacity of 1.0 mgd, exceeding the projected 2034 peak hour flow.

Recommendations

It is recommended that a manually cleaned coarse bar screen be installed in the bypass channel with a high level alarm to indicate when cleaning is required. The estimated cost of installing a coarse bar screen in the bypass channel is approximately $6,000.

Although not necessary at this time, due to the current age of the fine screen mechanism (18 years) it is anticipated that it will need replacement during the planning duration of this document. The cost to replace the existing mechanical fine screen is approximately $260,000, including sales tax, contingency and engineering design. A detailed cost estimate for the mechanical fine screen replacement is included in Appendix C. The design criteria for the improved headworks with fine screen replacement is presented in Table 7-4. The existing headworks design criteria is provided in Chapter 4.

TABLE 7-4

Headworks Design Criteria

Headworks	
Channel Width	16-inches
Fine Screen	Microstrainer
Fine Screen Openings	1/4 inch
Fine Screen Capacity	1.0 mgd
Flow Meter	6-inch Parshall Flume, Ultrasonic
Bypass Channel Screen Type	Manual, 3/4-inch Opening
Bypass Channel Alarm	Float Switch

AERATED LAGOON

Process Description

The aerated lagoon is a large earthen basin with a rock covered PVC liner. The liquid contents of the aerated lagoon is referred to as the “mixed liquor,” a mix of screened raw wastewater and return activated sludge. Activated sludge refers to the microorganisms

cultivated in the treatment process to break down organic matter into carbon dioxide, water and other inorganic compounds. The mixed liquor is currently aerated by a single 25-hp surface aerator and mixed by a single 20-hp surface mixer. The organic waste in the wastewater provides the food source for the bacteria in the mixed liquor. Aeration provides the oxygen required by the bacteria to assimilate and break down the organic waste. The bacteria use the biodegradable organic waste material as a source of energy (through oxidation) and as a source of carbon for cell synthesis (to produce new bacterial cells). The bacterial population is continually dying and being replaced by synthesis. Ideally, the biological activities in the treatment process will be balanced so as to maintain an adequate biological population to process the available food supply.

The bacteria cells are removed by gravity sedimentation in the secondary clarifier and are returned to the aerated lagoon as return activated sludge. A small fraction of the solids, termed waste activated sludge, is wasted to the solids handling system to maintain the desired solids concentration in the activated sludge system.

The original design allowed for a second aerator to replace the mixer when loading to the plant increased. The use of the mixer allows a portion of the lagoon to be used for denitrification. Although not required by the current permit, the lagoon is operated to provide some removal of nitrogen from the wastewater. Nitrification is provided in the oxygenated (aerobic) zone of the lagoon near the aerator and denitrification occurs in the anoxic zone of the lagoon near the mixer where dissolved oxygen approaches zero. Existing aerated lagoon design criteria is provided in Chapter 4.

Structural

The aerated lagoon is in good condition, however, the PVC liner, installed in 1986, is nearing the end of its anticipated life span (30 to 50 years) and will need to be replaced before the end of this 20 year planning period. The lagoon is currently single lined. New Ecology standards require all wastewater impoundments (ponds/lagoons) to be double lined with leak detection or single lined with groundwater monitoring.

Mechanical

Both the aerator and the mixer are original equipment supplied during construction of the plant. Although both the aerator and mixer currently run satisfactorily, this equipment is approximately 30 years old and beyond the 20 to 25 year typical life span. In addition, there is no redundancy for this equipment in case of failure.

Capacity

Per Ecology's *Criteria for Sewage Works Design*, to achieve "all known available and reasonable methods of prevention, control and treatment" (AKART), both BOD_5 and TSS removal are required for treatment as well as the nitrification of ammonia.

The aerated lagoon capacity requirements are dependent on three major design criteria. These criteria are solids retention time (SRT), net heterotrophic and autotrophic yields, and design mixed liquor suspended solids (MLSS) concentration. SRT is the criteria of greatest importance for nitrification, which establishes the process design requirements for the activated sludge system. The net specific growth rate of the nitrifying biomass is an order of magnitude lower than that of carbon oxidizing bacteria and is therefore used as the basis for determining the SRT of the aerated lagoon system. Also, the SRT used to calculate the required value for nitrification must be the aerobic SRT since nitrification only occurs under aerobic conditions.

SRT Calculation

The first step is to calculate the maximum specific nitrifier growth rate ($\mu_{n,max}$), decay rate (k_{dn}), and ammonia half saturation coefficient (K_n) at the winter design temperature of 10 degrees C. using the following equations and kinetic values (*Wastewater Engineering, Treatment and Reuse*, Fourth Edition, Metcalf and Eddy, Inc., McGraw-Hill, 2003).

$$\mu_{n,max,10} = (\mu_{n,m}) \times (\theta^{t-20}) = (0.9/d) \times (1.072^{10-20}) = 0.45/d$$

$$k_{dn,10} = (k_{dn}) \times (\theta^{t-20}) = (0.08\ mg/L) \times (1.04^{10-20}) = 0.115\ mg/L$$

$$K_{n,10} = (K_n) \times (\theta^{t-20}) = (0.74\ mg/L) \times (1.053^{10-20}) = 0.442\ mg/L$$

The numerical values for the various parameters above are typical for domestic wastewater.

Assuming typical values for effluent ammonia concentration of 1 mg/L, a dissolved oxygen concentration (DO) of 2.0 mg/L, and an oxygen half saturation coefficient (K_O) of 0.5 mg/L, the actual nitrifier growth rate is calculated as follows:

$$\mu_n = (\mu_{n,max,10})\left(\frac{N}{K_{N10}+N}\right)\left(\frac{DO}{K_O+DO}\right) - k_{dn,10} = (0.49/d)\left(\frac{1.0}{0.442+1.0}\right)\left(\frac{2.0}{0.5+2.0}\right) - 0.115\ /d$$

This yields a net specific nitrifier growth rate of 0.134/d, which is then used to calculate the required SRT using the following equation:

$$SRT = 1/\mu_n = 7.46 \text{ days}$$

Applying a safety/peaking factor of 2 to this value, to account for daily fluctuations in TKN loading, produces a required SRT of 15 days.

In order to calculate the aerobic mass required for the design SRT, the net sludge production for the treatment system must first be estimated. Assuming a typical cell

yield of 0.4 lb VSS/lb biodegradable COD (bCOD), a typical influent wastewater and biomass VSS/TSS ratio of 0.85, and a design temperature of 10 degrees C, the total sludge production can be determined using the following equation:

$$P_{X,TSS} = \left[\frac{(Y)(S_0 - S)}{(1+(k_{d,t})(SRT))0.85}\right] + \left[\frac{(f_d)(k_{d,t})(Y)(S_0 - S)(SRT)}{(1+(k_{d,t})(SRT))0.85}\right] + \left[\frac{(Y_n)(NO_x)}{(1+(k_{dn,t})(SRT))0.85}\right] + X_{iVSS} + X_{iTSS}$$

$$= \frac{P_{x,Bio}}{0.85} + X_{iVSS} + X_{iTSS}$$

And

$$P_{X,VSS} = P_{X,BIO} + X_{iVSS}$$

Where:

$P_{X,TSS}$ = mass of waste activated sludge per day, lb TSS/day
$P_{X,Bio}$ = biomass production lb VSS/day
$P_{X,VSS}$ = mass of VSS per day, lb VSS/day

Y = heterotrophic cell yield = 0.40 lb/lb bCOD (typical for domestic wastewater)
Y_n = autotrophic cell yield = 0.12 lb/lb TKN (typical for domestic wastewater)
S_o = mass of influent bCOD, taken as 1.6 x influent BOD_5 = 1,376 lb/day (860 lb/day x 1.6)
S = mass of effluent bCOD at 1 mg/L bCOD in effluent = 4 lb/day
f_d = fraction of cell mass remaining as cell debris = 0.15 lb/lb (typical for domestic wastewater)
$k_{d,t}$ = endogenous heterotrophic decay coefficient, 0.081 day^{-1} (see below)
$k_{dn,t}$ = endogenous nitrogenous decay coefficient, 0.115 day^{-1} (see above)
SRT = solids retention time of the SRT = 15 days (see above)
X_{iVSS} = nonbiodegradable volatile suspended solids =157 lb/d (see below)
X_{iTSS} = influent nonvolatile suspended solids = influent TSS – influent VSS = 102 lb/day
t = aerated lagoon temperature = 10 degrees C
NO_x = amount of influent TKN oxidized, assumed to be 80% of influent TKN = 0.8 x 133 = 106 lb/day.

The value for k_d at the design temperature of 10° C can be determined as follows.

$$k_{d,10} = (k_{n,\max})(q^{t-20}) = (0.12/d)(1.04^{10-20}) = 0.081/d$$ (typical for domestic wastewater)

The value for *XiVSS* is calculated from the following equation:

$$XiVSS = \left[1 - \frac{bCOD / BOD_5 (BOD_5 - sBOD)}{COD - sCOD}\right] VSS = 157\ lb/d$$

Where:

bCOD = S_o = 1376 lb/d (see above)
sBOD = soluble BOD_5, taken as 0.35 times influent BOD_5 = 301 lb/d
COD = total chemical oxygen demand taken as 2.2 x influent BOD_5 = 1,892 lb/d
sCOD = soluble chemical oxygen demand taken as 0.35 times COD = 662 lb/d
VSS = volatile suspended solids taken as 0.85 * TSS = 576 lb/d

The sludge production can then be calculated as follows:

$$P_{X,TSS} = \left[\frac{(0.4)(1{,}376 - 4.0)}{(1 + (0.081)(11))0.85}\right] + \left[\frac{(0.15)(0.081)(0.4)(1{,}376 - 4.0)(15)}{(1 + (0.081)(15)0.85}\right] + \left[\frac{(0.12)(106)}{(1 + (0.115)(15))0.85}\right] + 157 + 102$$

$$P_{X,TSS} = 609 \text{ lb/day}$$

And

$$P_{X,Bio} = 297$$
$$P_{X,VSS} = 455$$

This equation yields a total estimated sludge production of 609 lb/day. At the design SRT of 15 days, this waste sludge production results in a required total aerobic mass of 9,134 lbs.

$$609\,lb/day * 15 days = 9{,}134 lbs$$

<u>*Wastewater Engineering*</u> (Metcalf & Eddy, 2003) recommends a design MLSS of no more than 4,000 mg/L, since higher concentration can cause solids overloading in the secondary clarifiers. The design MLSS concentration used in this analysis is 2,200 mg/L. Using this MLSS concentration the required aerated lagoon volume is 500,000 gallons.

$$9{,}134 lbs / (8.34 * 2{,}200 mg/L) * 1{,}000{,}000 \approx 500{,}000 gal$$

This represents approximately 75 percent of the total of the existing lagoon volume of 670,000 gallons.

Recycle streams from the screw press and digester are returned to the aerated lagoon. The estimated increase in flows and loads to the aerated lagoon is less than 5 percent and have therefore not been included in the above analysis. Adequate volume exists within the existing aerated lagoon to treat the additional loads associated with these recycle streams. Appendix D provides spreadsheet calculations for quantifying the additional flow and loads due to the recycle streams.

Aeration requirements and solids loading on the secondary clarifier at this design MLSS concentration are discussed below.

Aeration Requirements

To biologically oxidize the BOD_5 and ammonia in the wastewater, oxygen must be continuously added to the aerated lagoon. The required quantity of oxygen consists of a carbonaceous oxygen demand and a nitrogenous oxygen demand.

The carbonaceous oxygen demand is calculated as follows:

Carbonaceous O_2 Demand = $S_0 - 1.42(P_{xbio})$

Where:

S_0 = mass influent bCOD, 1,376 lb/d (from above)

P_{xbio} = 297 lb/day (from above)

Therefore, the carbonaceous oxygen demand is 954 lb/day.

The nitrogenous oxygen demand is calculated by the amount of nitrogen oxidized to nitrate:

Nitrogenous O_2 Demand = $4.33*TKN_{ox}$

Where:

$TKN_{ox} = (TKN_{in} - TKN_{out} - 0.12(P_{xbio})) = 93.1$
TKN_{in} = influent TKN = 133 lb/day (Table 7-1)
TKN_{out} = effluent TKN = 4.2 lb/d (1 mg/L concentration at 0.5 mgd)
P_{xbio}= 297 lb/d (from above)

Therefore, the nitrogenous oxygen demand is 403 lb/d. The total oxygen demand is the sum of carbonaceous and nitrogenous oxygen demand, or 1,357 lb/d. Applying a safety factor of 1.2 to account for fluctuations in diurnal loads results in a design oxygen demand of 1,628 lb/d, which is the required actual oxygen transfer rate (AOTR).

Oxygenation equipment is specified based upon standard oxygen transfer rate (SOTR), the oxygen transfer rate in clean 20 degrees C water with no suspended solids. The SOTR is calculated as follows:

$$AOTR = SOTR\left(\frac{bC_{STH} - C_O}{C_{S20}}\right)(1.024^{T-20})a$$

Where:

- a = oxygen transfer correction factor, 0.82 (Metcalf and Eddy, 4th Ed.) states the range is 0.6 to 1.2 for mechanical aeration equipment.
- b = salinity surface tension factor, 0.95
- C_{STH} = dissolved oxygen concentration at operating temperature and elevation, = 9.08 mg/L
- C_{S20} = dissolved oxygen concentration at 20 degrees C and 1 atm, 9.08 mg/L
- C_O = operating dissolved oxygen concentration, 2 mg/L
- T = 20 degrees C

The resulting SOTR is therefore 2,720 lb/d or 113 lb/hr.

Alkalinity Requirements

The stoichiometric reaction for the oxidation of ammonia nitrogen to nitrate shows that two moles of hydrogen are produced for every mole of ammonia nitrogen oxidized. In a wastewater treatment system, these hydrogen ions are neutralized by the wastewater's natural alkalinity (buffering capacity), preventing this acidic condition from significantly reducing the pH within the treatment system. However, if the alkalinity present in the influent wastewater is not sufficient to neutralize the hydrogen ions released during nitrification, the pH within the system will begin to drop. This, in turn, can lead to a significant reduction in nitrification efficiency. pH readings outside the range of 7.2 to 8.0 can have an inhibitory effect on the nitrifying organisms.

The amount of alkalinity remaining following the biological process is calculated as follows:

Influent Alk Required = Alk Consumed + Alk Required to Maintain Neutral pH = 999 lb/d or 240 mg/L

Where:

Alkalinity Consumed = TKN_{ox} * 7.14 = 665 lb/d
TKN_{ox} =93.1 (see above)
TKN_{in} = Influent TKN = 133 lb/d (see above)
TKN_{out} = 4.2 lb/d (see above)
Alkalinity Required for Neutral pH = 80 mg/L * 0.5 mgd * 8.34 = 334 lb/d

It is calculated above that an influent alkalinity of approximately 239 mg/L is required in the influent to avoid a drop in pH that would inhibit the biological treatment processes. Typical wastewater alkalinity is approximately 200 mg/L. It appears that the lagoon may be slightly deficient in alkalinity for the design 2034 influent flows and loads, however, low pH has not historically been an operating problem it is recommended that influent alkalinity be measured to determine if sufficient alkalinity exists in the wastewater or if an alkalinity addition system will be required in the future.

As shown in the above analysis, the existing lagoon has sufficient volume to treat the projected 2034 influent flow to meet the exiting 2007 permit limits. The existing 25 hp floating aerator is estimated to provide approximately 50 lbs-O_2/hr, based on an oxygen transfer efficiency of 2 lbs-O_2 per hour per horsepower per Ecology's *Criteria for Sewage Works Design*, typical for floating aerators. The existing floating aerator does not have sufficient capacity to provide the oxygen required to treat the projected 2034 influent load.

Recommendations

The existing lagoon has sufficient volume to provide treatment to comply with the 2007 permit limits.

The PVC lagoon liner is approximately 30 years old. The anticipated lifespan of these liners ranges from 30 to 50 years. It is recommended that the liner be replaced at some point during the planning period of this document. Current Ecology standards require lagoons to be either double lined with leak detection or single lined with groundwater monitoring. Typically, it is recommended that lagoons be double lined with a 60 ml HDPE liner with a leak detection system. The double liner with leak detection provides greater protection to groundwater and reduces additional operational expenses resulting from the compliance with requirements for monitoring for a single lined system. Operators of single lined systems are required to demonstrate (record) continued compliance with the groundwater standards by ensuring ground water contaminant levels do not exceed the enforcement limits set by ecology during the permitting process. Another consideration is that failure of a single lined system could require soil remediation in addition to replacement of the liner. Approximate costs for the double and single lined systems are $78,000 and $50,000, respectively.

Projects to replace aerated lagoon liners present logistical difficulties for a treatment facility. The plant must ensure adequate treatment is maintained and that effluent permit limits are met during the replacement of the liner. Typically, this requires the modification of an existing basin or the construction of an additional basin to provide temporary treatment. It is recommended in the Solids Handling Facilities section of this chapter (below) that a digester be constructed to provide redundancy in the solids handling system. The digester has sufficient volume to temporarily treat the current influent flow to the plant to meet the existing permit limits. It is therefore recommended

that the digester and lagoon lining be done as a single project with the digester constructed first and then used to temporarily treat the influent during the liner replacement before being brought on-line as a digester.

Additional recommendations include the replacement of the 25-hp aerator and 20-hp mixer. Both of these equipment items are original installations and beyond their anticipated life span of 20 to 25 years. It is recommended that two new aerators and a new mixer be purchased for the lagoon. Initially, the lagoon can be operated as it is currently, with one mixer and one aerator in operation to save energy costs. As loading to the lagoon increases, operation of a second aerator will be required to meet the oxygen demand. Design criteria for the upgraded aerated lagoon are provided in Table 7-5.

TABLE 7-5

Aerated Lagoon Design Criteria

Aerated Lagoon	
Total Volume	0.67 mgd
Aerobic Volume	0.50 mgd
Anoxic Volume	0.17 mgd
Lagoon Dimensions	
Total Bottom Width	26 ft
Total Bottom Length	87 ft
Side Water Depth	12 ft
Side Slope	3H:1V
Surface Aerator	
Quantity	2
Motor	25 hp, 480 V, 3 Phase
Mixer	
Quantity	1
Motor	20 hp, 480 V, 3 Phase

Assuming the use of the digester to provide temporary treatment to the wastewater during construction, the estimated project cost for the above improvements to the existing lagoon is $520,000 including sales tax, contingency and engineering design. This project cost also includes the removal of the existing sludge deposited in the lagoon. A detailed cost estimate is included in Appendix C.

SECONDARY CLARIFIERS

Process Description

Following biological treatment, effluent from the aerated lagoon flows by gravity to the circular secondary clarifier. The secondary clarifier provides a quiescent environment where settlable solids are separated from the flow by gravity sedimentation. Settled sludge is transported by mechanically operated rotating rake arms along the floor of the clarifier to a central hopper. Solids are removed from the hopper for return to the aerated lagoon or wasted by means of the return activated sludge (RAS) pump and waste activated sludge (WAS) pump, respectively. Effluent exits the clarifier by passing over a weir at the edge of the tank. Design criteria for the existing secondary clarifier are provided in Chapter 4.

Structural

The secondary clarifier tank is in good condition with no noticeable cracks or spalling of the concrete and should be capable of continual operation for the 20-year planning period.

Mechanical

The clarifier does not currently have spray bars to assist in directing floating scum to the scum box.

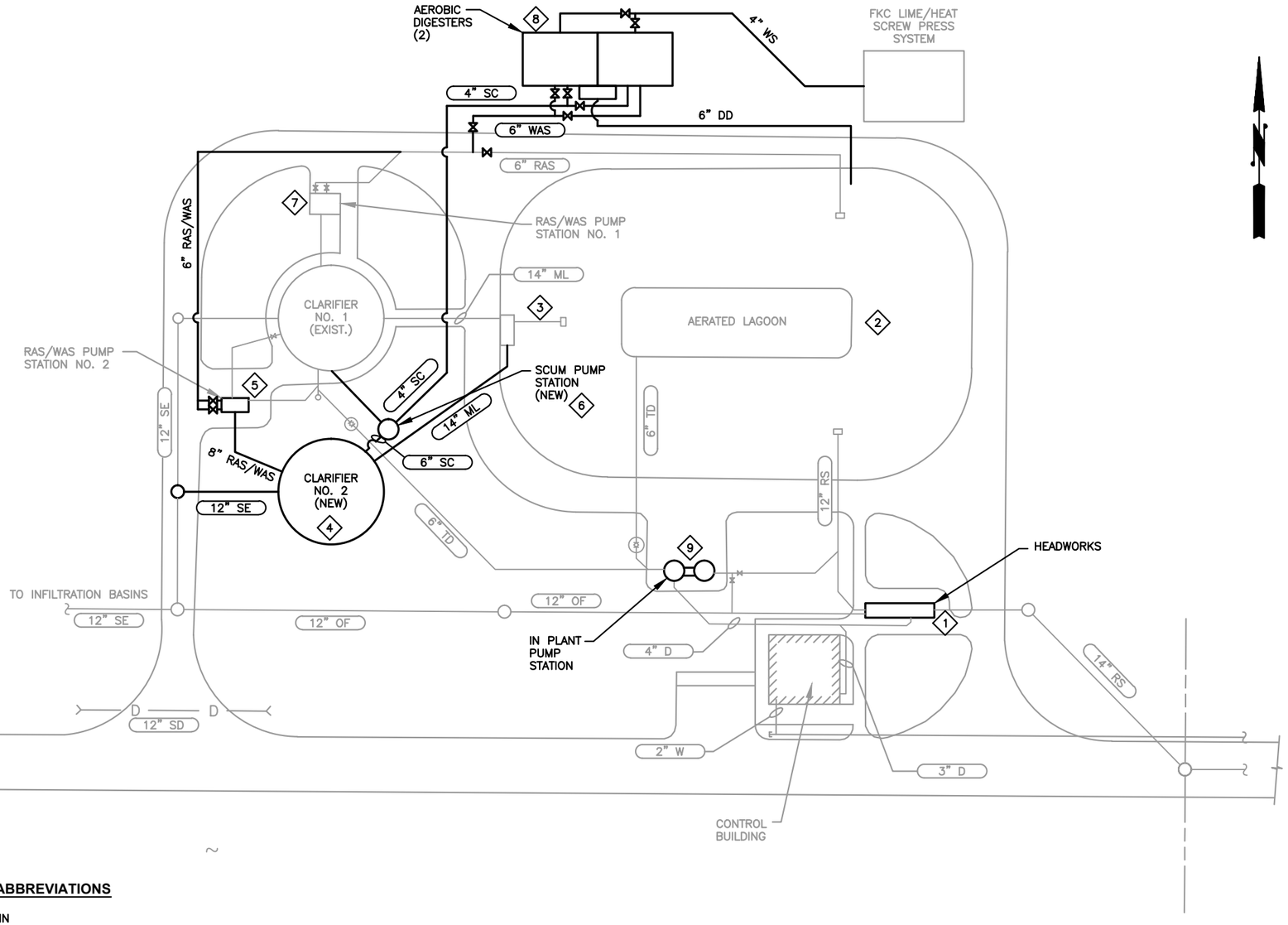
The clarifier weir, mechanism, and drive all appear to be in good condition, but the drive bearings may need replacement due to age.

Capacity

As noted in the *Criteria for Sewage Works Design*, in order to meet Ecology's reliability standards for a reliability class II facility, the secondary clarifier system must be capable of treating 50 percent of the design flow when the largest clarifier is out of service. The facility currently has no redundant clarifier capacity to meet this requirement.

Wastewater Engineering (Metcalf & Eddy, 2003) recommends a maximum surface overflow rate of 400 to 700 gpd/ft^2 at maximum month flow and 1,000 to 1,600 gpd/ft^2 at peak hour flow. The design hydraulic load is the influent flow and does not include the return activated sludge rate. Using the respective 2034 design flows, the overflow rates for the secondary clarifier are 520 gpd/ft^2 at the permitted flow (0.5 mgd) and 1010 gpd/ft^2 at peak hour flow (0.967 mgd). The hydraulic capacity of the secondary clarifier is adequate for the 20-year planning period.

In addition to recommendations for surface overflow rates, *Wastewater Engineering* recommends solids loading rates of 0.8 to 1.2 lb/ft^2/hr at maximum month flow and



PIPING ABBREVIATIONS

D	DRAIN
DD	DIGESTER DECANT
FE	FINAL EFFLUENT
ML	MIXED LIQUOR
OF	OVERFLOW
RAS	RETURN ACTIVATED SLUDGE
RS	RAW SEWAGE
SC	SCUM
SE	SECONDARY EFFLUENT
WAS	WASTE ACTIVATED SLUDGE
WS	WASTE SLUDGE

NOTES:

1. REPLACE EXISTING MECHANICAL FINE SCREEN. INSTALL BAR SCREEN IN OVERFLOW CHANNEL.
2. REPLACE AERATED LAGOON LINER. INSTALL NEW AERATORS AND MIXER.
3. MODIFY AERATED LAGOON OUTLET STRUCTURE TO CLARIFIER SPLITTER BOX TO SERVE BOTH CLARIFIERS.
4. CONSTRUCT NEW 35 FT. DIAMETER CLARIFIER FOR TREATMENT REDUNDANCY.
5. MODIFY EXISTING WAS PUMP STATION TO RAS/WAS PUMP STATION FOR CLARIFIER NO. 2. INCLUDES NEW SUBMERSIBLE PUMPS (2), VALVES AND FLOW METER.
6. CONSTRUCT NEW SCUM PUMP STATION TO CONVEY SCUM FROM CLARIFIER NO. 1 AND CLARIFIER NO. 2 TO AEROBIC DIGESTERS.
7. INSTALL NEW PUMPS (2), VALVES AND FLOW METER IN CLARIFIER NO. 1 RAS/WAS STATION.
8. CONSTRUCT 2 NEW AEROBIC DIGESTERS, TOTAL VOLUME 168,000 GALLONS. INCLUDES FINE BUBBLE DIFFUSION, BLOWERS (3), SLUDGE PUMPS (2), AND CONNECTION TO FKC SCREW PRESS BIOSOLIDS SYSTEM.
9. INSTALL NEW PUMPS (2) AND VALVES IN EXISTING IN-PLANT PUMP STATION.

CITY OF FORKS

GENERAL SEWER/WASTEWATER FACILITY PLAN
FIGURE 7-1
WWTF IMPROVEMENTS SITE PLAN

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CONSULTING ENGINEERS

1.6 lb/ft^2/hr at peak hour flow. The solids load is based on the total flow rate (influent plus return activated sludge) at the design MLSS concentration. Using the respective 2034 design flow rates (0.5 mgd) and a maximum return activated sludge rate of 100 percent of the maximum month influent flow rate, the solids loading rates are 0.8 lb/ft^2/hr at maximum month flow and 1.2 lb/ft^2/h at peak hour flow at an MLSS concentration of 2,200 mg/L. The solids loading capacity of the existing clarifier is adequate for the 20-year planning period.

Recommendations

The facility does not have redundant clarifier capacity. Ecology's reliability standards require redundant clarifier capacity. It is therefore recommended that a new, second clarifier be constructed to provide the redundancy required to meet Ecology's reliability standards. A new 35-foot-diameter clarifier (Clarifier No. 2) could be located to the south of the existing clarifier (Clarifier No. 1). Mixed liquor from the aerated lagoon could be split hydraulically in the existing splitter box, modified with weirs to provide an even distribution of flow to each clarifier when both are in service. A new 14-inch mixed liquor line would be required to convey the mixed liquor to the new clarifier from the modified splitter box. The existing clarifier by-pass line from the splitter box would be abandoned.

To reduce cost, the existing WAS pump station could be repurposed to pump sludge (RAS/WAS) from Clarifier No. 2 using two new submersible pumps (one duty, one spare) with variable speed drives. The WAS station is in good structural condition but the associated submersible pump is in need of replacement and the station lacks a retrieval mechanism to allow maintenance on the pump. The repurposed station would pump through a new 6-inch force main and tie in to the existing RAS line from Clarifier No. 1. A magnetic flow meter could be installed on the RAS force main to monitor the RAS/WAS flow rates. Prior to discharging to the lagoon, a 4-inch connection would be installed on the existing 6-inch RAS line to direct WAS to the solids handling system. WAS rates to the solids handling system could be monitored with a magnetic flow meter located on the 4-inch line to the solids handling system. Manually operated valves would be positioned on each line to allow operators to adjust wasting rates.

It is also recommended that a scum pump station be installed. Scum currently collected from the secondary clarifier flows by gravity to the In-plant pump station where it is recycled through the aerated lagoon back to the clarifier and is not removed from the plant. The new station would collect scum from both clarifiers and pump it, using a new submersible centrifugal pump, through a 4-inch force main to the solids handling system. The station will be located to intercept the existing scum line from Clarifier No. 1 to the in-plant pump station.

Secondary Effluent from the new clarifier would be connected to the existing piping to the infiltration system.

Table 7-6 provides design criteria for a new clarifier, RAS/WAS pump station and scum pump.

TABLE 7-6

Secondary Clarifier No. 2 Design Criteria

Secondary Clarifier No. 2	
Quantity	1
Type	Circular; Center Feed, Peripheral Withdrawal
Diameter	35 ft
Side Water Depth	12 ft
Surface Area	962 ft^2
Surface Overflow Rate	520 gpd/ft^2 MM, 1008 gpd/ft^2 PH
Solids Loading Rate	19 lb/ft^2/day MM, 28 lb/ft^2/day PH
RAS/WAS Pump Station No. 2	
No. of Pumps	2
Type	Submersible Centrifugal
Capacity	350 gpm @ 30 ft. TDH
Motor	5 HP, 480 V, 3 Phase (VFD)
Scum Pump Station	
No. of Pumps	1
Type	Submersible Centrifugal
Capacity	100 gpm @ 30 ft. TDH
Motor	3 HP, 480 V, 3 Phase

In addition to the construction of a second clarifier and other improvements as noted above, it is recommended that new drive bearings be installed in Clarifier No. 1.

Costs to provide a second clarifier with RAS/WAS pump station, scum pump station and the recommended improvements to the existing clarifier are estimated to be $915,000 including tax, contingency and engineering design. A detailed cost estimate is provided in Appendix C. A conceptual layout of the improvements is shown in Figure 7-1.

RETURN ACTIVATED SLUDGE SYSTEM

Process Description

Return Activated Sludge (RAS) is withdrawn from the sludge collection hopper at the bottom of the clarifier into the RAS pump station wet well and is pumped to the north east corner of the aerated lagoon. The plant was designed with two identical 5-hp wet pit chopper pumps discharging to a common force main, which discharges to the aerated lagoon. One of the pumps no longer functions and has been removed without replacement. Design criteria for the existing return activated sludge pump station is provided in Chapter 4.

Structural

The existing RAS pump station concrete slab and wet well are in good condition with no noticeable cracks or spalling of the concrete. A wooden enclosure has been constructed to house the single 5-hp chopper pump. The enclosure restricts access to the pump for maintenance and, if the pump is kept, is in need of replacement.

Mechanical

The pump station currently operates with a single 5-hp chopper pump with no redundancy. A second pump was part of the original design, but has failed and has not been replaced. The operating pump is part of the original equipment installed in 1986. It is beyond its typical life span of 20 to 25 years for well-maintained equipment.

Typically, RAS flow rates are measured to optimize the biological processes in the plant. The current RAS system has no means to measure the RAS flow rate.

Capacity

The 2008 Ecology *Criteria for Sewage Works Design* recommends a RAS capacity of 100 percent of the design flow. With this criterion a pump capacity of approximately 350 gpm is required to recirculate the RAS to the lagoon at the permitted flow of 0.5 mgd. The existing 325 gpm RAS pump does not have sufficient capacity to handle RAS pumping for the planning period.

Recommendation

It is recommended that the existing 30 year old 5-hp chopper pump be replaced with two submersible centrifugal pumps (one duty, one spare) for redundancy. Each pump should be rated for 350 gpm and have variable frequency drives (VFD) to allow operators to control the RAS return rate to the aerated lagoon. It is also recommended that a magnetic flow meter be installed on the RAS line to the aerated lagoon to optimize the biological treatment in the lagoon system. Design criteria for the improved RAS pump station is provided in Table 7-7.

TABLE 7-7

Return Activated Sludge Pump Station Design Criteria

RAS Pump Station No. 1	
No. of Pumps	2
Type	Submersible Centrifugal
Capacity	350 gpm @ 28 ft. TDH
Motor	5 hp, 480 V, 3 Phase (VFD)

The estimated cost of the improvements to the existing RAS pump station is $136,000. This cost includes tax, contingency and engineering design. A more detailed cost estimate is included in Appendix C.

EFFLUENT INFILTRATION BASINS

Process Description

Effluent from the secondary clarifiers flows by gravity to the rapid infiltration system for percolation to groundwater. The system is comprised of eight interconnected earthen basins. Flow is distributed through four separate distribution boxes, each box distributing flow to two basins. The basins are all connected via 12-inch overflow pipes that allow treated effluent to flow between the basins if a basin becomes plugged and overflows. Table 7-8 shows the design criteria for the infiltration basin.

TABLE 7-8

Infiltration Basin Design Criteria

Infiltration	
No. of Basins	8
Area per Basin	0.44 acre
Basin Depth	4 ft.
Total Area	3.52 acres
Design Hydraulic Loading Rate	AA – 21.9 inch/week; MM - 36.6 inches/week

Structural

The basins, distribution boxes and piping are all in good condition and functioning adequately.

Capacity

The hydraulic capacity of the total 3.52 acre basin area is 0.30 mgd at 21.9 in/wk and 0.50 mgd at 36.6 inches per week, therefore, the capacity of the infiltration basins exceeds both the 2034 projected flow (0.285 mgd) and the permitted flow (0.5 mgd).

Recommendations

There are no recommended improvements to the rapid infiltration basin system.

SOLIDS TREATMENT FACILITIES

Process Description

The City wastes sludge directly from the clarifier to an FKC lime stabilization and heated screw press system located in the solids handling building. There is no digester upstream of the screw press system. The WAS is mixed with lime to adjust the pH in a polyethylene mixing tank. The limed sludge is held in the mixing tank for a minimum of 24 hours at a pH of greater than 11.5 to achieve vector attraction reduction per WAS 173-308 requirements. The limed sludge is then pumped to the sludge feed tank. From the feed tank the sludge is pumped to the flocculation tank. Polymer is added to the sludge prior to the flocculation tank. From the flocculation tank, the sludge is sent to a rotary drum screen thickener and then flows by gravity to the steam-heated screw press for pasteurization and dewatering, creating Class A biosolids. Class A biosolids are available for public use from the City. The City currently spreads biosolids at the airport and on the grounds of the WWTF. Table 7-9 summarizes the existing design criteria for the sludge treatment system.

TABLE 7-9

Solids Handling Design Criteria

Solids Handling	
Lime Mixing Tank	
Quantity	1
Volume	6,480 gallons
Sludge Feed Tank	
Quantity	1
Volume	6,480 gallons
Polymer Storage Tank	
Quantity	1
Volume	370 gallons
Screw Press	
Make/Model	FKC RST-S630N2000L
Motor Size	1 hp, 1,800 rpm
Quantity	1
Capacity	35.4 lb/hr (dry)

Structural

The FKC lime stabilization system is housed in a building in the northeast corner of the site. The building appears in good condition with no improvements required given the existing configuration of the screw press system, but there is little room for increased capacity of the system within the building. The system is configured such that the City

owned haul truck is positioned inside the building in a bay below the discharge of the screw press on the upper floor.

Mechanical

All systems within solids handling system are functioning as designed with the exception of one of the two boilers supplying heat to the screw press. The boiler is not operating and is in need of repair or replacement.

Capacity

The existing FKC screw press system has a capacity to process 35.4 lb/hr hour of solids. The projected 2034 WAS production is approximately 609 lb/d (25.4 lb/hr) at maximum month design load. To process a weeks' sludge production in 2034, the screw press will need to run continuously for approximately 120 hours (5 days). FKC recommends sizing the press to run for 6 days (144 hours) per week, or less. Currently, the screw press runs unattended during the night, and it is assumed that unattended operation can be performed in the future.

The City prefers to set the design criteria for the FKC system at a maximum operation of 4 days per week (96 hours) to allow for system maintenance and planned shut down periods. To continue running on this schedule the capacity of the screw press system would need to increase to 45 lb/hr.

Recommendations

Two alternatives to increase the solids handling capabilities of the plant are discussed in the sections below. The first alternative is upgrade the screw press with additional capacity. The second alternative is to construct an aerobic digester to reduce the need to increase the screw press capacity.

Alternative No. 1 – New Screw Press

The first alternative is to install modifications to the existing FKC screw press system with sufficient capacity to process the projected 2034 waste sludge. To increase the capacity, the system modifications would include the replacement of a number of ancillary components in addition to the screw press including: new sludge holding tanks, new sludge feed pump, new polymer system, new flocculation tank, and new boiler skid. The screw press would need to be relocated in the building and the truck loading bay would need to be moved outside of the building. Biosolids would be transported to the truck by conveyor. Estimated cost to provide the required increase in capacity to the existing screw press system is approximately $920,000 including tax, contingency and engineering design. A more detailed cost estimate is included in Appendix C.

Alternative No. 2 – Aerobic Digester

The second alternative is to construct an aerobic digester to include in the solids handling system. A digester sized to provide the required 60 day solids retention time (SRT) to create Class B biosolids would, due to the destruction of volatile solids, reduce the solids loading to the FKC system from 606 lbs/day to 420 lb/day. The required screw press capacity to process a weeks' digested sludge production in 2034, is 31 lbs/hr or approximately 86 percent of the current screw press capacity.

The digester option reduces the required capacity of the screw press to within the existing screw press' design capacity at the City's current 96 hour operating schedule. In addition to negating the need for additional screw press capacity, a digester would provide greater flexibility to the operators regarding the schedule and duration of screw press system operation, as well as provide additional storage to allow for maintenance and repair of the screw press system. With no digester capacity, if the screw press system were unavailable for an extended period of time, such as due to equipment failure and need for repair, the plant would have to find an alternate disposition for unclassified waste sludge such as hauling to another WWTF, which would result in the costly transport of unclassified sludge. An aerobic digester sized to produce a Class B liquid biosolids would also provide redundancy to the Class A system, since Class B biosolids can, with a permit, be land applied without further treatment. Class B biosolids could potentially be permitted to be applied on the City's existing sprayfield during periods when the screw press is inoperable.

Aerobic digestion is similar to the activated sludge process discussed for the aerated lagoon. Waste solids from the secondary clarifiers are conveyed to the aerobic digesters for stabilization and solids reduction. The sludge is aerated and mixed in the digesters to provide oxygen to microorganisms which break down available food to carbon dioxide, water and cell tissue. As the supply of available food is depleted, the microorganisms begin to consume their own cell mass to obtain energy for cell maintenance. When this occurs, cell mass is oxidized aerobically to form carbon dioxide, water and ammonia. A major objective of aerobic digestion is to reduce the mass of the solids for disposal. This reduction takes place predominantly with the biodegradable (organic) content of the sludge, although there may be some removal of inorganics through biological processes as well.

Digester Volume

The required volume for an aerobic digestion system is based on the required detention time to achieve pathogen reduction requirements to produce Class B biosolids. Section 173-308-170 of the Washington Administrative Code (WAC) provides the requirements for biosolids to be classified as Class B using aerobic digestion. The biosolids must be agitated with air or oxygen to maintain aerobic conditions for a specific solids retention time (SRT) at a specific temperature. Values for the SRT and temperature must be between 40 days at 20 degrees C (68 degrees F) and 60 days at 15 degrees C

(59 degrees F) when accommodating the projected maximum month sludge loading. To be conservative, the digester has been sized using a design temperature of 15 degrees C and an SRT of 60 days.

As calculated in the aerated lagoon section of this chapter, daily waste sludge production ($P_{X,TSS}$) from the lagoon is 606 lb/day.

$$P_{X,TSS} = {P_{x,Bio}}/{0.85} + X_{iVSS} + X_{iTSS}$$

Where:

$P_{x,Bio}$ = biodegradable volatile suspended solids production = 297
X_{iVSS} = volatile nonbiodegradable solids, lb/day = 157 lb/day
X_{iTSS} = influent nonvolatile suspended solids, lb/day = 102 lb/day

Assuming a 45 percent reduction in biodegradable volatile suspended solids based on a 60 day SRT at a temperature of 15 degrees, the mass of solids wasted daily is calculated as follows:

$$\text{Mass of solids wasted} = {297}/{0.85} * 0.55 + 157 + 102 = 451\ {lb}/{d}$$

The total mass of solids in the digester is calculated by multiplying the SRT (60 days) by the daily mass of solids wasted.

$$\text{Total mass of solids in digester} = 451 * 60 = 27{,}060\ lbs$$

Assuming a digester concentration of 2.0 percent solids, the required digester volume is calculated as follows.

$$V = {27{,}000 lbs}\Big/{8.34 * 20{,}000 \left({mg}/{L}\right)} * 1{,}000{,}000 = 162{,}000 \text{ gallons.}$$

It is recommended that the digester volume be provided in two separate equally sized tanks placed in series, with piping to allow either tank to be taken off line for maintenance. Assuming a tank side water depth of 18 feet, the total square footage of tank required is 1,200 ft^2.

Digester Aeration Requirements

Aeration is required for the biological destruction of volatile solids. The demand is calculated assuming 45 percent reduction in volatile suspended solids at 10 degrees C and an SRT of 60 days. The oxygen requirement is therefore:

$$AOR = 2.3 * P_{x,vss} * 0.45 = 470 lb/d$$

Where:

AOR = actual oxygen transfer rate
Px,vss = 454 lb/d (see above)

Applying a factor of safety of 1.5 to account for fluctuations in diurnal loads, results in a design oxygen demand of 1,050 lb/d. Oxygenation equipment is specified based upon standard oxygen transfer rate (SOTR), the oxygen transfer rate in clean 20 degrees C water with no suspended solids. The SOTR is calculated as follows:

$$AOTR = SOTR\left(\frac{bC_{STH} - C_O}{C_{S20}}\right)\left(1.024^{T-20}\right)aF$$

Where:

AOR = actual oxygen transfer rate
SOR = standard oxygen transfer rate
a = oxygen transfer correction factor, 0.35
b = salinity surface tension factor, 0.95
C_{STH} = dissolved oxygen concentration at operating temperature and elevation, = 9.08 mg/L
C_{S20} = dissolved oxygen concentration at 20 degrees C and 1 atm, 9.08 mg/L
C_O = operating dissolved oxygen concentration, 2 mg/L
T = 20 degrees C
F = fouling factor, 0.9

Thus AOR = 0.23 SOR. The resulting SOR is therefore 2,044 lb/d.

Assuming an aeration diffuser efficiency of 1.9 percent per foot of diffuser submergence and 17 feet of submergence, the total aeration diffuser efficiency is 32 percent, the required total airflow for both tanks is then:

Air Flow = 2,044 lb O_2/d / (1440 min/d * 0.0173 lb O_2/SCFM * 0.25) = 256 SCFM

The air required for mixing the aerobic digester is calculated with the mixing requirement of 0.12 scfm per ft^2. The tanks, as determined above has an approximate volume of 162,000 gallons (21,660 ft^3). Assuming a tank depth of 18 feet, and a length to width ratio of 2:1, the dimension of the tank is approximately 25 feet x 50 feet The total aeration required to mix the tanks is therefore:

Mixing Air Required = 25 * 50 * 0.12 = 150 SCFM.

The aeration required to meet the oxygen demand in the digester is greater than the aeration needed to mix the tank therefore, the aeration requirement to meet the oxygen demand is used in the design of the aeration system.

Oxygen and mixing for the aerobic digester would be supplied by a diffused air system. The two digester basins would be equipped with fine bubble diffusers to maximize the oxygen transfer efficiency and reduce power consumptions. Each tank would have a dissolved oxygen meter to monitor oxygen levels in the tank. Three blowers (two duty, one spare) would supply air to the tanks. Each tank would have its own dedicated blower and separate air supply header from the three blowers.

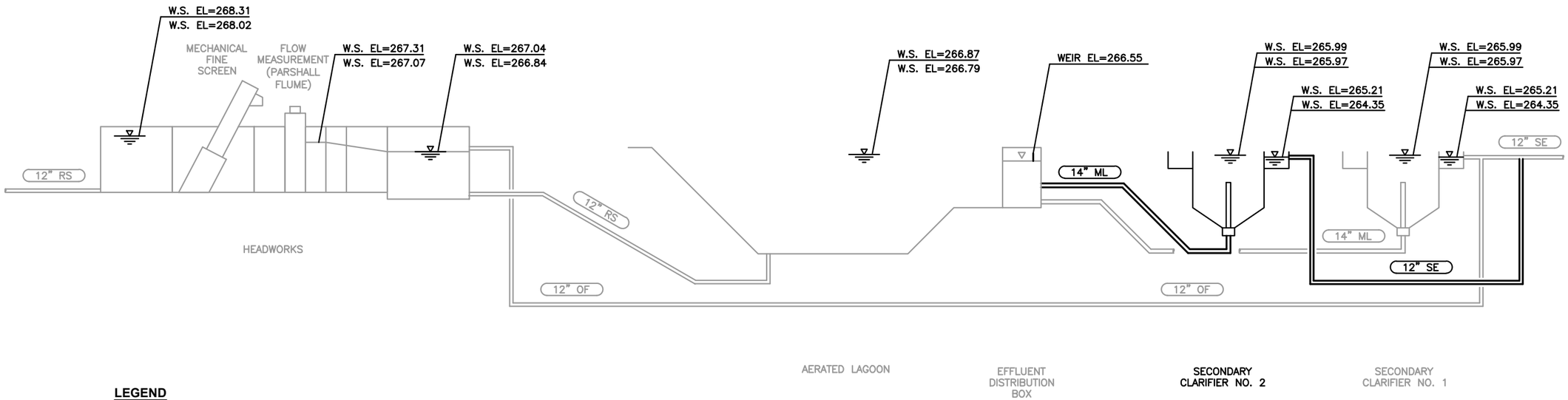
Table 7-10 summarizes the proposed design criteria for the new aerobic digester.

TABLE 7-10

Aerobic Digester Design Criteria

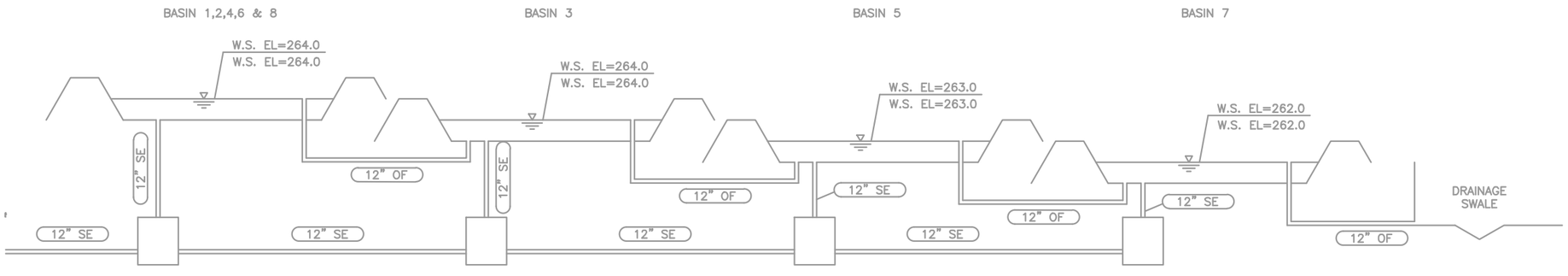
Tanks	
No of Tanks	2
Tank Volume (each)	84,000 gallons
Side Water Depth	18 feet
Length x Width (total)	25 feet x 50 feet
Solids Retention Time (SRT)	60 days @ 15 degrees C
Digester Mixing/Aeration	
Type of Mixing	Fine Bubble Aeration
Air per Tank	500 SCFM
No of Blowers	3
Blower Type	Positive Displacement
Motor	10 HP, 480 V, 3 Phase
Digester Sludge Pump	
Quantity	2
Type	Rotary Lobe
Capacity	200 gpm
TDH	20
Motor	3 hp, 480 V, 3 Phase

Of the two alternatives discussed above, it is recommended that a digester be constructed to produce Class B biosolids. The digester eliminates the need for a larger screw press, reduces screw press run time, and therefore operations and maintenance costs, and provides redundancy to the City's solids handling system to allow for maintenance on the screw press. The cost to provide an aerobic digester is estimated to be $814,000 as opposed to $920,000 for increasing the screw press capacity. This estimate includes tax, contingency and engineering design. A detailed cost estimate is provided in Appendix C.



LEGEND

WATER SURFACE ELEVATION AT PEAK HOUR FLOW
WATER SURFACE ELEVATION AT AVERAGE ANNUAL FLOW



INFILTRATION BASINS

CITY OF FORKS

GENERAL SEWER/WASTEWATER FACILITY PLAN
FIGURE 7-2
WWTF IMPROVEMENTS HYDRAULIC PROFILE

Gray & Osborne, Inc.
CONSULTING ENGINEERS

IN PLANT PUMP STATION

Process Description

The in-plant pump station can be used to drain the secondary clarifier, aerated lagoon and WAS pump station. In addition to providing a means to drain these tanks, the in-plant pump station also collects wastewater from the operations building and scum from the scum box of the secondary clarifier. The station consists of two, 3-hp submersible pumps in a 6-foot-diameter wet well. Existing pump station design criteria is provided in Chapter 4.

Structural

The pump station concrete slab and wet well are in good condition with no noticeable cracks or concrete spalling.

Mechanical

The 3-hp submersible pumps are the original pumps installed during construction of the plant and are beyond the typical equipment life span of 20 to 25 years. The rails for retrieving the pumps for maintenance and repair are badly corroded and need replacement. An electrical box sits within the wet well. The box appears to have the required seal-off but is not rated for installation in a Class 1 Division 1 environment. The electrical box should be removed from the wet well or replaced with an appropriately classified box.

Capacity

Each 3-hp pump provides a sufficient capacity of approximately 225 gpm at 30-foot TDH to handle 2034 design flows.

Recommendations

It is recommended that both in-plant pump station pumps be replaced with new submersible centrifugal pumps. In addition, new stainless steel guide rails should be installed to allow for retrieval of the pumps for maintenance and repair. It is recommended that the electrical box be removed from the wet well and all electrical components within the wet well be replaced with appropriate Class 1 Division 1 rated components. Design criteria for the improved In Plant pump station is provided in Table 7-11.

TABLE 7-11

In-Plant Pump Station Design Criteria

In-Plant Pump Station	
No. of Pumps	2
Type	Submersible Centrifugal
Capacity	225 gpm @ 30 ft. TDH
Motor	3 hp, 480V, 3 Phase

Costs to provide the recommended improvements to the In Plant Pumps Station are estimated to be $80,000 including tax, contingency and engineering design. A detailed cost estimate is provided in Appendix C.

ELECTRICAL SERVICE

The WWTF has two separate electrical service drops. A 480 volt, 3 phase, 600 amp, electrical service provides power to all areas of the plant with the exception of the solids handling facility which is served by a separate 480 volt, 3 phase, 250 amp service. Power is supplied by the PUD of Clallam County. The utility provides and maintains the primary distribution system, service transformers, kilowatt-hour meters and wiring to the main service disconnects. All wiring and electrical equipment of the load side of the each main service disconnect is owned and maintained by the City.

The WWTF has no on-site standby power generator. A portable 200 kVA generator is brought to the plant during outages. The generator is used to power all portions of the plant with the exception of the solids handling system.

It is recommended that a permanent on-site generator be installed to provide power to all electrical systems in the plant during outages. A preliminary load study of the plant with recommended improvements results in the need for a 250 kW generator. The generator would be housed outside in a sound attenuating enclosure. A new automatic transfer switch is also required to ensure power is switched to the generator during an outage. The estimated cost to install a new permanent generator with automatic transfer switch is $320,000. This cost includes tax, contingency and engineering design.

LAB AND MAINTENANCE BUILDING

The laboratory has adequate room to perform all of the required analysis. The building is in overall good condition, but requires some minor additions and maintenance work including:

- New counter tops and flooring
- Fan in bathroom
- Hood fan in Laboratory

- Heater/Temperature control system

NON-POTABLE WATER SYSTEM

The WWTF does not utilize effluent from the plant as a source for non-potable water. The system is connected through a backflow preventer to the City's potable water system and feeds the yard hydrants and spray mechanism on the fine screen. The operators have expressed an interest in using effluent as a source of non-potable water to provide wash water for the various process equipment. Use of effluent for non-potable water would require installation of an effluent disinfection system, or a disinfection system for the non-potable water separately at considerable cost. At the current cost of City water, it is not cost effective to install a new non-potable water system at this time.

Currently there is no physical separation of the City's potable water system and the NPW used on site. A physical separation of these systems is required by the Washington State Department of Health cross connections regulations. It is recommended that a new air-gap system be installed in accordance with the regulations. The system would be a package air-gap facility consisting of an open-top surge tank, a float-controlled inlet valve on the waterline to the surge tank, an inlet separated from the tank water surface by a physical ai gap, two centrifugal water supply pumps (one duty, one spare), and a hydro pneumatic pressure tank. The pumps will be automatically controlled based on distribution system pressure. The air-gap system could be installed in inside an existing WWTF building.

Design criteria for the air-gap system are provided in Table 7-12.

TABLE 7-12

Air-Gap System Design Criteria

Air-Gap System	
Surge Tank Volume	Per Manufacturer's Recommendation
Quantity of Pumps	2 (one duty, one spare)
Capacity	100 gpm
System Pressure	80 psig

The estimated cost to install a new air-gap non-potable water system is $80,000. This cost includes tax, contingency and engineering design.

SUMMARY OF RECOMMENDED IMPROVEMENTS

The recommended capital improvement projects to address the deficiencies at the City's WWTF are summarized in Table 7-13. The costs shown are the estimated total project costs including tax, contingency and engineering design. Detailed cost estimates are

provided in Appendix C. Chapter 10, Financial Analysis, provides the recommended schedule for the capital improvement projects and alternatives for funding the projects.

TABLE 7-13

Summary of Recommended Capital Improvement Projects

No.	Description	Estimated Project Cost
1	Headworks Improvements(1)	$262,000
2	Aerated Lagoon Improvements	$520,000
3	Clarifier No. 2, RAS/WAS PS, and Scum PS	$915,000
4	RAS PS Improvements (RAS/WAS PS No. 1)	$136,000
5	New Digester	$814,000
6	In-Plant Pump Station	$80,000
7	Electrical/Backup Generator	$320,000
8	Lab & Maintenance Building Improvements	$50,000
9	Air-Gap Non-Potable Water System	$80,000
10	Mill Creek Pump Station(2)	$80,000
Total		$3,257,000

(1) Fine screen mechanism replacement included in project.
(2) Recommended in Chapter 6, Wastewater Collection System.

The estimated total cost of all recommended capital improvement projects for the facility, including the Mill Creek Lift Station Improvements as discussed in Chapter 6 is $3,257,000.

Figure 7-1 is a preliminary site plan showing the improvements to the WWTF. A hydraulic profile including the improvements is provided in Figure 7-2.

CHAPTER 8

WASTEWATER TREATMENT FACILITY IMPROVEMENTS

INTRODUCTION

As required by RCW 90.48.112, this plan must evaluate the "opportunities for the use of reclaimed water." Reclaimed water is defined in RCW 90.46.010 as "effluent derived in any part from sewage from a wastewater treatment system that has been adequately and reliably treated, so that as a result of that treatment, it is suitable for beneficial use or a controlled use that would not otherwise occur, and is no longer considered wastewater."

Key differences between the requirements for water reuse and those for effluent disposal are the levels of reliability required within the treatment process. Distribution, and use areas. The state of Washington's reuse treatment standards call for continuous compliance, meaning that the treatment standards must be met on a constant basis or the treated water cannot be used as reclaimed water.

ALLOWABLE USES FOR RECLAIMED WATER

The Washington State *Water Reclamation and Reuse Standards* describe several allowable uses for reclaimed water, including:

- Agricultural irrigation;
- Landscape irrigation;
- Impoundments and wetlands;
- Groundwater recharge;
- Streamflow augmentation;
- Industrial and commercial uses; and
- Municipal uses.

Depending on its end use, there are four categories of reclaimed water; Class A, Class B, Class C and Class D. Class A has the highest degree of effluent treatment. In general, when unlimited public access to the reclaimed water is involved or when irrigation of crops for human consumption is the intended use, the criteria will require Class A reclaimed water.

REUSE EVALUATION

Factors that could lead a wastewater treatment provider to pursue reclaimed water include the following:

- Regulatory Requirements, Regulatory conditions are such that making reclaimed water is a viable option compared to continuing to discharge secondary effluent.
- Water Rights, The ability to make and reuse reclaimed water could benefit the City's water rights situation.
- Environmental Benefits, There can be environmental benefits in the right circumstances to making reclaimed water versus secondary effluent, such as diversion of pollutants from the ground waters.
- Cost Effectiveness, The cost to make and reuse reclaimed water is typically higher than the cost to make secondary effluent. In addition, control of the WWTF is more complex at a reclaimed water facility than a typical WWTF.

An evaluation of how each of these factors relates to the City's WWTF is provided in the following sections.

Regulatory Requirements

At this time, the City has exceeded 85 percent of the design criteria for BOD_5 loading on four occasions since 2008. The improvements listed in Chapter 7 will correct the issues dealing with any permit violations/exceedances, therefore producing reclaimed water is not required to meet the State Waste permit.

Water Rights

RCW 90.46.120 states that the owner has exclusive right to any reclaimed water generated by the wastewater treatment facility. Consequently, reclaimed water has the potential to benefit water purveyors who are water-right deficient. The City's water service area is not projected to require additional water rights in the future. As such, there is not a water right need to be addressed.

RCW 90.46.130 states that the facilities that reclaim water shall not impair existing downstream water rights unless the impaired water right holder is compensated or mitigated. It is unknown at this time whether diverting some or all of the secondary effluent as reclaimed water in lieu of infiltrating it as groundwater would cause impairment to any water right holder. Prior to implementing any plans to produce reclaimed water, it is recommended that the City study the water rights in the surrounding area to determine the impact of pursuing a water reclamation program.

Environmental Benefits

The WWFT currently produces 111 acre feet per year (ac-ft/yr) of effluent and is projected to produce 252 ac-ft/yr in 2034. The City does not have substantial industrial users that would be capable of utilizing reclaimed water effectively. The City could potentially utilize reclaimed water for irrigation, but the City's climate with high rainfall does not warrant significant irrigation use. Irrigation is also a seasonal use and the City has no other use for reclaimed water during the periods when irrigation is not utilized.

Cost Effectiveness

The following improvements, additional to those previously discussed in this report would be required at the WWTF to produce Class A reclaimed water.

- Polymer addition including coagulation and flocculation tanks
- Effluent filtration system
- Effluent pump station to pump effluent to the filtration system
- UV disinfection system
- Lined reclaimed water storage ponds
- Pump station and irrigation pipelines to the irrigation sites
- SCADA improvements for additional reliability considerations
- Bypass valves and piping.

This analysis assumes that the facility will bypass effluent not meeting reclaimed water standards to the existing rapid infiltration basin.

At the current annual average flow of 0.099 mgd, the plant produces approximately 110 acre feet of effluent per year. The estimated capitol cost for producing reclaimed water is $7,500,000 (see Appendix C for cost estimate) or approximately $67,000 per ac-ft. With little demand for reclaimed water and therefore little opportunity for selling reclaimed water to generate revenue, the City does not have a means to recoup the cost of these improvements. It is therefore not cost effective to produce reclaimed water.

Summary

Evaluation of the potential for water reclamation and reuse indicates that it is not cost effective, not warranted to meet regulatory requirements and not necessary to offset deficiency in the City's water supply therefore, the production of reclaimed water is not recommended.

CHAPTER 9

SEPTAGE MANAGEMENT

EVALUATION OF SEPTAGE HANDLING

Currently, domestic septage in unincorporated Clallam County is collected by septic tank pumper companies and hauled to treatment and land application locations. The majority of septage is hauled to a treatment and disposal facilities in Mason, King and Pierce Counties. An alternative to this method of septage handling is the acceptance and conversion of this waste material into reusable Class A biosolids at the Forks WWTF. Treating domestic septage at a wastewater treatment facility offers a number of potential advantages, including:

- Hauling costs are reduced.
- Treatment is performed in a controlled process, which is easily monitored for regulatory compliance.
- The treatment process is contained, resulting in no adverse environmental impact and risk of septage contaminating the environment during the treatment process.
- Revenue for the treatment plant is generated.
- Year-round availability is provided to haulers.
- Full-service treatment, serving both sewered and unsewered areas in a community, is provided.

Forks is considering upgrading its WWTF and accepting septage from local septage haulers. Septage treatment at the WWTF is evaluated in this section.

BACKGROUND

Septage includes waste pumped from septic tanks, as well as cesspools, portable toilets, "aerobic" tanks, holding tanks, and dry pits (*WEF Septage Handling Manual of Practice No. 24, 1997*). Septage differs from sewage sludge, in that sewage sludge is derived from a wastewater treatment facility, which typically has more varied contributors of wastewater, including commercial and industrial sources.

Septage derived from septic tanks and other sources undergoes its initial treatment in the septic tank. A septic tank acts as a combined skimming and settling tank, as well as a partial anaerobic digester, providing some reduction in both Biochemical Oxygen

Demand (BOD) and Total Suspended Solids (TSS) for the incoming wastewater. The organic material that settles on the bottom of the tank undergoes anaerobic and facultative decomposition that work to reduce the mass of TSS and BOD over time. However, the accumulation of solids exceeds this degradation rate, and, therefore, solids build-up in the tank over time. This accumulation necessitates the periodic pumping of septic tanks.

Domestic septage is similar to biosolids in terms of its biological, chemical and physical properties. Land application of domestic septage can benefit crops and this practice is governed by the same set of federal and state regulations that govern biosolids land application. However, there are differences between domestic septage and biosolids that can affect the manner in which septage must be managed in a land application program.

REGULATIONS CONCERNING DOMESTIC SEPTAGE

40 CFR Part 503

40 CFR Part 503 applies to septage from domestic septic tanks as well as sludge from municipal wastewater treatment systems. The 503 rules do not apply to wastes that are solely from commercial chemical toilets or industrial processes. However, if such wastes are mixed with municipal wastewater sludge (biosolids) or domestic septage, they become subject to the 503 rules.

At the discretion of the individual treating and handling the septage, septage meeting the definition of domestic septage may be managed as *domestic septage,* following the regulations for domestic septage, or alternatively, as (non-septage) *biosolids originating from municipal sewage,* following the rules for municipal sewage biosolids. (This option to manage domestic septage as *biosolids originating from municipal sewage* is not explicitly stated in the 503 regulations, but is explicitly stated and clarified in the state WAC 173-308 regulations.) Domestic septage, *when handled as domestic septage,* is considered a special class of biosolids; in general, the regulations for septage are less stringent than the general rules for municipal sewage biosolids, since it is assumed that no industrial or commercial source of pollutants are entering domestic septage. These differences in regulations include:

- For domestic septage, there are no requirements for monitoring pollutant concentrations.

- Domestic septage regulations have specific pathogen reduction requirements that differ from biosolids regulations.

- Pathogen reduction criteria must be met for septage just as it is for biosolids. The key difference with septage is that there are only two standards for pathogen reduction. One method involves enforcing site restrictions (discussed in the following paragraph). The other method,

using lime to raise the pH of the septage to 12 for 30 minutes or more, is also one of three vector attraction reduction standards for septage.

- Site restrictions and food crop consumption restrictions are essentially the same for both domestic septage and Class B biosolids with certain exceptions. (Note: Other than a requirement to apply at agronomic rates, there are essentially no site restrictions for Class A biosolids.)

- Land application of domestic septage does not require analytical determination of nitrogen concentrations in the septage. However, the rate of land application of domestic septage is based on very conservative projections of the nitrogen in the septage. Higher application rates could be achieved by handling the domestic septage as biosolids (as is expected by the City). *If handled as domestic septage*, the annual application rates (AAR) of septage is limited by the following formula:

  AAR = N/0.0026

  where:

  N = Amount of nitrogen in pounds per acre per 365-day period used by the cover crop

  AAR = Annual application rate of septage (gallons/acre) based on nitrogen uptake rates for the cover crop.

Septage would be co-treat with the City's biosolids in the City's biosolids treatment system. Once mixed and co-treated with WWTF sludge to Class A biosolids, regulations concerning Class A biosolids, rather than domestic septage, apply to the product.

WAC-173-308 Biosolids Management

WAC-173-308 addresses domestic septage in addition to municipal wastewater treatment plant sewage sludge. WAC-173-308-080 provides definitions for different categories of septage. The Class I, II, or III categories, and the regulatory distinctions that go with them, do not exist in the federal 503 regulations. The categories are as follows:

- **"Domestic septage"** means domestic septage – Class I, Class II, and Class III as defined in this section.

- **"Domestic septage – Class I"** is liquid or solid material removed from domestic septic tanks, cesspools, or similar treatment works that receive only domestic sewage, and that has had a sufficiently long residency time to be considered largely stabilized. For the purposes of managing mixed loads or batches of septage, a load or batch is considered Class I if it does not exceed 25 percent by volume of Class II domestic septage or

25 percent volume of restaurant grease trap waste, unless otherwise approved by the regulatory authority.

- **"Domestic septage – Class II"** is liquid or solid material removed from portable toilets, Type III marine sanitation devices, vault toilets, pit toilets, RV holding tanks, or other similar holding systems that receive only domestic sewage.

- **"Domestic septage – Class III"** is liquid or solid material removed from domestic septic tanks, cesspools, or similar treatment works that receive sewage from commercial or industrial sources, but which the department has determined to be domestic in quality under WAC 173-308-020(3)(g). In general, commercial septage, industrial septage, or a mixture of domestic septage and commercial or industrial septage, is *not* regulated under WAC-173-308 *unless* the department has determined it to be domestic in quality.

Class I septage is considered to be considerably more stabilized than Class II, because it receives treatment in the septic tank or other treatment device. Class II septage is considered to be close to raw sewage in quality, since it has only been stored, not treated, and thus requires significantly more treatment than does Class I. Class III is a special class of septage. Class III septage is so designated by Ecology if they have determined that the septage is domestic in quality. After septage has been determined to be Class III, it is managed similarly to Class I septage.

Although not stated explicitly in WAC-173-308, Class I and Class III septage may be treated as Class II septage, since Class II is of lower quality and its treatment and management options are more restrictive.

WAC 173-308-270 exclusively addresses the regulations governing domestic septage *managed as domestic septage*. Domestic septage may not be applied to a public contact site, a lawn, or a home garden, unless it is managed as biosolids originating from municipal sewage sludge. Since the City of Forks will be mixing and co-treating septage with biosolids and thus managing septage as biosolids, the requirements for domestic septage do not apply.

QUANTITY OF SEPTAGE

Although a detailed estimate of current and projected future volumes of septage generated and possibly treated by the Forks WWTF has not been developed, a rough estimate of this volume has been made. According to City officials, and the local septage hauler that pumps and hauls septage in the Forks area, the estimated current volume of septage generated per year is roughly 160,000 gallons. It is estimated that approximately 95 percent of this volume is residential (Class I) septage and approximately 5 percent Class II septage, primarily from portable toilets. Once mixed with biosolids and/or

treated to produce Class A biosolids, these septage class distinctions are no longer relevant.

Factors Influencing Septage Generation in the Future

The Departments of Ecology and Health have been imposing restrictions on septic tank and drainfield installation in the State of Washington. These actions are the result of concerns that on-site disposal systems can negatively impact groundwater and surface water quality. Although these restrictions have not been fully felt in less densely populated areas of the state like Clallam County, it is within the authority of Ecology and DOH to require local jurisdictions to control the installation and operation of on-site sewage disposal systems to protect water quality and the public health. Examples of such restrictions include periodic pumping requirements, maximum housing density criteria, and sewer connection covenants. For the purpose of this analysis, it is assumed that the proportion of the total population generating septage is not affected by State regulatory actions regarding on-site sewage systems. Annexations and sewer extensions by cities with municipal sewer systems, including Forks, could reduce the proportion of the total population that generates septage, but this is not expected to reduce the overall septage volume significantly within the 20-year planning period.

Assuming a septage volume growth rate of 1.0 percent consistent with the anticipated population growth rate in the area, the projected 2034 volume of septic waste is 200,000 gallons per year.

SEPTAGE COMPOSITION

Septage is generally characterized by a strong, offensive odor, high solids, grease and organic content, and poor settling and dewatering abilities. The characteristics of septage vary widely from batch to batch and from site to site. The factors that influence this variability are the sources of wastewater, the cooking and water use habits of the population, the septic tank size and design, and the pumping frequency. Typical characteristics of septage are shown in Table 9-1 (from *WEF Septage Handling Manual of Practice No. 24*, 1997). As shown, the design parameters for septage composition can vary by two orders of magnitude (100 times). Since no comprehensive analytical or compositional data exist on septage from Clallam County, the suggested EPA design values (deliberately conservative) as shown in Table 9-1 are assumed to be representative of the septage produced in Clallam County. However, the 4 percent total solids is considered too conservative; according to Ecology and a representative of FKC, Inc. (the Class A biosolids treatment system manufacturer), more typical ranges of total solids of septage in rural Washington State is 2 to 2-1/2 percent. Similarly, characterization of 20 years of septage hauled to the King County WWTP in Renton showed an average total solids of 2.3 percent. For the purposes of this analysis, a value of 3.0 percent total solids is employed for septage.

TABLE 9-1

Typical Septage Characteristics[(1)(2)]

Parameter	Range (mg/L)	Average (mg/L)	Suggested Design Value (EPA) (mg/L)	Ratio of Septage Design Concentrations to Municipal Wastewater
Total Solids	1,100 – 130,500	34,100	40,000 [3]	56
Total Volatile Solids	350 – 71,400	23,100	25,000	68
Total Suspended Solids	310 – 93,400	12,900	15,000	68
Volatile Suspended Solids	95 – 51,500	9,000	10,000	61
5–day Biochemical Oxygen Demand (BOD_5)	440 – 78,600	6,500	7,000	32
Soluble BOD_5	--	800	800	6
Chemical Oxygen Demand	1,500 – 703,000	31,900	15,000	30
Total Kjeldahl Nitrogen	66 –1,060	590	700	18
Ammonia-N	3 – 116	97	150	6
Total Phosphorus	20 –760	210	250	31
Alkalinity	520 – 4,200	970	1,000	10
Oil and Grease	210 – 23,400	5,600	8,000	80
pH	1.5 – 12.6	--	6.0	--

(1) Based on *WEF Septage Handling Manual of Practice No. 24, 1997,* based on information reported by the EPA in 1984 and 1994.
(2) All units are in mg/L, except pH.
(3) 30,000 mg/L used in this analysis.

SEPTAGE TREATMENT FACILITY

As mentioned in the introduction to this section, treating domestic septage at a wastewater treatment plant offers a number of potential advantages, including reduction in hauling costs, revenue for the treatment plant, and environmental benefits of year-round treatment in a controlled, monitored process.

In addition, there may be disadvantages of utilizing a municipal wastewater treatment plant, particularly if not designed properly, including:

- The cost of treating septage at municipal wastewater plants has historically not been competitive with land disposal, if available.

- Septage can cause WWTP equipment failure and process upsets due to rocks, rags and plastics, high organic strength and chemicals from holding tanks, or portable toilets. This disadvantage can be countered by the implementation of an effective screening and equalization scheme. Additionally, discharge of septage directly to the solids stream can reduce the probability of process upsets to the liquid stream biological treatment

process. However, loadings to solids handling systems increase, and the recycle streams from the solids treatment and dewatering systems will still impact the liquid stream processing. Screening, equalization and treatment with the solids stream will be incorporated into the septage handling and treatment scheme at Forks.

- Control of septic pumpers at the WWTF increases the operations staff duties.

Sizing criteria contained in this plan are conceptual and may require revision as a more accurate estimate of volumes is developed or to adapt to modifications to the treatment scheme. Cost estimates are provided for planning purposes only. Actual construction and operating costs may vary significantly. For implementation of the plan recommended at the end of this section, it is recommended that a more detailed engineering analysis be completed prior to final design.

An estimate of loading to the proposed new digester from incoming septage, based on the concentrations in Table 9-1 is presented in Table 9-2.

TABLE 9-2

Projected Septage Loading to Digester

Parameter	Units	Average Annual Loading[(1)]	Maximum Monthly Loading[(1)(2)]	Peak Daily Loading[(1)(3)]
Volume	gpd	550	1,715	6,000
Total Solids	lb/d	138	430	1,502
Total Volatile Solids	lb/d	115	360	1,251
Total Suspended Solids	lb/d	69	215	751
Volatile Suspended Solids	lb/d	46	144	501
5–day Biochemical Oxygen Demand (BOD_5)	lb/d	32	101	351
Soluble BOD_5	lb/d	4	12	41
Chemical Oxygen Demand	lb/d	69	215	751
Total Kjeldahl Nitrogen	lb/d	4	11	36
Ammonia-N	lb/d	1	3	8
Total phosphorus	lb/d	2	4	13
Alkalinity	lb/d	5	15	51
Oil and Grease	lb/d	37	115	401

(1) Based on an average of 200,000 gallons per year and suggested EPA design values from Table 9-1.

(2) Based on a two 6,000-gallons trucks per week and suggested design values from the EPA as shown in Table 9-1.

(3) Based on a single 6,000-gallon truck per day and suggested design values from the EPA as shown in Table 9-1.

Septage Screening

Hauling trucks will unload septage to a new septage receiving facility. The septage receiving facility will consist of a screening unit, level sensor, pump, control panel, piping and valves. The treatment scheme will consist of first removing debris and large materials with a 1/4- or 3/8-inch screen as required by Ecology. It is anticipated that the screen will be a rotary drum screen similar to that used at the headworks. The screening unit will have a cover to reduce odors. Screenings will be washed and dewatered and collected in a dumpster for disposal.

The liquid septage will flow by gravity to a new septage pump station. The station will consist of a wet well with a single submersible pump. The pumped septage will be piped to provide a direct discharge to both the digester and the screw press sludge holding tank. Typical operation would have the sludge going to the digester to reduce solids loading on the screw press.

Digester Volume

The liquid septage will be mixed with WAS from the aerated lagoon in the digester. Based on a maximum month volume of septage of 1,715 gpd (two 6,000-gallon trucks per week), total septic solids to the digester is 430 lb/d. Assuming 360 lb/d as volatile solids (Table 9-2) and a volatile solids destruction of 30 percent, the total additional mass of digested sludge production is approximately 322 lb/d. The total mass of digested sludge produced is therefore 742 lb/d, including 451 lb/d WAS from the clarifiers as described in Chapter 7.

$$\text{Mass of Solids Wasted} = 451\,{}^{lb}\!/_{d}\,WAS + (430\,{}^{lb}\!/_{d}\,TS - 30\% * 360\,{}^{lb}\!/_{d}\,VS) = 773\,{}^{lb}\!/_{d}$$

At its current design capacity of 35.4 lb/hr, the screw press would need to be operated approximately 152 hours per week (6.4 days). To process the sludge within the City's 96-hour operating schedule, the FKC system would need a capacity of approximately 56.5 lb/hr.

As presented in Chapter 7, required volume for the aerobic digester is based on the providing the required detention time (60 days) to achieve pathogen reduction requirements. The total mass of solids in the digester is calculated by multiplying the SRT (60 days) by the daily mass of digested solids wasted.

$$\text{Total Mass of Solids in Digester} = 773\,{}^{lb}\!/_{d} * 60 = 46{,}380\,lb$$

Assuming a digester concentration of 2.0 percent solids, the required digester volume is calculated as follows.

$$V = \frac{46{,}380 lbs}{8.34 * 20{,}000 \left(\frac{mg}{L}\right)} * 1{,}000{,}000 = 278{,}000 \text{ gallons.}$$

Assuming a side-water depth in the digester of 18 feet, the resulting footprint of the digester is approximately 2,070 square feet. This results in a 65% increase in the size of the proposed digester.

Digester Aeration Requirements

Aeration is required for the biological destruction of volatile solids. The air demand for the septage is calculated assuming a 30 percent destruction of volatile solids in the septic waste stream. Aeration requirements for the WAS stream are discussed in Chapter 7. Total air required is calculated as follows:

AOR= 2.3 * (360 lb/d Septic Sludge VS) * (30% VS Destruction) + 700 lb O_2/d (WAS) = 948 lb O_2/d

Applying a factor of safety of 1.5 to account for fluctuations in diurnal loads, results in a design oxygen demand of 1,422 lb/d. Oxygenation equipment is specified based upon standard oxygen transfer rate (SOTR), the oxygen transfer rate in clean 20 ^oC water with no suspended solids. The SOTR is calculated as follows:

$$AOTR = SOTR\left(\frac{b C_{STH} - C_O}{C_{S20}}\right)\left(1.024^{T-20}\right)a$$

Where:

AOR	= actual oxygen transfer rate
SOR	= standard oxygen transfer rate
a	= oxygen transfer correction factor, 0.17 (Chapter 7)
b	= salinity surface tension factor, 0.95
C_{STH}	= dissolved oxygen concentration at operating temperature and elevation, = 10.97 mg/L
C_{S20}	= dissolved oxygen concentration at 20^oC and 1 atm, 9.08 mg/L
C_O	= operating dissolved oxygen concentration, 2 mg/L
T	= 20^oC

Thus AOR = 0.17 SOR. The resulting SOR is therefore 8,365 lb/d.

Assuming an aeration diffuser efficiency of 25 percent, the required airflow is then:

Air Flow = 8,365 lb O_2/d / (1,440 min/d * 0.0173 lb O_2/scfm * 0.25) = 1,345 scfm

The air required for mixing the aerobic digester is calculated with the mixing requirement of 0.12 scfm per ft^2. The tank, as determined above has a foot print of approximate 2,065 ft^2, therefore:

Mixing Air Required = 2,065 * 0.12 = 248 SCFM.

The aeration required to meet the oxygen demand in the digester is greater than the aeration needed to mix the tank therefore, the aeration requirement to meet the oxygen demand is used in the design of the aeration system.

Design criteria for the aerobic digester with a septage treatment facility is shown in Table 9-3.

TABLE 9-3

Aerobic Digester Design Criteria

Tanks	
No of Tanks	2
Tank Volume (each)	133,500 gallons
Side Water Depth	18 ft
Length x Width (total)	32 ft x 65 ft
Solids Retention Time (SRT)	60 days @ 15 degrees C
Digester Mixing/Aeration	
Type of Mixing	Fine Bubble Aeration
Air per Tank	672 scfm
Blower Type	Positive Displacement
Motor Size	15 HP, 480 V, 3 Phase
Digester Sludge Pump	
Quantity	2
Type	Rotary Lobe
Capacity	200 gpm
TDH	20
Motor Size	3 hp

Impact on Biosolids Treatment

The screw press in the Class A Biosolids Treatment System can process approximately 35.4 pounds of dry sludge per hour. As calculated in Chapter 7, the biosolids treatment system is projected to require a run time of 83 hours per week to process digested solids from the WWTP. With septage included, the run time of the screw press is increased to

approximately 147 hours per week. This results in a screw press run time increase of approximately 77 percent.

Revenue

Based on information obtained from haulers and treatment facilities, the cost of septage disposal at other facilities ("dumping fees") ranges from 4 to 25 cents per gallon, with most in the range of 7 to 15 cents per gallon. For 200,000 gallons per year, this range of rates, 4 to 25 cents, suggests annual revenue of $8,000 to $50,000.

Operating Cost Estimates

A detailed evaluation of operating costs was not performed for this study. However, based on other septage facilities and expected costs for processing biosolids through the Class A Biosolids Treatment System, the estimated costs for accepting and treating septage are presented in Table 9-4.

Labor costs will be minimal for receiving, screening and digestion of septage, since the haulers can be assumed to perform the unloading. However, the solids generated must be treated in the Class A Biosolids Treatment System, and then be hauled away. The additional run time of the screw press, 64 hours per week, would increase monitoring and maintenance requirements for the Class A Biosolids Treatment System.

Chemicals/fuel include lime and polymer for the Class A Biosolids Treatment System and fuel for the boiler and the truck hauling Class A biosolids.

The power estimate includes that required for septage screening and pumping (minimal cost) with the more substantial costs associated with aerating the septage in the digester and treating it in the Class A Biosolids Treatment System.

Waste product disposal includes an allowance for disposal of screenings from the incoming septage. Equipment maintenance includes that projected for the septage screening and pumping equipment and a prorated amount (one third) of the projected maintenance cost for the Class A Biosolids Treatment System. (Overall maintenance costs are estimated as 1.5 percent of the purchase cost of new equipment.)

Miscellaneous costs include permitting, fees, administration and contingency.

The actual costs may vary substantially from that shown in Table 9-4, depending on actual septage composition and labor requirements. After septage treatment and handling commences, the actual cost of septage treatment and disposal at the WRF should be determined in order to establish a proper fee.

TABLE 9-4

Operating Cost Estimate for Septage Handling and Treatment Facilities(1)

Item	Annual Average
Labor (0.25 Full Time Equivalent, FTE)	$16,800
Chemicals/Fuel	$ 1,200
Power	$ 600
Waste Product Disposal	$ 300
Equipment Maintenance	$ 3,000
Miscellaneous	$ 1,200
TOTAL O&M COSTS	**$23,100**

(1) Based on handling 200,000 gallons septage per year.

Capital Cost Estimates

Capital cost estimates for a septage receiving/screening facility are shown in Table 9-5. The capital costs include all required equipment and engineering, construction administration, contingency and sales tax. Optional equipment, including grit removal, pH monitoring or an automatic billing system, could be added in the future.

TABLE 9-5

Cost Estimate for Septage Handling and Treatment Facilities

Item	Cost
Septage Receiving Station with Screening, Dewatering and Compacting Equipment (capacity of 525 gpm at 3 percent solids)	$240,000
Keypad, Receipt Printer and Magnetic Flow Meter	$35,000
Pumps/Piping	$25,000
Site Work	$15,000
Concrete Pad and Gravel	$10,000
Incremental Cost Increase of Proposed Digester	$123,000
Electrical	$35,000
Subtotal	$483,000
Engineering, Construction Administration, Taxes, and Contingency (@ 45%)	$217,350
TOTAL	**$700,350**

RECOMMENDATIONS

The septage receiving station is included as a separate project in the finance chapter (Chapter 10). Assuming the project is funded by a 20-year loan to the City at 2.5 percent, service to the debt would be approximately $44,920. Adding the operations and maintenance expense of $23,100, as shown in Table 9-4, total yearly expenditures for the station are approximately $68,020. At a current volume of 160,000 gallons per year, a

rate of approximately 43 cents per gallon is needed to cover expenditures. Given that projected inflation rates and cost of living adjustments as discussed in Chapter 10 are anticipated to be higher than the rate of increase in septage volume to the facility, it is expected that the cost per gallon rate would increase slightly over time.

A cost of 43 cents per gallon is not competitive when average rates range between 4 and 25 cents per gallon. The City could only offer this service to the community at a loss and an incurrence of dept. It is not recommended that the City provide a septage handling facility.

REFERENCES

1. *Land Application Equipment for Livestock and Poultry Manure Management,* Donald L. Pfost and Charles D. Fulhage, Agricultural Engineering Extension Otto Alber, Natural Resources Conservation Service

2. *Septage Handling,* WEF Manual of Practice No. 24, 1997

CHAPTER 10

FINANCIAL ANALYSIS

This chapter contains an analysis that describes how the City of Forks can support future operating expenses and finance the general sewer and wastewater facility improvements outlined in the previous chapters. The potential funding sources, the financial status of the sewer utility, the funding required to pay for the scheduled improvements, and the impact of wastewater improvements on sewer rates are presented.

FINANCIAL STATUS OF EXISTING WASTEWATER UTILITY

CURRENT SEWER RATES

The sewer rates for the City of Forks are defined in Forks Municipal Code (FMC) Chapter 13, Section 13.10.010. Rates are subject to an annual increase equal to the annual percentage increase indicated in the Consumer Price Index All Urban Consumers (CPI-U for the Seattle-Tacoma Bellevue area), per Chapter 13, Section 13.30.050. Table 10-1 summarizes monthly sewer rates for the City of Forks.

TABLE 10-1

Basic Sewer Rates

Unit Type	2012	2013	2014
Single-Family Residence	$28.82	$29.60	$30.01
Duplex (each unit)	$28.82	$29.60	$30.01
Multi-Family (three or more units)	$28.82	$29.60	$30.01
Mobile Home Court (Occupied Space)	$28.82	$29.60	$30.01
Mobile Home Court (Recreational Vehicle Space)	$4.11	$4.22	$4.28
All Others			
First 700 CF of water consumption	$28.82	$29.60	$30.01
Per CF > 700 CF	$0.0413	$0.0424	$0.0430

CURRENT SEWER CONNECTION CHARGES

Connection charges are defined in City of Forks Municipal Code (FMC) Chapter 13, Section 13.05.080. For all connections within the existing ULID established by Ordinance No. 264, a basic connection charge of $100.00 is assessed for each individual connection discharging to the sewer. Connections are charged the same amount, regardless of classification as residential, commercial, or industrial. Section 13.05.080 allows for an increase in the connection charge for users which produce wastewater in quantity or strength that results in a disproportionate impact on the wastewater treatment facility.

Connections in areas outside of the existing ULID boundary are allowed to connect to the system in accordance with a special connection permit. These connections are permitted upon the establishment that the connection will not impact the ability of the sewer collection system or treatment plant to collect, convey and treat all wastewater generated within the ULID. The fee for the special permit is the existing connection charge of $100.00 plus an amount determined to be reasonable based on the amount that would have been imposed as an assessment of the connecting property had the property been part of the ULID in accordance with Ordinance No. 280, or the cost of construction of a sewer lateral extending the sewer collection system to the property line of the connecting property, whichever is greatest.

HISTORICAL FINANCIAL OPERATIONS

Wastewater utility operating revenues for the years 2010 through 2013 provided by the City are summarized in Table 10-2.

TABLE 10-2

Historical Operating Revenues

Operating Revenue	2010	2011	2012	2013	Background[1]
Sewer Charges[2]	$286,102	$259,313	$276,400	$294,811	$294,811
Connection Charges	-	-	-	-	-
Investment Interest[3]	$249	$203	$276	$250	$245
Miscellaneous Revenue[3]	$248	$1,871	$312	$345	$694
Total Operating Revenue[4]	**$286,600**	**$261,400**	**$277,000**	**$295,400**	**$295,700**

(1) Background values used as 2014 baseline for projected values.
(2) Background based on most recent value.
(3) Background based on average of previous 3 years.
(4) Total background is the sum of the background column.

Table 10-3 summarizes the historical operating expenses for the wastewater system. Operating expenses for the years 2010 through 2013 were provided by the City.

TABLE 10-3

Historical Operating Expenditures

Operating Expenditures	2010	2011	2012	2013	Background[1]
Finance and Admin.[3]	$25,324	$25,085	$20,536	$28,501	$24,862
Sewer O&M[3]	$74,422	$8,955	$3,276	$3,073	$22,432
Salaries and Wages[2]	$80,312	$79,589	$80,130	$98,392	$98,392
Personnel Benefits[2]	$35,488	$43,388	$38,698	$47,986	$47,986
Supplies[3]	$40,391	$6,770	$14,544	$11,253	$10,856
Utilities[3]	-	$37,426	$27,591	$30,612	$23,907
Other[4]	-	$40,298	$65,186	$72,091	$44,394
Total Operating Expenses[4]	**$255,900**	**$241,500**	**$250,000**	**$291,900**	**$272,800**

(1) Background values used as 2014 baseline for projected values.
(2) Background based on most recent value.
(3) Background based on average of previous 3 years.
(4) Total background is the sum of the background column.

Table 10-4 summarizes the net operating revenue (operating revenue minus operating expenses) from 2010 to 2013. As displayed in Table 10-4, net operating revenue has been positive over this period of time.

TABLE 10-4

Historical Net Operating Revenue

Net Operating Revenue	2010	2011	2012	2013
Beginning Fund Balance	$79,600	$110,200	$130,200	$157,200
Revenue	$286,600	$261,400	$277,000	$295,400
Expenses	($255,900)	($241,500)	($250,000)	($291,900)
Net Operating Revenue	$30,700	$19,900	$27,000	$3,500
Ending Fund Balance	$110,200	$130,200	$157,200	$160,700

PROJECTED GROWTH

In order to project future revenues, the growth in the number of customers must be estimated. In Chapter 5, sewer service area population was projected to grow approximately 1 percent annually through the 20-year planning period. For purposes of projecting future revenues and expenses, connections and ERUs are projected to increase at the same rate shown in Chapter 5.

PROJECTED EXPENSES, REVENUES, AND CAPITAL RESERVES

FUTURE OPERATING REVENUES AND EXPENSES

Tables 10-2 and 10-3 show the background data upon which the projections developed below are based. Forecast factors used in determining the projections are shown in Table 10-5. The ERU growth rate is as projected in Chapter 5. CPI-U annual rate increases are assumed to continue through the 20-year planning period.

TABLE 10-5

Forecast Factors

Forecast Factors	Value
Sewer Rate Increase(1)	2.00%
COLA(2)	2.00%
Inflation(3)	2.00%

(1) CPI-U for the Seattle-Tacoma Bellevue area, Bureau of labor Statistics
(2) Cost of living increase. 2011 to 2014 Average, Social Security Administration.
(3) 2010 to 2013 Average, Bureau of Labor Statistics.

Table 10-6 presents the projected connection charge revenues. The connection charges are based on the number of new ERUs projected in Chapter 5. Again, ERUs are calculated based on the projected Average Annual Flow (in gallons per day) divided by 127 gpd/ERU. Approximately $700 per year is projected from connection charges. The new ERUs shown in Table 10-6 are a result of development occurring within the existing ULID sewer service area. It is assumed that all new connections during the 6-year period are within the existing ULID. Connections outside of the ULID boundary will require an expansion of the sewer collection system. Expansion of the collection system is not anticipated to occur within the 6-year period. New connections may not occur at the anticipated rate, therefore, the future revenue associated with connection charges will be separated in the following tables.

TABLE 10-6

ULID Connection Charge Revenues

Connection Charge Revenues	2015	2016	2017	2018	2019	2020
Number of ERUs	679	686	693	700	707	714
Growth in ERUs(1)	7	7	7	7	7	7
Connection Charge(2) ($/ERU)	$100	$100	$100	$100	$100	$100
Projected Connection Charge Revenue	**$700**	**$700**	**$700**	**$700**	**$700**	**$700**

(1) All new connections until 2020 are assumed to be within the existing ULID boundary.
(2) Per FMC Chapter 13, Section 13-05-080.

Table 10-7 presents the projected six-year operating revenues for the sewer utility. The sewer charge projection includes a 1 percent population growth and an annual 2.0 percent rate increase. Revenues and expenses for 2008-2013 are based on the baseline values shown in Tables 10-2 and 10-3 escalated using the forecast factors shown in Table 10-5.

TABLE 10-7

Projected Operating Revenues

Operating Revenue	2015	2016	2017	2018	2019	2020
Sewer Charges[(1)]	$303,600	$312,800	$322,100	$331,800	$341,800	$352,000
Investment Interest[(2)]	$300	$400	$500	$600	$700	$800
Miscellaneous Revenue[(2)]	$800	$900	$1,000	$1,100	$1,200	$1,300
Connection Charges	$700	$700	$700	$700	$700	$700
Total Operating Revenue	**$305,400**	**$314,800**	**$324,300**	**$334,200**	**$344,400**	**$354,800**

(1) Includes a 1 percent increase due to growth and a 2 percent increase due to annual CPI-U increase.
(2) Baseline value annually increased by inflation rate identified in Table 10-5.

Table 10-8 presents the projected 6-year operating expenditures for the sewer utility.

TABLE 10-8

Projected Operating Expenditures

Operating Expenditures	2015	2016	2017	2018	2019	2020
Finance and Admin.[(1)]	$25,400	$26,000	$26,600	$27,200	$27,800	$28,400
Sewer O&M[(1)]	$22,900	$23,400	$23,900	$24,400	$24,900	$25,400
Salaries and Wages[(2)]	$100,400	$102,500	$104,600	$106,700	$108,900	$111,100
Personnel Benefits[(2)]	$49,000	$50,000	$51,000	$52,100	$53,200	$54,300
Supplies[(1)]	$11,100	$11,400	$11,700	$12,000	$12,300	$12,600
Utilities[(1)]	$24,400	$24,900	$25,400	$26,000	$26,600	$27,200
Other[(1)]	$45,300	$46,300	$47,300	$48,300	$49,300	$50,300
Total Operating Expenses	**$278,500**	**$284,500**	**$290,500**	**$296,700**	**$303,000**	**$309,300**

(1) Baseline value annually increased by inflation rate identified in Table 10-5.
(2) Baseline value annually increased by COLA rate identified in Table 10-5.

Table 10-9 summarizes the projected 6-year operational revenues and expenses as displayed in Tables 10-7 and 10-8, and the net revenue.

TABLE 10-9

Summary of Projected Operating Cash Flow[(1)]

Operating Cash Flow	2015	2016	2017	2018	2019	2020
Operating Revenue (w/o Conn. Charge)	$304,700	$314,100	$323,600	$333,500	$343,700	$354,100
Connection Charges	$700	$700	$700	$700	$700	$700
Operating Expenses	($278,500)	($284,500)	($290,500)	($296,700)	($303,000)	($309,300)
Net Revenue	$26,900	$30,300	$33,800	$37,500	$41,400	$45,500

(1) Operating revenue shown includes the rate increases identified in Table 10-7.

CAPITAL EXPENDITURES AND RESERVES

Capital improvement projects to be funded over the six-year period 2015 to 2020 are summarized in Table 10-10. No major sewer capital improvements for 2015 were included in the City's 2015 budget. Capital improvement expenditures include treatment plant improvements and sewer line replacements. Due to the capital cost of the treatment plant improvements, replacement of sewer lines have been scheduled beyond the 6-year planning period to minimize additional impacts to the City's sewer rates.

TABLE 10-10

Projected Capital Expenditures

Capital Expenses[(1)]	2015	2016	2017	2018	2019	2020	2021-2034[(2)]
Wastewater Treatment Plant Upgrade[(3)]	-	-	$3,389,000	-	-	-	-
Septage Receiving Station	-	-	-	$722,000	-	-	-
Robin Hood East Collection System	-	-	-	-	-	-	$1,835,000
Robin Hood West Collection System	-	-	-	-	-	-	$1,682,000
Bogachiel East Collection System	-	-	-	-	-	-	$1,546,000
Bogachiel West Collection System	-	-	-	-	-	-	$3,453,000
Trillium North Collection System	-	-	-	-	-	-	$1,512,000
Trillium South Collection System	-	-	-		-	-	$1,036,000
Total CIP Cost	**$-**	**$-**	**$3,389,000**	**$722,000**	**$-**	**$-**	**$11,064,000**

(1) Capital improvement costs from Chapters 6, 7 and 9 have been adjusted 2 percent annually for inflation based on the year the project is estimated to begin construction.
(2) Costs shown in this column are shown for the year 2021.
(3) Summarized in Table 7-13, Includes Mill Creek Lift Station.

Tables 10-11 identifies the capital expenditures and reserves in conjunction with the operating revenues and expenditures identified previously. This scenario assumes the City can obtain a Public Works Trust Fund Loan at an interest rate of 2.5 percent to fund the necessary improvements. As shown in the table, additional rate increases, above the CPI-U increases, are necessary to maintain a positive cash reserve.

TABLE 10-11

Projected Capital Expenditures and Reserves (Projected Growth)

	2015	2016	2017	2018	2019	2020
Operating Revenue without Septage[1]	$304,700	$314,100	$323,600	$333,500	$343,700	$354,100
New Rate Revenue[2]	$59,000	$115,100	$182,800	$188,200	$193,900	$199,700
New Septage Revenue[3]				$72,300	$72,800	$73,400
Connection Charge	$700	$700	$700	$700	$700	$700
Operating Expense without Septage	($278,500)	($284,500)	($290,500)	($296,700)	($303,000)	($309,300)
Septage Operating Expense[4]	-	-	-	($24,600)	($25,100)	($25,700)
Net Operating[5] Revenue	$85,900	$145,400	$216,600	$225,700	$235,300	$245,200
New Debt Service without Septage[6]	-	-	($217,400)	($217,400)	($217,400)	($217,400)
Dept Service Septage[6]	-	-	-	($47,700)	($47,700)	($47,700)
Net Revenue[7]	$85,900	$145,400	($ 800)	$8,300	$17,900	$27,800
Loans[8]	NA	NA	$3,305,000	$743,000	NA	NA
Capital	NA	NA	($3,305,000)	($743,000)	NA	NA
Cash-flow	$85,900	$145,400	($800)	$8,300	$17,900	$27,800
Cash Reserve, Jan.1	$30,000	$115,900	$261,300	$260,500	$268,800	$286,700
Cash Reserve, Dec. 31	$115,900	$261,300	$260,500	$268,800	$286,700	$314,500
New Rate/Month[9]	$38.80	$45.39	$53.11	$51.17	$55.25	$56.36
Septage Rate/Gallon[10]	NA	NA	NA	$ 0.43	$0.43	$0.43

(1) Based on values shown in previous tables.
(2) New Rate Revenue is based on a 20 percent increase in rates in 2015, a 15 percent increase in rates in 2016 and 2017.
(3) Septage revenue based on projected septage volumes (1% growth per year) multiplied by Septage Rate/Gallon.
(4) Total O&M Costs (Table 9-4) with 2% annual increase per Forecast factors (Table 10-5)
(5) Net operating revenue is the sum of all expenses and revenues.
(6) New debt service is based on a 20 year PWTF loan with a 2.5 percent interest rate.
(7) Net revenue is the sum of net operating revenue and new debt service.
(8) PWTF Loan for total of Capital Improvement Projects. (Includes Mill Creek Pump Station)
(9) New monthly rate shown is the minimum to fund the 6-year CIP projects and maintain a cash reserve through the 20-year planning period.
(10) Septage Rate is minimum to service debt and pay for O&M costs for septic receiving station.

Maintaining reserves at an appropriate level to provide for operations, revenue stabilization, emergency repair or replacement of essential equipment, and for capital maintenance is an element of sound utility management. Total current utility reserves should be increased to finance needed capital improvements and maintain adequate capital reserves.

CAPITAL IMPROVEMENTS FINANCING

The following section describes several funding sources available to the City without reference to any specific project.

AVAILABLE CAPITAL PROJECT FUNDING SOURCES

This section describes several funding sources available to the City without reference to any specific project, including information on the following:

Grants:	Centennial Clean Water Fund (CCWF) Community Development Block Fund (CDBG) Community Investment Fund (CIF) US Economic Development Administration (US EDA) US EPA State and Tribal Assistance Grant (STAG) USDA Forest Service, Rural Assistance Program (USFS) USDA Rural Development (RD)
Loans:	Water Pollution Control State Revolving Fund (SRF) Public Works Trust Fund (PWTF) Community Economic Revitalization Board (CERB) USDA Rural Development (RD)
Bonds:	Revenue Bonds General Obligation Bonds
Other:	Utility Local Improvement Districts (ULID)

CENTENNIAL CLEAN WATER FUND (CCWF)

The Department of Ecology administers the State Revolving Fund (SRF) and Centennial Clean Water Fund (CCWF) programs that provide low interest loans for water pollution control projects. Ecology bases interest rates for non-hardship projects on the average market interest rate for tax exempt municipal bonds as published in the Bond Buyer's Index. Interest rates are based on the average daily market interest rate for the period 60 to 30 days before the start of the application cycle. Interest is compounded monthly.

For a repayment period of up to 5 years, the rate is 30 percent of market rate for tax-exempt municipal bonds. For a repayment period of more than 5 years, but no more than 20 years, the rate is 60 percent of market rate for tax-exempt municipal bonds. Interest rates for hardship loans and on-site local loan funds may vary. The primary program requirements are to have an approved facilities plan for treatment works and to demonstrate the ability to repay the loan through a dedicated funding source. The loans can be used to finance sewer system replacement for the elimination of excessive infiltration and inflow and for the construction of facilities with reserve capacities to

accommodate flows corresponding to the 20-year projected growth in the service area. Land acquisition is not eligible for SRF funding.

Grant money is available only to those who can document hardship. Hardship is demonstrated when project costs for construction of facilities result in total cost for debt service and operation and maintenance in excess of 1.5 percent of the median household income. A project may be phased and receive funds from several cycles to complete the project. In addition, a higher grant amount may be available if the three-year average local unemployment rate exceeds the three-year average statewide unemployment rate. Grants require a 50 percent matching fund, which is provided by a mandatory SRF loan. If the project is enrolled in Ecology's Small Town Environmental Program, an in-kind match may be used.

COMMUNITY DEVELOPMENT BLOCK GRANT (CDBG)

The Community Development Block Grant program is a competitive source of federal funding for a broad range of community development projects. A primary requirement of the CDBG program is that the project must principally benefit at least 51 percent of the low-to-moderate income residents of the project area. The State typically receives about $7.5 million in federal funds per funding cycle. CDBG has two programs including General Purpose and Planning Only. The General Purpose program provides grant funds for the design, construction, or reconstruction of water and sewer systems up to the amount of $1,000,000. The Planning Only program includes projects such as comprehensive plans, community development plans, capital improvement plans, and other plans such as land use and urban environmental design, economic development, floodplain and wetlands management, transportation, and utilities. Planning Only grants are limited to $24,000 for a single applicant or $40,000 for a joint applicant.

Eligible applicants for the CDBG programs include cities and towns with less than 50,000 people or counties with populations less than 200,000. Though port districts and economic development districts are not eligible to apply directly, a city or county can submit a joint application and include these entities as partners.

US ECONOMIC DEVELOPMENT ADMINISTRATION (US EDA)

US EDA offers competitive grants up to $1 million for projects within Region 10. Projects are selected locally by an economic development district and submitted to Congress for competitive selection among other regions in the US. Similar to CERB, applicants must have an industrial partner ready to proceed or a feasibility study that establishes realistic job creation.

US EPA STATE AND TRIBAL ASSISTANCE GRANT (STAG)

Local jurisdictions within the state of Washington can apply to the State and Tribal Assistance Grant program through the office of their local Congressional representative.

The Congressional representative will work to add the project as a line item to the VA/HUD Appropriations Bill. Applicants can obtain grant funds up to approximately $2 million.

US FOREST SERVICE (USFS)

Forest Service grants are available through the Rural Community Assistance Program to assist rural communities that are dependent on natural resources. Project proposals must show a broad community benefit that results in greater ability to improve economically, socially, or environmentally. The project must have the potential for economic development and/or job creation/retention. An application must be located within 100 miles of a Forest Service office and be able to document a history of at least 15 percent dependency on forest products. Grant funds are available for components of planning and design and are limited to $50,000.

USDA RURAL DEVELOPMENT (RD)

The RD Rural Utility Service administers a water and wastewater loan and grant program to improve the quality of life and promote economic development in rural areas.

Rural Development has a loan program that, under certain conditions, includes a limited grant program. Grants may be awarded when the annual debt service portion of the utility rate exceeds 1.0 percent to 1.5 percent of the municipality's median household income.

In addition, RD has a loan program for needy communities that cannot obtain funding by commercial means through the sale of revenue bonds. The loan program provides 30- to 40-year loans at an interest rate that is based on federal rates and varies with the commercial market. RD loans are revenue bonds with a 1.1 debt coverage factor.

Eligible projects include the construction, expansion, extension or improvement of rural water, sanitary sewers, solid waste disposal, storm, and wastewater disposal facilities.

Basic criteria for RD funding follows:

- Dependent on inability to obtain funds from other sources at reasonable terms.

- A 45 percent grant is available if the median household income of the service area exceeds 80 percent of the statewide non-metropolitan median household income.

- A 75 percent grant is eligible if the service area is below the higher of the poverty line or 80 percent of the state non-metropolitan median household income, and the project is necessary to alleviate a health and safety issue.

Eligible applicants include municipalities; counties; non-profit corporations, associations, or cooperatives; and federally recognized Indian tribes in rural areas with populations less than 10,000.

PUBLIC WORKS TRUST FUND (PWTF)

The Public Works Trust Fund is a revolving loan fund designed to help local governments finance public works projects through low-interest loans and technical assistance. The PWTF, established in 1985 by legislative action, offers loans substantially below market rates, payable over periods ranging up to 20 years. To be eligible for the PWTF programs, an applicant must be a local government such as a city, county, or a special purpose utility district.

PWTF has four loan programs including Construction, Preconstruction, Planning, and Emergency. At the time this was written, the PWTF loan fund has not been made available by the legislature.

The Construction Program accepts applications once per year in the spring, and the money becomes available approximately 1 year later. The Preconstruction and Planning programs are open on a year-round basis and must be submitted to the Public Works Board prior to the 15th of the month to be reviewed at the next Board meeting. These funds become available shortly after the Public Works Board makes their final decision as to the award. Emergency projects must have a locally declared emergency and are applied for on an open cycle depending on the availability of funds. Project expenditures are reimbursable from the date of the declared emergency.

An applicant must have a long-term plan for financing its public works needs. If the applicant is a county or city, it must adopt the 1/4 percent real estate excise tax that is dedicated to public works construction projects. Eligible public works projects include streets and roads, bridges, storm sewers, sanitary sewer collection and treatment systems, and domestic water. Loans are presently offered only for purposes of repair, replacement, rehabilitation, reconstruction, or improvement of existing eligible public works systems. Eligible project costs can include expenses related to serving 20-year forecasted growth as identified in growth management comprehensive plans.

Since substantially more trust fund dollars are requested than are available, local jurisdictions must compete for the available funds. The applications are carefully evaluated, and the Public Works Board submits a prioritized list of those projects to the Legislature that are recommended to receive low-interest financing. The Legislature reviews the list and indicates its approval through the passage of an appropriation from the Public Works Assistance Account to cover the cost of the proposed loans. Once the Governor has signed the appropriation bill into law (an action that usually occurs by the following April), those local governments recommended to receive loans are offered a

formal loan agreement with appropriate interest rates and terms as determined by the Public Works Board.

COMMUNITY ECONOMIC REVITALIZATION BOARD (CERB)

The Community Economic Revitalization Board's prime mission is to partner with business and private industry and local governments to maintain and create jobs. Established by the Legislature in 1982, CERB provides low-interest loans, and in unique circumstances grants, to help finance local public infrastructure necessary to develop or retain stable business and industrial activities. Projects eligible for funding include roads, domestic and industrial water systems, sanitary and storm sewers, port facilities, and general-purpose industrial buildings.

CERB provides loans up to $1 million and, and where applicable, grants in the amount of $300,000. The interest rate is tied to the current cost of a 10-year bond and a local match of 10 percent is required.

Eligible applicants include Washington State subdivisions in partnership with private enterprise. If there is no economic partner, a local government can produce a feasibility study that documents realistic job retention or creation. Applications must be submitted 45 days prior to a regularly scheduled CERB Meeting, which typically meets in January, March, July, and November

REVENUE BONDS

The most common source of funds for construction of major utility improvements is the sale of revenue bonds. These are tax-free bonds issued by a city. The major source of funds for debt service on revenue bonds is from monthly sewer service charges. In order to sell revenue bonds and make them marketable to investors, the bonds typically have contractual provisions for the City to meet debt coverage requirements. The City must show that its annual net operating income (gross income less operation and maintenance expenses) must be equal to or greater than a factor, typically 1.2 to 1.4 times the annual debt service on all par debt. If a coverage factor has not been specified it will be determined at the time of any future bond issues.

GENERAL OBLIGATION BONDS

A city may by council action or special election issue general obligation bonds to finance almost any projects of general benefit to the City. The bonds are repaid by tax assessments levied against all privately owned properties within the City. This includes vacant property that would not otherwise contribute to the cost of the specific improvements. This type of bond issue is usually reserved for municipal improvements that are of general benefit to the public, such as arterial streets, bridges, lighting, municipal buildings, firefighting equipment, parks, and water and wastewater facilities. General obligation bonds are the most attractive bonds to investors because they are

backed by the municipality's full taxing authority and carry the lowest rate of interest of any type of bond that a city may issue.

Disadvantages of general obligation bonds include the following:

- Voter approval is often required. The City will incur the legal costs of drafting a ballot measure and pay for the cost of holding a special election. There is also the additional cost of investing staff time in public education of the need for the project, yet there is always uncertainty to the outcome of elections.

- There are legal, as well as practical limits on the amount of general obligation debt a city can issue. Financing capital improvements through general obligation debt reduces the ability of the city to issue additional general obligation debt, which is often the only source of outside financing for many general government facilities.

UTILITY LOCAL IMPROVEMENT DISTRICTS

Another potential source of funds for improvements can be obtained through the formation of Utility Local Improvement Districts (ULIDs) involving a special assessment made against properties benefiting by the improvements. ULID bonds are further backed by a legal claim to the revenues generated by the utility, similar to revenue bonds.

Sewer system expansion is a frequent application of ULID financing. Typically, ULIDs are formed by the city at the written request (by petition) of the property owners within a specific section of the city's service area. Upon receipt of a sufficient number of signatures or petitions, and acceptance by the City Council, the local improvement area is formed. Therefore, a sewer system is designed for that particular area in accordance with the City's sewer comprehensive plan. Each separate property in the ULID is assessed in accordance with the special benefits the property receives from the water or wastewater system improvements. A city-wide ULID could form part of a financing package for large-scale capital projects such as sewer line extensions or replacements that benefit all residents in the service area. The assessment places a lien on the property that must be paid in full upon sale of the property. ULID participants have the option of paying their assessment immediately upon receipt, thereby reducing the portion of the costs financed by the ULID bonds.

The advantages of ULID financing, as opposed to rate financing, to the property owner include:

- The ability to avoid interest costs by early payment of assessments.

- If the ULID assessment is paid in installments, it may be eligible to be deducted from federal income taxes.

- Low-income senior citizens may be able to defer assessment payments until the property is sold.

- Some Community Block Grant funds are available to property owners with incomes near or below poverty level. Funds are available only to reduce assessments.

The major disadvantage to the ULID process is that it may be politically difficult to approve formation. The ULID process may be stopped if 40 percent of the property owners protest its formation. Also, there are significant legal and administrative costs associated with the ULID process, which increases total project costs by approximately 30 percent over other financing options.

APPENDIX A

SEPA ENVIRONMENTAL CHECKLIST

SEPA ENVIRONMENTAL CHECKLIST

UPDATED 2014

Purpose of checklist:

Governmental agencies use this checklist to help determine whether the environmental impacts of your proposal are significant. This information is also helpful to determine if available avoidance, minimization or compensatory mitigation measures will address the probable significant impacts or if an environmental impact statement will be prepared to further analyze the proposal.

***Instructions for applicants*: [help]**

This environmental checklist asks you to describe some basic information about your proposal. Please answer each question accurately and carefully, to the best of your knowledge. You may need to consult with an agency specialist or private consultant for some questions. You may use "not applicable" or "does not apply" only when you can explain why it does not apply and not when the answer is unknown. You may also attach or incorporate by reference additional studies reports. Complete and accurate answers to these questions often avoid delays with the SEPA process as well as later in the decision-making process.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Instructions for Lead Agencies:

Please adjust the format of this template as needed. Additional information may be necessary to evaluate the existing environment, all interrelated aspects of the proposal and an analysis of adverse impacts. The checklist is considered the first but not necessarily the only source of information needed to make an adequate threshold determination. Once a threshold determination is made, the lead agency is responsible for the completeness and accuracy of the checklist and other supporting documents.

***Use of checklist for nonproject proposals:* [help]**

For nonproject proposals (such as ordinances, regulations, plans and programs), complete the applicable parts of sections A and B plus the SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS (part D). Please completely answer all questions that apply and note that the words "project," "applicant," and "property or site" should be read as "proposal," "proponent," and "affected geographic area," respectively. The lead agency may exclude (for non-projects) questions in Part B - Environmental Elements –that do not contribute meaningfully to the analysis of the proposal.

A. background [help]

1. Name of proposed project, if applicable: [help]

Forks General Sewer/Wastewater Facility Plan

2. Name of applicant: [help]

City of Forks, Washington

3. Address and phone number of applicant and contact person: [help]

Dave Zellar
Public Works Director, City of Forks
500 East Division Street
Forks, WA 98331
(360) 374-5412

Arn Coombs, P.E.
Gray & Osborne, Inc.
701 Dexter Avenue North, Suite 200
Seattle, WA 98109
(206) 284-0860

4. Date checklist prepared: [help]

October 9, 2014

5. Agency requesting checklist: [help]

Washington Department of Ecology

6. Proposed timing or schedule (including phasing, if applicable): [help]

Draft *General Sewer/Wastewater Facility Plan* will be submitted in January 2015.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain. [help]

The Sewer Facility Plan includes a list of Capital Improvement Projects (CIPs), mostly at the City's wastewater treatment plant (WWTP) that are proposed to be constructed in 2016. Projects include a second secondary clarifier, aerobic digester and upgrades and replacements of equipment used at the WWTP and the City's Mill Creek Pump Station.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal. [help]

None to our knowledge. SEPA Checklists, Environmental reports (including ESA consultation and NHPA compliance) will be needed for construction projects and CIPs on a project by project basis.

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain. [help]

None to our knowledge. Permits required for individual CIPs will be completed on a project by project basis.

10. List any government approvals or permits that will be needed for your proposal, if known. [help]

- The Washington State Department of Ecology will need to approve the final *General Sewer/Wastewater Facility Plan*.
- The City already has a State Waste Discharge Permit with the Department of Ecology that allows it to discharge treated effluent into rapid infiltration basins on the WWTP site.
- Government approvals and permits for CIPs will be sought out on a project by project basis.

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.) [help]

This checklist is for the City of Forks' *General Sewer/Wastewater Facility Plan*. Projects include a second secondary clarifier, new aerobic digester and upgrades and replacements of equipment used at the WWTP and the City's Mill Creek Pump Station. CIPs that are a part of the Facility Plan will each have separate SEPA checklists (and NEPA or SERP documentation depending upon the funding source) as they go through the permitting process.

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist. [help]

The City's sewage collection system serves a utility local improvement district (ULID) made up of the central core of the City. Areas not within the ULID are served by individual septic systems. Sewage from within the ULID is conveyed to the City's

WWTP, located at 10 Nottingham Way, Forks, WA 98331. The Mill Creek Pump Station is located in the north shoulder of Forks Ave just east of the Forks Airport.

B. ENVIRONMENTAL ELEMENTS [help]

1. Earth

a. General description of the site [help]
(circle one): Flat, rolling, hilly, steep slopes, mountainous, other _____

b. What is the steepest slope on the site (approximate percent slope)? [help]

Not applicable. This checklist is for a sewer facility plan that covers the entire Urban Growth Area for the City of Forks, generally the topography of Forks is flat.

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils. [help]

The National Resources Conservation Service Soil Survey indicates that the majority of soils in Forks are Solduc very gravelly sandy loam and Quillayute silt loam.

Land in the area is generally considered Prime Farmland and Farmland of Statewide importance according to Washington Farm Soils Maps created from the Soil Survey Geographic (SSURGO) data base. Land at the Forks WWTP and the Mill Creek Pump Station Sites is considered exempt from Prime Farmland designation due to its development for another public use or purpose.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe. [help]

Not applicable. This checklist is for a sewer facility plan that covers the entire Urban Growth Area for the City of Forks.

e. Describe the purpose, type, total area, and approximate quantities and total affected area of any filling, excavation, and grading proposed. Indicate source of fill. [help]

Not applicable. Most work proposed in the Sewer Facility Plan will not require filling, excavation, or grading as most improvements will be to equipment at the WWTP or Mill Creek Pump Station.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe. [help]

Erosion could occur during completion of CIPs, however, erosion and sedimentation control best management practices (BMPs) will be implemented in order to reduce impacts.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)? [help]

Not applicable.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any: [help]

Ground disturbing activities will be restricted to the dry summer months as much as possible. Erosion and sedimentation control best management practices (BMPs) will be implemented in order to reduce impacts.

2. Air

a. What types of emissions to the air would result from the proposal during construction, operation, and maintenance when the project is completed? If any, generally describe and give approximate quantities if known. [help]

Not applicable to the *General Sewer/Wastewater Facility Plan.*

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe. [help]

None.

c. Proposed measures to reduce or control emissions or other impacts to air, if any: [help]

None. Measures will be taken during construction of individual CIPs, however.

3. **Water**

a. Surface Water: [help]

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into. [help]

The Calawah River intersects Forks through the northwest portion of the city limits. The Forks WWTP is located approximately 560 feet from the south bank of the Calawah River.

Forks is intersected by Mill Creek through the southern city limits. The Mill Creek Pump Station is approximately 150 feet west of Mill Creek at the S Forks Ave (US 101) crossing.

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans. [help]

The CIP includes a second secondary clarifier, new aerobic digester and upgrades to equipment at the Forks WWTP which will take place more than 200 feet from the Calawah River. It also covers potential projects to the City's Mill Creek Pump Station, which is also outside of the 100-year floodplain. A separate SEPA checklist will be completed for work done at the WWTP.

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material. [help]

None.

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known. [help]

None to our knowledge.

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan. [help]

According to FIRM Panel 5300220001B, parts of the Forks sewer collection system are within 100-year floodplain. However, the WWTP and the Mill Creek Pump Station are located outside the 100-year floodplain.

6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge. [help]

No. Effluent from the Forks WWTP is discharged to a system of 8 interconnected earthen infiltration basins on site. No discharges occur directly to surface water.

b. Ground Water:

1) Will groundwater be withdrawn from a well for drinking water or other purposes? If so, give a general description of the well, proposed uses and approximate quantities withdrawn from the well. Will water be discharged to groundwater? Give general description, purpose, and approximate quantities if known. [help]

No.

2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals. . . ; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

Effluent from the Forks WWTP is discharged to a system of eight interconnected, earthen infiltration basins on site. Only two of the eight are required to infiltrate the effluent and effluent volumes are not expected to rise significantly.

c. Water runoff (including stormwater):

1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe. [help]

Not applicable.

2) Could waste materials enter ground or surface waters? If so, generally describe. [help]

As is currently the case, only treated effluent that meets the Washington State Department of Ecology's standards will continue to be discharged.

2) Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site? If so, describe.

No.

d. Proposed measures to reduce or control surface, ground, and runoff water, and drainage pattern impacts, if any:

None.

4. **Plants** [help]

a. Check the types of vegetation found on the site: [help]

__X_deciduous tree: alder, maple, aspen, other
__X_evergreen tree: fir, cedar, pine, other
__X__shrubs
__X__grass
____pasture
____crop or grain
____ Orchards, vineyards or other permanent crops.
____ wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
____water plants: water lily, eelgrass, milfoil, other

____other types of vegetation

b. What kind and amount of vegetation will be removed or altered? [help]

Will be determined on a project by project basis during design of individual CIPs.

c. List threatened and endangered species known to be on or near the site. [help]

The Department of Natural Resources List of Sections Containing Rare & Endangered Plant Species was reviewed. No threatened or endangered species are known to be present in or near Township 29N, Range 13 West, Section 5.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any: [help]

None.

e. List all noxious weeds and invasive species known to be on or near the site.

None known.

5. **Animals**

a. List any birds and other animals which have been observed on or near the site or are known to be on or near the site. Examples include: [help]

birds: hawk, heron, eagle, songbirds, other:
mammals: deer, bear, elk, beaver, other:
fish: bass, salmon, trout, herring, shellfish, other _____

b. List any threatened and endangered species known to be on or near the site. [help]

Bald Eagle (WDFW Priority Habitats and Species Interactive Mapping)
Northern Spotted Owl (WDFW Priority Habitats and Species Interactive Mapping)
Spring, Summer, Fall Chinook (WDFW Salmonscape)
Winter, Summer Steelhead (WDFW Salmonscape)
Coho (WDFW Salmonscape)
Fall Chum (WDFW Salmonscape)

c. Is the site part of a migration route? If so, explain. [help]

While the area served by the Facilities Plan does not include the various rivers in and around Forks, salmonids migrate up and down the Calawah River and other streams in the area. Similarly, Forks is located along the Pacific Flyway for waterfowl, though it is unlikely that these birds would concentrate in the vicinity of Forks WWTP or the Mill Creek Pump Station and conveyance infrastructure.

d. Proposed measures to preserve or enhance wildlife, if any: [help]

None associated with completion of the Facilities Plan, however improved treatment of wastewater should improve water quality and fish and wildlife habitat in the Calawah and downstream.

e. List any invasive animal species known to be on or near the site.

None known.

6. **Energy and natural resources**

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc. [help]

Electricity will be used to power any improvements at the WWTP or pump station. The collection system is mostly gravity with 1 existing pump station (Mill Creek).

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe. [help]

No.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any: [help]

None.

7. **Environmental health**

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe. [help]

No.

1) Describe any known or possible contamination at the site from present or past uses.

None known.

2) Describe existing hazardous chemicals/conditions that might affect project development and design. This includes underground hazardous liquid and gas transmission pipelines located within the project area and in the vicinity.

None known.

3) Describe any toxic or hazardous chemicals that might be stored, used, or produced during the project's development or construction, or at any time during the operating life of the project.

None known.

4) Describe special emergency services that might be required.

None.

5) Proposed measures to reduce or control environmental health hazards, if any:

None.

b. **Noise**

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)? [help]

None.

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site. [help]

None associated with completion and adoption of the Facilities Plan. Construction of CIP Projects would be restricted to typical daytime work hours.

3) Proposed measures to reduce or control noise impacts, if any: [help]

None proposed. This would be addressed on a project to project basis.

8. **Land and shoreline use**

a. What is the current use of the site and adjacent properties? Will the proposal affect current land uses on nearby or adjacent properties? If so, describe. [help]

Land use at project sites will be addressed on a project to project basis as CIPs are completed. The WWTP is between approximately 560 feet from the Calawah River. Work proposed in the CIPs will not expand the footprint of the WWTP or Mill Creek Pump Station beyond their current property boundaries and will not impact land use on the site or adjacent properties.

b. Has the project site been used as working farmlands or working forest lands? If so, describe. How much agricultural or forest land of long-term commercial significance will be converted to other uses as a result of the proposal, if any?

If resource lands have not been designated, how many acres in farmland or forest land tax status will be converted to nonfarm or nonforest use? [help]

Not to our knowledge. This will be addressed on a project to project basis.

1) Will the proposal affect or be affected by surrounding working farm or forest land normal business operations, such as oversize equipment access, the application of pesticides, tilling, and harvesting? If so, how:

No.

c. Describe any structures on the site. [help]

This will be addressed on a project to project basis as CIPs are completed. The WWTP is comprised of a Control Building, Aeration Basin, Sedimentation Tank, and FKC Lime/Heat Screw Press System.

d. Will any structures be demolished? If so, what? [help]

No.

e. What is the current zoning classification of the site? [help]

This will be addressed on a project to project basis as CIPs are completed. The WWTP site is designated "Public Land" and the Mill Creek Pump Station, located on the north side of Forks Ave, just east of the airport is in an area designated "Moderate Density Commercial/Moderate Density Residential, OL-5."

f. What is the current comprehensive plan designation of the site? [help]

Residential and/or Commercial.

g. If applicable, what is the current shoreline master program designation of the site? [help]

Not applicable.

h. Has any part of the site been classified as a critical area by the city or county? If so, specify. [help]

None to our knowledge. This will be addressed on a project to project basis as CIPs are completed.

i. Approximately how many people would reside or work in the completed project? [help]

This will be addressed on a project to project basis as CIPs are completed. An estimated 1,109 people live within the City's sewer service area. The population of Forks is currently 3,545 according to the Washington OFM Intercensal Estimate.

j. Approximately how many people would the completed project displace? [help]

None.

k. Proposed measures to avoid or reduce displacement impacts, if any: [help]

Not applicable.

L. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any: [help]

The sewer facility plan does not propose any land use changes and will support existing land uses.

m. Proposed measures to ensure the proposal is compatible with nearby agricultural and forest lands of long-term commercial significance, if any:

The sewer facility plan will not impact agricultural or forest lands in the area.

9. **Housing**

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing. [help]

None.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing. [help]

None.

c. Proposed measures to reduce or control housing impacts, if any: [help]

None.

10. **Aesthetics**

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed? [help]

No new structures are proposed.

b. What views in the immediate vicinity would be altered or obstructed? [help]

None.

c. Proposed measures to reduce or control aesthetic impacts, if any: [help]

None.

11. **Light and glare**

a. What type of light or glare will the proposal produce? What time of day would it mainly occur? [help]

None.

b. Could light or glare from the finished project be a safety hazard or interfere with views? [help]

No.

c. What existing off-site sources of light or glare may affect your proposal? [help]

None.

d. Proposed measures to reduce or control light and glare impacts, if any:
[help]

None.

12. **Recreation**

a. What designated and informal recreational opportunities are in the immediate vicinity? [help]

Forks is close to Olympic National Park and there are many hiking, hunting and fishing opportunities in the area.

b. Would the proposed project displace any existing recreational uses? If so, describe. [help]

No.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any: [help]

None.

13. **Historic and cultural preservation**

a. Are there any buildings, structures, or sites, located on or near the site that are over 45 years old listed in or eligible for listing in national, state, or local preservation registers located on or near the site? If so, specifically describe. [help]

None known. Site work outside of existing plant footprint will necessitate an Area of Potential Effects Memo to be submitted to the Department of Archeology and Historic Preservation and concerned Tribes.

b. Are there any landmarks, features, or other evidence of Indian or historic use or occupation? This may include human burials or old cemeteries. Are there any material evidence, artifacts, or areas of cultural importance on or near the site? Please list any professional studies conducted at the site to identify such resources. [help]

None known.

c. Describe the methods used to assess the potential impacts to cultural and historic resources on or near the project site. Examples include consultation with tribes and the department of archeology and historic preservation, archaeological surveys, historic maps, GIS data, etc. [help]

Area of Potential Effects Memo to be submitted to the Department of Archeology and Historic Preservation and concerned Tribes.

d. Proposed measures to avoid, minimize, or compensate for loss, changes to, and disturbance to resources. Please include plans for the above and any permits that may be required.

Area of Potential Effects Memo to be submitted to the Department of Archeology and Historic Preservation and concerned Tribes. A qualified Archeologist will inspect areas of potential ground disturbance and resulting recommendations for mitigation will be followed.

14. **Transportation**

a. Identify public streets and highways serving the site or affected geographic area and describe proposed access to the existing street system. Show on site plans, if any. [help]

The City of Forks is located along U.S. Highway 101. No work is proposed within streets or highways.

b. Is the site or affected geographic area currently served by public transit? If so, generally describe. If not, what is the approximate distance to the nearest transit stop? [help]

Clallam Transit offers bus service through Forks, and from La Push through Forks to Port Angeles and Sequim. The Jefferson Transit Olympic Connection offers service from Forks to Grays Harbor by way of Amanda Park at Lake Quinault and the Grays Harbor Transit system.

c. How many additional parking spaces would the completed project or non-project proposal have? How many would the project or proposal eliminate? [help]

None.

d. Will the proposal require any new or improvements to existing roads, streets, pedestrian, bicycle or state transportation facilities, not including driveways? If so, generally describe (indicate whether public or private). [help]

No.

e. Will the project or proposal use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe. [help]

No.

f. How many vehicular trips per day would be generated by the completed project or proposal? If known, indicate when peak volumes would occur and what percentage of the volume would be trucks (such as commercial and nonpassenger vehicles). What data or transportation models were used to make these estimates? [help]

None.

g. Will the proposal interfere with, affect or be affected by the movement of agricultural and forest products on roads or streets in the area? If so, generally describe.

No.

h. Proposed measures to reduce or control transportation impacts, if any: [help]

Not applicable.

15. **Public services**

a. Would the project result in an increased need for public services (for example: fire protection, police protection, public transit, health care, schools, other)? If so, generally describe. [help]

No. CIPs associated with the General Sewer Facility Plan will make wastewater conveyance and treatment infrastructure more reliable.

b. Proposed measures to reduce or control direct impacts on public services, if any. [help]

No.

16. **Utilities**

a. Circle utilities currently available at the site: [help]
electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other _____

This will be addressed on a project to project basis as CIPs are completed.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed. [help]

The CIPs proposed in the Sewer Facility Plan will provide improved sanitary sewer collection and treatment reliability for the City of Forks.

C. Signature [HELP]

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: _____
Name of signee _____
Position and Agency/Organization _____
Date Submitted: _____

D. supplemental sheet for nonproject actions [help]

(**IT IS NOT NECESSARY** to use this sheet for project actions)

Because these questions are very general, it may be helpful to read them in conjunction
with the list of the elements of the environment.

When answering these questions, be aware of the extent the proposal, or the types of
activities likely to result from the proposal, would affect the item at a greater intensity or
at a faster rate than if the proposal were not implemented. Respond briefly and in general
terms.

1. How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?

No significant excavation is proposed as a part of the proposed CIPs. No discharges to surface waters would be necessary and no release of toxic or hazardous substances would be required. Typical construction noise would occur during normal working hours but the completed projects would not cause any additional noise.

Proposed measures to avoid or reduce such increases are:

Erosion and sedimentation control BMPs will be used during construction of any CIPs proposed in the General Sewer Facility Plan. Construction will be limited to normal

daytime working hours to limit noise disruption. Detours would be used on streets if required during construction. No measures should be required following construction of the CIPs.

2. How would the proposal be likely to affect plants, animals, fish, or marine life?

The only direct impacts to animals would be possible noise disruption during construction of CIPs identified in the Plan. There should be no impacts on plants, fish or marine life. There should be no impacts to surface water, as treated effluent from the WWTP is discharged to rapid infiltration basins on the WWTP site.

> Proposed measures to protect or conserve plants, animals, fish, or marine life are:

CIPs that are proposed in the General Sewer Facility Plan will improve reliability of the Mill Creek Pump Station and WWTP by improving equipment within the footprints of the existing sites. No additional measures to protect wildlife are necessary.

3. How would the proposal be likely to deplete energy or natural resources?

Improvements at the City's WWTP or pump station could have additional energy requirements but will not deplete energy or natural resources. New electrical infrastructure would be provided to serve any needs identified by the Plan.

> Proposed measures to protect or conserve energy and natural resources are:

Not applicable.

4. How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection; such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?

CIPs that are proposed in the General Sewer Facility Plan will improve reliability of the Mill Creek Pump Station and WWTP by improving equipment within the footprints of the existing sites. This will have no adverse impact on threatened or endangered species in the surrounding area or on nearby surface waters. No adverse impacts to parks, wilderness, cultural sites, wetlands, floodplains, or prime farmlands are anticipated.

> Proposed measures to protect such resources or to avoid or reduce impacts are:

No additional measures are necessary as no adverse impacts to these resources are anticipated.

5. How would the proposal be likely to affect land and shoreline use, including whether it
would allow or encourage land or shoreline uses incompatible with existing plans?

No work is proposed within approximately 400 feet of the Calawah River. All work proposed in the CIP is limited to upgrade and replacement of equipment at the Mill Creek Pump Station and the City's WWTP.

Proposed measures to avoid or reduce shoreline and land use impacts are:

None necessary.

6. How would the proposal be likely to increase demands on transportation or public services and utilities?

No increases to demands on transportation or public services and utilities are anticipated.

Proposed measures to reduce or respond to such demand(s) are:

Work areas associated with CIP's in City rights-of-way will be properly flagged and detoured to minimize construction impacts. The proposed CIPs will increase reliability of the City's sewer collection and treatment infrastructure.

7. Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.

This Sewer Facility Plan is a requirement of the Washington State Department of Ecology and will serve to ensure that Forks' sewer collection and treatment infrastructure remains reliable. There will be no conflicts with local, state or federal laws.

APPENDIX B

STATE WASTE DISCHARGE PERMIT NUMBER ST 6031

FACT SHEET FOR STATE WASTE DISCHARGE PERMIT ST 6031

ADDENDUM TO THE FACT SHEET FOR THE 2007 REAUTHORIZATION FOR STATE WASTE DISCHARGE PERMIT NO. ST 6031

Issuance Date: June 6, 2007
Effective Date: July 1, 2007
Expiration Date: June 30, 2012

STATE WASTE DISCHARGE PERMIT NUMBER ST 6031

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Southwest Regional Office

In compliance with the provisions of the
State of Washington Water Pollution Control Law
Chapter 90.48 Revised Code of Washington, as amended,
authorizes

The City of Forks

500 East Division Street

Forks, Washington 98331

to discharge wastewater in accordance with the special and general conditions which follow.

Plant Location: 10 Nottingham Way Forks, WA 98331	Discharge Location: Legal Description: NE ¼ or NW ¼ Section 8, Range 13W, Township 28N
Treatment Type: Activated sludge lagoon with aeration, and clarification discharging to rapid infiltration basins.	Latitude: 47° 56' 57" N Longitude: 124° 24' 45" W

Steve Eberl, P.E.
Acting Southwest Region Manager
Water Quality Program
Washington State Department of Ecology

TABLE OF CONTENTS

SUMMARY OF PERMIT REPORT SUBMITTALS

Refer to the Special and General Conditions of this permit for additional submittal requirements.

Permit Section	Submittal	Frequency	First Submittal Date
S3.A.	Discharge Monitoring Report	Monthly	August 15, 2007
S3.E.	Non-Compliance Notification	As Necessary	
S4.B.	Plans for Maintaining Adequate Capacity	As Necessary	
S4.C.	Infiltration and Inflow Evaluation	Annually	March 15, 2008
S4.D.	Wasteload Assessment	Annually	March 15, 2008
S5.G.	O&M Manual Update or Review Letter	Annually	July 15, 2008
S7.A.	Industrial Discharge Authorization	As Necessary	
S7.C.	Notification of Industrial User Violations	As Necessary	
S7.D.	Pretreatment Local Sewer Ordinance Update	1/permit cycle	April 15, 2008
S8.	Metals Monitoring Report	1/permit cycle	March 15, 2009
S8.	Sampling & Quality Assurance Plan	1/permit cycle	January 15, 2008
G1.	Signature Requirements	As Necessary	
G4.	Reporting a Cause for Modification	As Necessary	
G5.	Notification of New or Altered Sources	As Necessary	
G8.	Application for permit renewal	1/permit cycle	December 31, 2011

SPECIAL CONDITIONS

S1. DISCHARGE LIMITATIONS

All discharges and activities authorized by this permit shall be consistent with the terms and conditions of this permit. The discharge of any of the following pollutants more frequently than, or at a concentration in excess of, that authorized by this permit shall constitute a violation of the terms and conditions of this permit.

Beginning on the effective date and lasting through the expiration date of this permit, the Permittee is authorized to discharge wastewater to infiltration ponds, at the permitted location subject to the following limitations: apply wastewater to land via infiltration at rates specified in the design criteria listed under S4.A on the following designated lands: Eight infiltration basins located in the northwest corner of Forks just south of the Calawah River (see legal description of site location on front page).

Discharges shall be subject to the following limitations:

	EFFLUENT LIMITATIONS	
Parameter	**Average Monthly**[a]	**Maximum Weekly** [b]
Flow	0.50 MGD	NA
pH	Shall not be outside the range of 6.0 to 9.0	
BOD_5	30 mg/L, 125 lbs/day[c] 85% Removal	45 mg/L, 187 lbs/day[c]
TSS	30 mg/L, 125 lbs/day[c] 85% Removal	45 mg/L, 187 lbs/day[c]

[a] The average monthly effluent limitation is defined as the highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month.

[b] The maximum weekly effluent limitation is defined as the highest allowable weekly discharge. The weekly discharge means the discharge of a pollutant measured during a seven day period.

[c] For pollutants with limitations expressed in units of mass, the daily discharge is calculated as the total mass of the pollutant discharged over the day. For other units of measurement, the daily discharge is the average measurement of the pollutant over the day.

S2. MONITORING REQUIREMENTS

A. Wastewater Monitoring

The sampling point for the influent will be at headworks.

The sampling point for the effluent from the above ground treatment works will be at the end-of-pipe prior to discharging into the infiltration basins and prior to discharging to the sprayfields.

The Permittee shall monitor the wastewater according to the following schedule:

Category	Parameter	Units	Sample Point	Minimum Sampling Frequency	Sample Type
Wastewater Influent	Flow	MGD	Influent Parshall Flume	Continuous[a]	Recording
Wastewater Influent	BOD_5	mg/L lbs/day	Plant Influent	1/week	24-Hour Composite
Wastewater Influent	TSS	mg/L lbs/day	Plant Influent	1/week	24-Hour Composite
Wastewater Effluent	BOD_5	mg/L lbs/day % Removal	Plant Effluent	1/week	24-Hour Composite
Wastewater Effluent	TSS	mg/L lbs/day % Removal	Plant Effluent	1/week	24-Hour Composite
Wastewater Effluent	pH	Standard Units	Plant Effluent	5/week	Grab
Wastewater Effluent	Total Dissolved Solids	mg/L	Plant Effluent	Quarterly[b]	Grab
Wastewater Effluent	Fecal Coliform	#/100 mL	Plant Effluent	Quarterly[b]	Grab
Wastewater Effluent	TKN as N	mg/L	Plant Effluent	Quarterly[b]	Grab
Wastewater Effluent	Nitrate as N	mg/L	Plant Effluent	Quarterly[b]	Grab
Wastewater Effluent	Ammonia as N	mg/L	Plant Effluent	Quarterly[b]	Grab

[a] Continuous means uninterrupted except for brief lengths of time for calibration, for power failure, or for unanticipated equipment repair or maintenance. Sampling shall be taken daily when continuous monitoring is not possible.

[b] Quarterly is defined as:
1st—January 1 to March 31 (Submit Data with March DMR)
2nd—April 1 to June 30 (Submit Data with June DMR)
3rd—July 1 to September 30 (Submit Data with September DMR)
4th--October 1 to December 31 (Submit Data with December DMR)

B. Ground Water Monitoring

The sampling points for ground water shall be monitoring wells 1-3.

The Permittee shall monitor the ground water according to the following schedule:

Category	Parameter	Units	Sample Point	Minimum Sampling Frequency	Sample Type
Ground Water Monitoring	Static Water Level (nearest 0.01 feet)	Feet	MW1, MW2, MW3	Quarterly[a]	Measurement
Ground Water Monitoring	Temperature	°C	MW1, MW2, MW3	Quarterly[a]	Grab
Ground Water Monitoring	Dissolved Oxygen	mg/L	MW1, MW2, MW3	Quarterly[a]	Grab
Ground Water Monitoring	pH	Standard Units	MW1, MW2, MW3	Quarterly[a]	Grab
Ground Water Monitoring	Conductivity	µomho/cm	MW1, MW2, MW3	Quarterly[a]	Measurement
Ground Water Monitoring	Total Coliform	#/100 mL	MW1, MW2, MW3	Quarterly[a]	Grab
Ground Water Monitoring	Chloride	mg/L	MW1, MW2, MW3	Quarterly[a]	Grab
Ground Water Monitoring	Sulfate	mg/L	MW1, MW2, MW3	Quarterly[a]	Grab
Ground Water Monitoring	Total Dissolved Solids	mg/L	MW1, MW2, MW3	Quarterly[a]	Grab
Ground Water Monitoring	Nitrate as N	mg/L	MW1, MW2, MW3	Quarterly[a]	Grab
Ground Water Monitoring	TKN as N	mg/L	MW1, MW2, MW3	Quarterly[a]	Grab
Ground Water Monitoring	Sodium	mg/L	MW1, MW2, MW3	Quarterly[a]	Grab

[a]Quarterly is defined as:
1st—January 1 to March 31 (Submit Data with March DMR)
2nd—April 1 to June 30 (Submit Data with June DMR)
3rd—July 1 to September 30 (Submit Data with September DMR)
4th--October 1 to December 31 (Submit Data with December DMR)

C. Sampling and Analytical Procedures

Samples and measurements taken to meet the requirements of this permit shall be representative of the volume and nature of the monitored parameters, including representative sampling of any unusual discharge or discharge condition, including bypasses, upsets and maintenance-related conditions affecting effluent quality.

Ground water sampling shall conform to the latest protocols in the *Implementation Guidance for the Ground Water Quality Standards*, (Ecology 1996).

Sampling and analytical methods used to meet the water and wastewater monitoring requirements specified in this permit shall conform to the latest revision of the *Guidelines Establishing Test Procedures for the Analysis of Pollutants* contained in 40 CFR Part 136 or to the latest revision of *Standard Methods for the Examination of Water and Wastewater* (APHA), unless otherwise specified in this permit or approved in writing by the Department of Ecology (Department).

D. Flow Measurement

Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to ensure the accuracy and reliability of measurements of the quantity of monitored flows. The devices shall be installed, calibrated, and maintained to ensure that the accuracy of the measurements are consistent with the accepted industry standard for that type of device. Frequency of calibration shall be in conformance with manufacturer's recommendations and at a minimum frequency of at least one calibration per year. Calibration records shall be maintained for at least three years.

E. Laboratory Accreditation

All monitoring data required by the Department shall be prepared by a laboratory registered or accredited under the provisions of, *Accreditation of Environmental Laboratories*, Chapter 173-50 Washington Administrative Code (WAC). Flow, temperature, settleable solids, conductivity, pH, and internal process control parameters are exempt from this requirement. Conductivity and pH shall be accredited if the laboratory must otherwise be registered or accredited. Crops, soils, and hazardous waste testing has not been included in the accreditation program. Crops, soils, and hazardous waste data shall be provided by a lab accredited for similar parameters in water media.

S3. REPORTING AND RECORDKEEPING REQUIREMENTS

The Permittee shall monitor and report in accordance with the following conditions. The falsification of information submitted to the Department shall constitute a violation of the terms and conditions of this permit.

A. Reporting

The first monitoring period begins on the effective date of the permit. Monitoring results shall be submitted monthly. Monitoring data obtained during the previous month shall be

summarized and reported on a form provided, or otherwise approved, by the Department, and be received no later than the 15th day of the month following the completed reporting period, unless otherwise specified in this permit. Priority pollutant analysis data shall be submitted no later than 45 days following the reporting period. The report(s) shall be sent to the Department of Ecology, P.O. Box 47775, Olympia, Washington 98504-7775

Discharge Monitoring Report forms must be submitted monthly whether or not the facility was discharging. If there was no discharge or the facility was not operating during a given monitoring period, submit the form as required with the words "no discharge" entered in place of the monitoring results.

B. Records Retention

The Permittee shall retain records of all monitoring information for a minimum of three years. Such information shall include all calibration and maintenance records and all original recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit. This period of retention shall be extended during the course of any unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by the Director.

The Permittee shall retain all records pertaining to the monitoring of sludge for a minimum of five years.

C. Recording of Results

For each measurement or sample taken, the Permittee shall record the following information: (1) the date, exact place and time of sampling; (2) the individual who performed the sampling or measurement; (3) the dates the analyses were performed; (4) who performed the analyses; (5) the analytical techniques or methods used; and (6) the results of all analyses.

D. Additional Monitoring by the Permittee

If the Permittee monitors any pollutant more frequently than required by this permit using test procedures specified by Condition S2 of this permit, then the results of this monitoring shall be included in calculation and reporting of the data submitted in the Permittee's self-monitoring reports.

E. Noncompliance Notification

In the event the Permittee is unable to comply with any of the permit terms and conditions due to any cause, the Permittee shall:

1. Immediately take action to stop, contain, and cleanup unauthorized discharges or otherwise stop the violation, and correct the problem;

2. Repeat sampling and analysis of any violation and submit the results to the Department within 30 days after becoming aware of the violation;

3. Immediately notify the Department of the failure to comply; and

4. Submit a detailed written report to the Department within 30 days, unless requested earlier by the Department, describing the nature of the violation, corrective action taken and/or planned, steps to be taken to prevent a recurrence, results of the resampling, and any other pertinent information.

Compliance with these requirements does not relieve the Permittee from responsibility to maintain continuous compliance with the terms and conditions of this permit or the resulting liability for failure to comply.

S4. FACILITY LOADING

A. Design Criteria

Flows or waste loadings of the following design criteria for the permitted treatment facility shall not be exceeded:

Average flow for the maximum month:	0.50 mgd
BOD_5 loading for maximum month:	434 lbs/day
TSS loading for maximum month:	434 lbs/day

B. Plans for Maintaining Adequate Capacity

When the actual flow or wasteload reaches 85 percent of any one of the design criteria in S4.A for three consecutive months, or when the projected increases would reach design capacity within five years, whichever occurs first, the Permittee shall submit to the Department, a plan and a schedule for continuing to maintain capacity at the facility sufficient to achieve the effluent limitations and other conditions of this permit. This plan shall address any of the following actions or any others necessary to meet this objective.

1. Analysis of the present design including the introduction of any process modifications that would establish the ability of the existing facility to achieve the effluent limits and other requirements of this permit at specific levels in excess of the existing design criteria specified in paragraph A above.

2. Reduction or elimination of excessive infiltration and inflow of uncontaminated ground and surface water into the sewer system.

3. Limitation on future sewer extensions or connections or additional wasteloads.

4. Modification or expansion of facilities necessary to accommodate increased flow or wasteload.

5. Reduction of industrial or commercial flows or waste loads to allow for increasing sanitary flow or wasteload.

Engineering documents associated with the plan must meet the requirements of WAC 173-240-060, "Engineering Report," and be approved by the Department prior to any construction. The plan shall specify any contracts, ordinances, methods for financing, or other arrangements necessary to achieve this objective.

C. Infiltration and Inflow Evaluation

1. The Permittee shall conduct an infiltration and inflow evaluation. Refer to the U.S. EPA publication, *I/I Analysis and Project Certification*, available as Publication No. 97-03 at: Publications Office, Department of Ecology, P.O. Box 47600, Olympia, WA, 98504-7600. Plant monitoring records may be used to assess measurable infiltration and inflow.

2. A report shall be prepared which summarizes any measurable infiltration and inflow. If infiltration and inflow have increased by more than 15 percent from that found in the first report based on equivalent rainfall, the report shall contain a plan and a schedule for: (1) locating the sources of infiltration and inflow; and (2) correcting the problem.

3. Any infiltration or inflow identified in segments of the collection system which are under or adjacent to surface water (100 yards) shall be further characterized for the existence of exfiltration.

4. The report summarizing the results of the evaluation and any recommendations for corrective actions shall be submitted by **March 15, 2008**, and **annually** thereafter.

D. Wasteload Assessment

The Permittee shall conduct an annual assessment of their flow and waste load and submit a report to the Department by **March 15, 2008**, and **annually** thereafter. The report shall contain the following: an indication of compliance or noncompliance with the permit effluent limitations; a comparison between the existing and design monthly average dry weather and wet weather flows, peak flows, BOD, and total suspended solids loadings; and (except for the first report) the percentage increase in these parameters since the last annual report. The report shall also state the present and design population or population equivalent, projected population growth rate, and the estimated date upon which the design capacity is projected to be reached, according to the most restrictive of the parameters above. The interval for review and reporting may be modified if the Department determines that a different frequency is sufficient.

S5. OPERATION AND MAINTENANCE

The Permittee shall at all times be responsible for the proper operation and maintenance of any facilities or systems of control installed to achieve compliance with the terms and conditions of the permit.

A. Certified Operator

An operator certified for at least a Class II plant by the state of Washington shall be in responsible charge of the day-to-day operation of the wastewater treatment plant. An operator certified for at least a Class I plant shall be in charge during all regularly scheduled shifts.

B. O & M Program

The Permittee shall institute an adequate operation and maintenance program for their entire sewage system. Maintenance records shall be maintained on all major electrical and mechanical components of the treatment plant, as well as the sewage system and pumping stations. Such records shall clearly specify the frequency and type of maintenance recommended by the manufacturer and shall show the frequency and type of maintenance performed. These maintenance records shall be available for inspection at all times.

C. Short-term Reduction

If a Permittee contemplates a reduction in the level of treatment that would cause a violation of permit discharge limitations on a short-term basis for any reason, and such reduction cannot be avoided, the Permittee shall give written notification to the Department, if possible, 30 days prior to such activities, detailing the reasons for, length of time of, and the potential effects of the reduced level of treatment. This notification does not relieve the Permittee of their obligations under this permit.

D. Electrical Power Failure

The Permittee is responsible for maintaining adequate safeguards to prevent the discharge of untreated wastes or wastes not treated in accordance with the requirements of this permit during electrical power failure at the treatment plant and/or sewage lift stations either by means of alternate power sources, standby generator, or retention of inadequately treated wastes. The Permittee shall maintain Reliability Class II (EPA 430-99-74-001) at the wastewater treatment plant, which requires primary sedimentation.

E. Prevent Connection of Inflow

The Permittee shall strictly enforce their sewer ordinances and not allow the connection of inflow (roof drains, foundation drains, etc.) to the sanitary sewer system.

F. Bypass Procedures

The Permittee shall immediately notify the Department of any spill, overflow, or bypass from any portion of the collection or treatment system. Restaurant grease traps shall be inspected and pumped out annually.

The bypass of wastes from any portion of the collection or treatment system is prohibited unless one of the following conditions (1, 2, or 3) applies:

1. Unavoidable Bypass -- Bypass is unavoidable to prevent loss of life, personal injury, or severe property damage. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass.

   If the resulting bypass from any portion of the treatment system results in noncompliance with this permit the Permittee shall notify the Department in accordance with Condition S3.E, "Noncompliance Notification."

2. Anticipated Bypass That Has The Potential to Violate Permit Limits or Conditions -- Bypass is authorized by an administrative order issued by the Department. The Permittee shall notify the Department at least 30 days before the planned date of bypass. The notice shall contain a description of the bypass and its cause; the duration of the bypass, including exact dates and times; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the bypass. The Department will consider the following prior to issuing an administrative order:

   a. If the bypass is necessary to perform construction or maintenance-related activities essential to meet the requirements of the permit.

   b. If there are feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, maintenance during normal periods of equipment down time, or transport of untreated wastes to another treatment facility.

   c. If the bypass is planned and scheduled to minimize adverse effects on the public and the environment.

   After consideration of the above and the adverse effects of the proposed bypass and any other relevant factors, the Department will approve or deny the request. The public shall be notified and given an opportunity to comment on bypass incidents of significant duration, to the extent feasible. Approval of a request to bypass will be by administrative order issued by the Department under Revised Code of Washington (RCW) 90.48.120.

3. Bypass For Essential Maintenance Without the Potential to Cause Violation of Permit Limits or Conditions -- Bypass is authorized if it is for essential maintenance and does not have the potential to cause violations of limitations or other conditions of the permit, or adversely impact public health as determined by the Department prior to the bypass.

G. Operations and Maintenance Manual

The approved Operation and Maintenance (O&M) Manual shall be kept available at the treatment plant and all operators shall follow the instructions and procedures of this manual.

The O&M Manual shall be reviewed by the Permittee at least annually. The Permittee shall confirm the review by letter and/or a manual update to the Department by **July 15, 2008,** and **annually** thereafter. Substantial changes or updates to the O&M Manual shall be submitted to the Department for review and approval whenever they are incorporated into the manual.

S6. RESIDUAL SOLIDS

Residual solids include screenings, grit, scum, primary sludge, waste activated sludge and other solid waste. The Permittee shall store and handle all residual solids in such a manner so as to prevent their entry into state ground or surface waters. The Permittee shall comply with WAC 173-308 and any associated order for handling biosolids.

S7. PRETREATMENT

The Permittee shall work cooperatively with the Department to ensure that all commercial and industrial users of the wastewater treatment system are in compliance with pretreatment regulations.

A. Discharge Authorization Required

Significant commercial or industrial operations shall not be allowed to discharge wastes to the Permittee's sewerage system until they have received prior authorization from the Department in accordance with Chapter 90.48 RCW and Chapter 173-216 WAC, as amended. The Permittee shall immediately notify the Department of any proposed new sources of wastewater from significant commercial or industrial operations.

B. Prohibitions

A non-domestic discharger may not introduce into the Permittee's sewerage system any pollutant(s) that cause pass-through or interference.

The following non-domestic discharges shall not be discharged into the Permittee's sewerage system.

1. Pollutants that create a fire or explosion hazard in the domestic wastewater facilities (including, but not limited to waste streams with a closed cup flashpoint of less than 140 degrees Fahrenheit or 60 degrees Centigrade using the test methods specified in 40 CFR 261.21).

2. Pollutants that will cause corrosive structural damage to the domestic wastewater facilities, but in no case discharges with pH lower than 5.0 standard units or greater than 11.0 standard units, unless the works are specifically designed to accommodate such discharges.

3. Solid or viscous pollutants in amounts that could cause obstruction to the flow in sewers or otherwise interfere with the operation of the POTW.

4. Any pollutant, including oxygen demanding pollutants, (BOD, etc.) released in a discharge at a flow rate and/or pollutant concentration which will cause interference with the POTW.

5. Heat in amounts that will inhibit biological activity in the POTW resulting in interference, but in no case heat in such quantities such that the temperature at the POTW exceeds 40°C (104°F) unless the Department, upon request of the Permittee, approves, in writing, alternate temperature limits.

6. Petroleum oil, non-biodegradable cutting oil, or products of mineral origin in amounts that will cause interference or pass through.

7. Pollutants which result in the presence of toxic gases, vapors, or fumes within the POTW in a quantity which may cause acute worker health and safety problems.

8. Any trucked or hauled pollutants, except at discharge points designated by the Permittee.

9. As provided by WAC 173-303-071(3)(a), discharges of dangerous wastes into the sewerage system by industrial or commercial users are prohibited unless the discharger has submitted an application for a state waste discharge permit. The applicant must accurately describe the wastewater on a State Waste Discharge Permit Application for Industrial Discharges to a POTW (Ecology Form 040-177).

10. Noncontact cooling water in significant volumes.

11. Stormwater and other direct inflow sources.

12. Wastewaters significantly affecting system hydraulic loading, which do not require treatment or would not be afforded a significant degree of treatment by the system.

C. Notification of Industrial User Violations

The Permittee shall notify the Department if any non-domestic user violates the prohibitions listed in S7.B above.

D. Local Sewer Ordinance

The Permittee shall update or develop a sewer ordinance and submit once during the permit to the Department by **April 15, 2008**. The ordinance shall include annual pumping of grease traps by restaurants and the prohibitions listed above.

S8. METALS MONITORING

Both effluent and ground water from the monitoring wells shall be monitored for metal once during the permit cycle. A report of the monitoring results is due by **March 15, 2009**. Metals shall be sampled using clean sampling techniques.

The Permittee shall sample and analyze the effluent and ground water for hardness, temperature, pH, salinity, mercury, and arsenic. The following metals shall be analyzed for both total recoverable and dissolved: zinc, copper, and lead. The Permittee shall follow the clean sampling techniques (*Method 1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels*, EPA Publication No. 821-R-95-034, April 1995). All chemical analysis shall be conducted according to methods given in 40 CFR 136 and shall have the following detection levels:

POLLUTANT PARAMETER	DETECTION LIMIT REQUIRED	SAMPLE LOCATION	SAMPLING FREQUENCY	SAMPLE TYPE
Copper	1.0 µg/L	Effluent & Monitoring wells	1/permit	Grab
Lead	1.0 µg/L	Effluent & Monitoring wells	1/permit	Grab
Zinc	4.0 µg/L	Effluent & Monitoring wells	1/permit	Grab
Mercury	0.2 µg/L	Effluent & Monitoring wells	1/permit	Grab
Arsenic	1.0 µg/L	Effluent & Monitoring wells	1/permit	Grab

Any subsequent sampling and analysis shall also meet these requirements. The Permittee shall submit the results of the study to the Department within 90 days of completing the effluent and receiving water studies.

The Permittee shall collect receiving ground water information necessary to determine if the effluent has a reasonable potential to cause a violation of the ground water quality standards. If reasonable potential exists the Department will use this information to calculate effluent limits. All sampling and analysis shall be conducted in accordance with the guidelines given in *Guidelines and Specifications for Preparing Quality Assurance Project Plans*, Ecology Publication 91-16. The Permittee shall submit a Sampling and Quality Assurance Plan for Department review and approval by **January 15, 2008**.

GENERAL CONDITIONS

G1. SIGNATORY REQUIREMENTS

All applications, reports, or information submitted to the Department shall be signed as follows:

A. All permit applications shall be signed by either a principal executive officer or ranking elected official.

B. All reports required by this permit and other information requested by the Department shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

1. The authorization is made in writing by the person described above and is submitted to the Department at the time of authorization, and

2. The authorization specifies either a named individual or any individual occupying a named position.

C. Changes to authorization. If an authorization under paragraph B.2 above is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization must be submitted to the Department prior to or together with any reports, information, or applications to be signed by an authorized representative.

D. Certification. Any person signing a document under this section shall make the following certification:

> "I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

G2. RIGHT OF ENTRY

Representatives of the Department shall have the right to enter at all reasonable times in or upon any property, public or for the purpose of inspecting and investigating conditions relating to the pollution or the possible pollution of any waters of the state. Reasonable times shall include normal business hours; hours during which production, treatment, or discharge occurs; or times when the Department suspects a violation requiring immediate inspection. Representatives of the Department shall be allowed to have access to, and copy at reasonable cost, any records required to be kept under terms and conditions of the permit; to inspect any monitoring equipment or method required in the permit; and to sample the discharge, waste treatment processes, or internal waste streams.

G3. PERMIT ACTIONS

This permit shall be subject to modification, suspension, or termination, in whole or in part by the Department for any of the following causes:

A. Violation of any permit term or condition;

B. Obtaining a permit by misrepresentation or failure to disclose all relevant facts;

C. A material change in quantity or type of waste disposal;

D. A material change in the condition of the waters of the state; or

E. Nonpayment of fees assessed pursuant to RCW 90.48.465.

The Department may also modify this permit, including the schedule of compliance or other conditions, if it determines good and valid cause exists, including promulgation or revisions of regulations or new information.

G4. REPORTING A CAUSE FOR MODIFICATION

The Permittee shall submit a new application, or a supplement to the previous application, along with required engineering plans and reports, whenever a new or increased discharge or change in the nature of the discharge is anticipated which is not specifically authorized by this permit. This application shall be submitted at least 60 days prior to any proposed changes. Submission of this application does not relieve the Permittee of the duty to comply with the existing permit until it is modified or reissued.

G5. NOTIFICATION OF NEW OR ALTERED SOURCES

The Permittee shall submit written notice to the Department whenever any new discharge or increase in volume or change in character of an existing discharge into the sewer is proposed which: (1) would interfere with the operation of, or exceed the design capacity of, any portion of the collection or treatment system; (2) would increase the total system flow or influent waste loading by more than ten percent; (3) is not part of an approved general sewer plan or approved plans and specifications; or would be subject to pretreatment standards under 40 CFR Part 403 and Section 307(b) of the Clean Water Act. This notice shall include an evaluation of the system's ability to adequately transport and treat the added flow and/or wasteload.

G6. PLAN REVIEW REQUIRED

Prior to constructing or modifying any wastewater control facilities, an engineering report and detailed plans and specifications shall be submitted to the Department for approval in accordance with Chapter 173-240 WAC. Engineering reports, plans, and specifications should be submitted at least 180 days prior to the planned start of construction. Facilities shall be constructed and operated in accordance with the approved plans.

G7. COMPLIANCE WITH OTHER LAWS AND STATUTES

Nothing in the permit shall be construed as excusing the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

G8. DUTY TO REAPPLY

The Permittee must apply for permit renewal by **December 31, 2011**.

G9. PAYMENT OF FEES

The Permittee shall submit payment of fees associated with this permit as assessed by the Department. The Department may revoke this permit if the permit fees established under Chapter 173-224 WAC are not paid.

G10. PENALTIES FOR VIOLATING PERMIT CONDITIONS

Any person who is found guilty of willfully violating the terms and conditions of this permit shall be deemed guilty of a crime, and upon conviction thereof shall be punished by a fine of up to ten thousand dollars and costs of prosecution, or by imprisonment in the discretion of the court. Each day upon which a willful violation occurs may be deemed a separate and additional violation.

Any person who violates the terms and conditions of a waste discharge permit shall incur, in addition to any other penalty as provided by law, a civil penalty in the amount of up to $10,000 for every such violation. Each and every such violation shall be a separate and distinct offense, and in case of a continuing violation, every day's continuance shall be and be deemed to be a separate and distinct violation.

FACT SHEET FOR STATE WASTE DISCHARGE PERMIT ST 6031
CITY OF FORKS

SUMMARY

The sewage treatment plant for the City of Forks uses a lagoon with aeration and activated sludge followed by clarification, and discharge to infiltration basins that percolate to ground water. The facility has had difficulty disposing of sewage sludge which has been spray applied to land on-site. The main problem has been the over application of solids and excessive hydraulic loading at the sludge disposal site. The City serves approximately 1,200 connections.

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INTRODUCTION

This fact sheet is a companion document to the draft State Waste Discharge Permit No. ST 6031. The Department of Ecology (Department) is proposing to issue this permit, which will allow discharge of wastewater to waters of the state of Washington. This fact sheet explains the nature of the proposed discharge, the Department's decisions on limiting the pollutants in the wastewater, and the regulatory and technical bases for those decisions.

Washington State law [Revised Code of Washington (RCW) 90.48.080 and 90.48.162] requires that a permit be issued before discharge of wastewater to waters of the state is allowed. Regulations adopted by the State include procedures for issuing permits [Chapter 173-216 Washington Administrative Code (WAC)], technical criteria for discharges from municipal wastewater treatment facilities (Chapter 173-221 WAC) and water quality criteria for ground waters (Chapter 173-200 WAC). They also establish the basis for effluent limitations and other requirements which are to be included in the permit.

This fact sheet and draft permit are available for review by interested persons as described in Appendix A--Public Involvement Information.

The fact sheet and draft permit have been reviewed by the Permittee. Errors and omissions identified in these reviews have been corrected before going to public notice. After the public comment period has closed, the Department will summarize the substantive comments and the response to each comment. The summary and response to comments will become part of the file on the permit and parties submitting comments will receive a copy of the Department's response. The fact sheet will not be revised. Changes to the permit will be addressed in Appendix D--Response to Comments

GENERAL INFORMATION	
Applicant	City of Forks
Facility Name and Address	Forks Wastewater Treatment Plant 10 Nottingham Way Forks, WA 98331
Mailing Address	500 East Division Street Forks, WA 98331
Type of Treatment System	Activated sludge lagoon with aeration, and clarification
Discharge Location	Latitude: 47 56' 57" N Longitude: 124 24' 45" W.
Legal Description of Application Area	NE1/4 of NW1/4, Section 8, township 28 N., range 13 W.
Contact at Facility	Name: Dan Wahlgren, Plant Operator Telephone #: 360/374-3124, FAX #: 360/374-9430
Responsible Official	Name: Phil Arbeiter Title: Mayor Address: 500 East Division Forks, WA 98331

BACKGROUND INFORMATION

DESCRIPTION OF THE COLLECTION AND TREATMENT SYSTEM

HISTORY

The last permit for this facility was written in March of 1986 with no fact sheet. The facility and collection system were built in 1986 to replace failing on-site septic systems. The 1986 permit was the first permit for this facility and the permit has not been updated since that time. No recent changes have been made to the treatment system. However, changes to the system were made early on to improve mixing and increase aeration which has improved bacteria selection and the removal of nitrogen. The soils in the infiltration basins have a high rate of infiltration, so that even though the facility has eight infiltration basins, only one or two basins are used at any one time. The operator has at times moved the discharge from basin to basin to even out the groundwater discharge.

Sludge from the treatment plant has historically been sprayed on land adjacent to the facility. The sludge has been over applied to the application sites (separate from the effluent infiltration basins) and built up an accumulation of biosolids on the surface. These solids have probably sealed the ground preventing further infiltration of the liquid portion.

COLLECTION SYSTEM STATUS

The collection system was installed in 1986 along with the rest of the system and consists predominantly of PVC pipe. The Permittee submitted an inflow and infiltration (I&I) report in 1998 showing at times that I&I constituted up to ten percent of the design flow. The operator and town continue to evaluate and address I&I problems as they are found.

TREATMENT PROCESSES

The wastewater influent travels through the treatment system as follows: entering first a manually cleaned bar screen, comminutor type of grinder, Parshall flume with an ultrasonic flow meter, aeration basin, clarifier, and finally discharges effluent to infiltration basins. This system does not disinfect the waste water before discharge. As a result, there is no chlorine residual. The activated sludge basin is in the form of an aerated lagoon with one mixer and one aerator. The operation of the aerator is controlled by a dissolved oxygen probe in the lagoon and a timer to turn the aerator on and off. Sludge from the clarifier is returned to the lagoon or wasted to a sludge storage sump. At the time of writing this fact sheet, sludge was being trucked to the Port Angeles publicly owned treatment works (POTW) instead of being sprayed on-site.

DISTRIBUTION SYSTEM (INFILTRATION BASIN)

The effluent is discharged to one of eight infiltration basins at a time. The basins were originally intended to be filled with wastewater prior to infiltration. However, the infiltration rate is rapid enough that no one basin fills up. The operator can rotate the discharge to each infiltration basin, but uses only the first two basins to maintain vegetation and an even flow of water across the surface of those basins used.

RESIDUAL SOLIDS

The treatment facilities remove solids during the treatment of the wastewater at the headworks (grit and screenings), and at the clarifier, in addition to incidental solids (rags, scum, and other debris) removed as

part of the routine maintenance of the equipment. Grit, rags, scum and screenings are drained and disposed of as solid waste at the local transfer station.

At the time of writing this permit, the Permittee was in the process of changing how it processes solids removed from the clarifier. The Permittee is applying for coverage under the statewide Biosolids permit in order to meet the requirements of Chapter 173-308 WAC. The Permittee will be required under the wastewater permit to obtain a biosolids permit. The future options for managing biosolids range from: clearing away the existing biosolids and applying future biosolids at specified rates on-site; using a process to treat and dewater the biosolids in order to have a high quality product and returning liquid to the treatment system; or shipping all sludge to another POTW that can handle and process the sludge.

GROUND WATER

There are three monitoring wells that were intended to check the conditions of ground water at the facility. There is no documentation of direction of ground water flow, therefore, it is not clear from data gathered so far if the placement of the monitoring wells will intercept contaminated groundwater if it were to occur. Wells 1 and 2 were intended to be down gradient of the infiltration basins and sludge sprayfields. Well 3 is an unused public water supply well and is likely upgradient or outside of any influence of the site because of distance. The ground surface of the facility sprayfields and infiltration basins is roughly 60 feet in elevation above the surface of the Calawah River. There is a horizontal distance of 200 feet from the northern sludge sprayfield to the river and 400 feet from the infiltration basins.

The monitoring wells were completed within a water bearing zone between 96 feet and 108 feet below the surface. The static water levels were approximately 79 feet below the surface which places the static water level near in elevation to the level of the river. The depth and water level for these wells are very similar to water supply wells for the City of Forks which are located less than one mile east of the facility site.

Information on the ground soils and hydrology was provided by a soil survey and site feasibility study, conducted by Hong Consulting Engineers in 1982 for the Forks facility, and well logs for the monitoring wells. According to this study the terraced area where the facility site is located has 16-28 feet of soil at the surface that is composed of loose sand and gravel with excessively high permeability. Before site development, there was very little standing water, ponds or streams in this area. This surface layer is underlain by numerous relatively impervious till barriers that impede vertical water movement. The town water supply aquifer is under the till layer at 100-130 feet in depth and appears to recharge very rapidly. Groundwater flows in the terrace beneath the site are likely toward the Calawah River and probably trend generally southwest.

The permeability of the surface soils was confirmed during a recent site visit on February 7, 2002, which occurred at the end of a three inch rain event over two days. During this visit, very little water was observed in the two basins that were receiving effluent (0 to 3 inches standing water in the basin). The six other basins which were not in use did not have any standing water in them despite the large rain event.

PERMIT STATUS

The previous permit for this facility was issued on March 26, 1986.

An application for permit renewal was submitted to the Department in January 1996, and again in September 2001, and accepted by the Department at that time. It is assumed that the applicant submitted an application before the original expiration date in 1991, however, a complete record at the Department of Ecology is not readily available before 1995. Records were archived before 1995.

SUMMARY OF COMPLIANCE WITH THE PREVIOUS PERMIT

The facility last received an inspection on October 26, 1998, by Gerald Anderson, P.E. No samples were taken at that time. No major problems with the plant operation were noted at that time, however, it was noted that grease build-up was occurring in the clarifier. It was concluded that Fork's grease-trap ordinance has not been actively enforced. The facility received a technical assistance visit from the Department staff member Carl Jones on November 2, 2000, who assisted with issues related to biosolids treatment and composting.

During the history of the previous permit, the Permittee has mostly remained in compliance based on Discharge Monitoring Reports (DMRs) and other reports submitted to the Department and inspections conducted by the Department. There was one incident reported in December of 2001, where a sewer backed up and discharge 25 gallons of sewage onto a street due to equipment failure.

WASTEWATER CHARACTERIZATION

The concentration of pollutants in the discharge was reported in the permit application and in discharge monitoring reports. The proposed wastewater discharge prior to infiltration or land application is characterized for the following parameters:

Table 1: Wastewater Characterization (DMR data from 11/98-10/01)

Parameter	Concentration	Existing Limit
BOD_5	4 mg/L average	30 mg/L
	4 lbs/d average	125 lbs/d
	98% average removal of influent	No limit for percent removal
TSS	5 mg/L average	30 mg/L
	5 lbs/d average	125 lbs/d
	97 average removal of influent	No limit for percent removal
pH	6.99 Standard Units, min 10 Standard Units, max (one time), 7.7 Standard Units, 95^{th} percentile	Shall not be outside the range of 6.0 to 9.0
Nitrate NO_3-N	1.760 mg/L, 95^{th} percentile	No permit limit. (Ground water standard criteria 10 mg/L)
Nitrite NO_2-N	0.049 mg/L, 95^{th} percentile	No permit limit.
Ammonia NH_3-N	0.221 mg/L, 95^{th} percentile	No permit limit.

The Forks sewage treatment facility has had a good performance over the last three years with one incident of sewage backup in town, as noted above, and one incident of pH of 10. Otherwise all parameters monitored were well below limits set in the original permit (see table 1 above). The facility consistently removed more than 98 percent of the BOD and more than 97 percent of the TSS. The nutrient parameters, nitrate, nitrite, and ammonia, all had low values at the 95^{th} percentile over the three years of data gathered.

One area the plant has had difficulty with is in the application of biosolids within agronomic rates. The application of biosolids has averaged 2.88 million gallons per year or 7,900 gallons per day. The

biosolids application is not covered or managed under the state waste discharge permit and is managed through a separate program at the Department. The original permit did not have limits for the application of biosolids. The Solid Waste Program at the Department is working with the Permittee to remedy the biosolids application problem.

It is unlikely that the town of Forks produces any toxics in quantity. No metals have been routinely measured. There are no industrial establishments and a couple of restaurants and service stations constitute the only commercial establishments.

SEPA COMPLIANCE

There are no known or proposed construction projectsor changes to the system that would trigger State Environmental Policy Act (SEPA) at this time. Changes to the City's Biosolids Program will require compliance with SEPA when proposed.

PROPOSED PERMIT LIMITATIONS

State regulations require that limitations set forth in a waste discharge permit must be technology- and water quality-based. Wastewater must be treated using all known, available, and reasonable treatment (AKART) and not pollute the waters of the state.

The permit also includes limitations on the quantity and quality of the wastewater applied to the infiltration basins and the sludge sprayfield that have been determined to protect the quality of the ground water. The approved engineering report includes specific design criteria for this facility. Water quality-based limitations are based upon compliance with the Ground Water Quality Standards (Chapter 173-200 WAC).

The more stringent of the water quality-based or technology-based limits are applied to each of the parameters of concern. Each of these types of limits is described in more detail below.

TECHNOLOGY-BASED EFFLUENT LIMITATIONS

All waste discharge permits issued by the Department must specify conditions requiring available and reasonable methods of prevention, control, and treatment of discharges to waters of the state (WAC 173-216-110). The following permit limitations are necessary to satisfy the requirement for AKART:

Table 2: Technology-Based Limits

Parameter	Limit
pH	Shall be within the range of 6 to 9 standard units.
BOD_5 & TSS	Average Monthly Limit is the most stringent of the following: 30 mg/L May not exceed fifteen percent (15%) of the average influent concentration. Average Weekly Limit = 45 mg/L

The following technology-based mass limits are based on WAC 173-220-130(3)(b) and 173-221-030(11)(b).

Monthly effluent mass loadings (lbs/day)for BOD_5 and TSS were calculated as the maximum monthly design flow (0.5 mgd) x Concentration limit (30 mg/L) x 8.34 (conversion factor) = mass limit 125 lbs/day. The weekly mass limit is 1.5 x the monthly limit = 187 lbs/day.

GROUND WATER QUALITY-BASED EFFLUENT LIMITATIONS

In order to protect existing water quality and preserve the designated beneficial uses of Washington's ground waters including the protection of human health, WAC 173-200-100 states that waste discharge permits shall be conditioned in such a manner as to authorize only activities that will not cause violations of the Ground Water Quality Standards. Drinking water is the beneficial use generally requiring the highest quality of ground water. Providing protection to the level of drinking water standards will protect a great variety of existing and future beneficial uses.

Applicable ground water criteria as defined in Chapter 173-200 WAC and in RCW 90.48.520 for this discharge include the following:

Table 3: Ground Water Quality Criteria

Total Coliform Bacteria	1 Colony/ 100 ml
Total Dissolved Solids	500 mg/L
Chloride	250 mg/L
Sulfate	250 mg/L
Nitrate	10 mg/L
pH	6.5 to 8.5 standard units
Manganese	0.05 mg/L
Total Iron	0.3 mg/L
Toxics	No toxics in toxic amounts

The Department has reviewed existing records and is unable to determine if background ground water quality is either higher or lower than the criteria given in Chapter 173-200 WAC. The nearest water supply well appears to be greater than 500 feet to the east of the infiltration basins or the sludge sprayfields. The discharges authorized by this proposed permit are not expected to interfere with beneficial uses.

The resultant effluent limits were as follows:

Table 4: Proposed Effluent Limitations.

Parameter	Limitation
BOD_5	Average monthly limit: 30 mg/L, 125 lbs/day May not exceed fifteen percent (15%) of the average influent concentration Average weekly limit: 45 mg/L, 187 lbs/day
TSS	Average monthly limit: 30 mg/L, 125 lbs/day May not exceed fifteen percent (15%) of the average influent concentration

	Average weekly limit: 45 mg/L, 187 lbs/day
pH	Shall not be outside the range of 6.0 to 9.0

The direction of groundwater flow at the site has not been well documented. Water levels in the monitoring wells have not been routinely taken. As stated earlier, the direction of water flow was believed to be toward the Calawah River and trending to the southwest. Since the Calawah River is to the north west, the original directions may be contradictory. However, effluent quality appears to be good. If at a future date effluent quality is in question, an assessment of ground water flows should be conducted. An evaluation of ground water flow would at a minimum entail a proper survey of well casing elevations, and regular water depth measurements and may require installation additional monitoring wells.

The monitoring wells were installed after the initial determination of ground water flow direction. A determination of ground water flow in the City's main aquifer by a hydrogeologist will be necessary. The monitoring well No. 3 (city well No. 4) is likely up-gradient in either case. Background data on well No. 3 shows that almost all parameters are below water quality standards or below detection. However, it has not been demonstrated that the monitoring wells are properly located in order to intercept ground water flowing away from the site.

The disinfection of the effluent was not required in the previous permit. Because the infiltration basins are isolated, there is no sprayed effluent, the basins are surrounded by a 100-foot buffer, and public access to the basins is restricted by fencing, disinfection will not be required in this permit.

COMPARISON OF LIMITATIONS WITH THE EXISTING PERMIT ISSUED IN 1986

Table 5: Comparison of Previous and New Limits

Parameter	Existing Limits (from 1986)	Proposed Limits
BOD_5	Average monthly limit 30 mg/L, 125 lbs/day	Average monthly limit 30 mg/L, 125 lbs/day May not exceed fifteen percent (15%) of the average influent concentration Average weekly limit 45 mg/L, 187 lbs/day
TSS	Average monthly limit 30 mg/L, 125 lbs/day	Average monthly limit 30 mg/L, 125 lbs/day May not exceed fifteen percent (15%) of the average influent concentration Average weekly limit 45 mg/L, 187 lbs/day
pH	Shall not be outside the range	Shall not be outside the range

	of 6.0 to 9.0	of 6.0 to 9.0

MONITORING REQUIREMENTS

Monitoring, recording, and reporting are specified to verify that the treatment process is functioning correctly, that ground water criteria are not violated, and that effluent limitations are being achieved (WAC 173-216-110).

INFLUENT AND EFFLUENT MONITORING

The monitoring and testing schedule is detailed in the proposed permit under Condition S2. Specified monitoring frequencies take into account the quantity and variability of the discharge, the treatment method, past compliance, significance of pollutants, and cost of monitoring.

Monitoring for fecal coliform, nitrates and ammonia is being required to further characterize the effluent. These pollutants could have a significant impact on the quality of the ground water.

GROUND WATER MONITORING

The monitoring of ground water at the site is required in accordance with the Ground Water Quality Standards, Chapter 173-200 WAC. The Department has determined that this discharge has a potential to pollute the ground water. Therefore, the Permittee is required to evaluate the impacts on ground water quality. Monitoring of the ground water at the site boundaries and within the site is an integral component of such an evaluation. Monitoring ground water will be required once per quarter. Static water depth in the monitoring wells will be added to the monitoring schedule to aid in determining the direction of ground water flow.

OTHER PERMIT CONDITIONS

REPORTING AND RECORDKEEPING

The conditions of S3 are based on the authority to specify any appropriate reporting and recordkeeping requirements to prevent and control waste discharges (WAC 273-216-110).

FACILITY LOADING

The design criteria for this treatment facility are taken from a 1986 engineering report prepared by Kramer, Chin and Mayo and are as follows:

Annual average flow	0.30 mgd
Monthly average flow (max. month):	0.50 mgd
Instantaneous peak flow (peak hour):	0.91 mgd
BOD influent loading (average annual):	434 lbs/day
TSS influent loading (average annual):	434 lbs/day
Design population equivalent	1,500 people

The permit requires the Permittee to maintain adequate capacity to treat the flows and waste loading to the treatment plant (WAC 173-216-110[4]). The Permittee is required to submit an engineering report when the plant reaches 85 percent of its flow or loading capacity. For significant new discharges, the

permit requires a new application and an engineering report (WAC 173-216-110[5]). At the present time, the plant averages 71 percent of design capacity for flow and 80 percent of capacity based on the design population. The permit requires the Permittee to submit annual reports comparing the actual flow and waste loadings to the design criteria for the plant.

IRRIGATION AND CROP MANAGEMENT PLANS

The infiltration basins do not have a crop and are not irrigating. However, the sludge sprayfield is supplying irrigation to a forest crop. If the sludge sprayfield is to continue, the irrigation rates will have to be within agronomic rates and must comply with WAC 173-308. This application should be covered by the statewide biosolids monitoring plan administered by the Solid Waste Program at the Department. If application of sludge solids and liquid is to continue on-site, the Permittee will be required to submit an irrigation plan which should describe and evaluate various irrigation controls. The irrigation and crop management plan is required to support the engineering report and operations and maintenance manual.

OPERATIONS AND MAINTENANCE

The facility has not updated their O&M manual since 1986, much has changed in the operation of the facility since that time. The proposed permit contains Condition S.5 as authorized under RCW 90.48.110, WAC 173-220-150, Chapter 173-230 WAC, and WAC 173-240-080. It is included to ensure proper operation and regular maintenance of equipment, and to ensure that adequate safeguards are taken so that constructed facilities are used to their optimum potential in terms of pollutant capture and treatment. The proposed permit requires submission of an updated O&M manual in S5.G for the entire wastewater system.

RESIDUAL SOLIDS HANDLING

To prevent water pollution the Permittee is required in permit Condition S6 to store and handle all residual solids (grit, screenings, scum, sludge, and other solid waste) in accordance with the requirements of RCW 90.48.080 and State Water Quality Standards, WAC 173-201A, and Biosolids Handling regulations covered under WAC173-308

The final use and disposal of sewage sludge from this facility is regulated by U.S. EPA under 40 CFR 503. The disposal of other solid waste is under the jurisdiction of the local health district.

PRETREATMENT

WAC 173-216-110 requires that the list of prohibitions in WAC 173-216-060 be included in the permit.

Federal pretreatment requirements in 40 CFR 403 and Sections 307(b) and 308 of the Clean Water Act apply to this facility. Therefore, notification to the Department is required when pretreatment prohibitions are violated and when new sources of commercial or industrial wastewater discharge are added to its system.

Duty to Enforce Discharge Prohibitions

This provision prohibits the POTW from authorizing or permitting an industrial discharger to discharge certain types of waste into the sanitary sewer. The first portion of the provision prohibits acceptance of pollutants which cause pass through or interference. The definitions of pass through and interference are in Appendix B of this fact sheet.

The second portion of this provision prohibits the POTW from accepting certain specific types of wastes, namely those which are explosive, flammable, excessively acidic, basic, otherwise corrosive, or

obstructive to the system. In addition wastes with excessive BOD, petroleum based oils, or which result in toxic gases are prohibited to be discharged. The regulatory basis for these prohibitions is 40 CFR Part 403, with the exception of the pH provisions which are based on WAC 173-216-060.

The third portion of this provision prohibits certain types of discharges including cooling water in significant volumes, stormwater and other direct inflow sources, and wastewaters significantly affecting system hydraulic loading, which do not require treatment.

Included in the pretreatment portion of the permit is a requirement to establish a local ordinance to include the items listed as prohibitions and to require restaurants to have their grease traps pumped out at least once per year.

GROUND WATER QUALITY EVALUATION (HYDROGEOLOGIC STUDY)

A hydrologic study will not be required at this time. However, a study may be required in the future if the quality of treatment deteriorates. If a study is required, the Permittee would need to prepare and submit a hydrogeologic study for Departmental approval in accordance with WAC 173-200-080. The hydrogeologic study would need to be based on soil and hydrogeologic characteristics and be capable of assessing impacts on ground water. Guidelines are given in the *Implementation Guidance for the Ground Water Quality Standards,* Ecology 1996.

The hydrologic study, if needed, should use the existing wells to the greatest extent possible. The intention is to determine the direction of ground water flow and determine if additional monitoring wells are needed.

GENERAL CONDITIONS

General Conditions are based directly on state laws and regulations and have been standardized for all industrial waste discharge to ground water permits issued by the Department.

Condition G1 requires responsible officials or their designated representatives to sign submittals to the Department. Condition G2 requires the Permittee to allow the Department to access the treatment system, production facility, and records related to the permit. Condition G3 specifies conditions for modifying, suspending or terminating the permit. Condition G4 requires the Permittee to apply to the Department prior to increasing or varying the discharge from the levels stated in the permit application. Condition G5 requires the Permittee to submit written notice of significant increases in the amount or nature of discharges (typically new industrial discharges) into the sewer system tributary to the permitted facility. Condition G6 requires the Permittee to construct, modify, and operate the permitted facility in accordance with approved engineering documents. Condition G7 prohibits the Permittee from using the permit as a basis for violating any laws, statutes or regulations. Condition G8 requires application for permit renewal 60 days prior to the expiration of the permit. Condition G9 requires the payment of permit fees. Condition G10 describes the penalties for violating permit conditions.

RECOMMENDATION FOR PERMIT ISSUANCE

This proposed permit meets all statutory requirements for authorizing a wastewater discharge, including those limitations and conditions believed necessary to control toxics, and to protect human health and the beneficial uses of waters of the state of Washington. The Department proposes that the permit be issued for five years.

REFERENCES FOR TEXT AND APPENDICES

Faulkner, S.P., Patrick Jr., W.H., Gambrell, R.P., May-June, 1989. Field Techniques for Measuring Wetland Soil Parameters, Soil Science Society of America Journal, Vol. 53, No.3.

Washington State Department of Ecology, 1993. Guidelines for Preparation of Engineering Reports for Industrial Wastewater Land Application Systems, Ecology Publication # 93-36. 20 pp.

Washington State Department of Ecology and Department of Health, 1997. Water Reclamation and Reuse Standards, Ecology Publication # 97-23. 73 pp.

Washington State Department of Ecology, 1996. Implementation Guidance for the Ground Water Quality Standards, Ecology Publication # 96-02.

Washington State University, November, 1981. Laboratory Procedures - Soil Testing Laboratory. 38 pp.

APPENDICES

APPENDIX A--PUBLIC INVOLVEMENT INFORMATION

The Department has tentatively determined to issue a permit to the applicant listed on page one of this fact sheet. The permit contains conditions and effluent limitations which are described in the rest of this fact sheet.

Public notice of application was published on March 27, 2002, and in the *Forks Forum* to inform the public that an application had been submitted and to invite comment on the reissuance of this permit.

The Department published a Public Notice of Draft (PNOD) on June 26, 2002 in the *Forks Forum* to inform the public that a draft permit and fact sheet are available for review. Interested persons are invited to submit written comments regarding the draft permit. The draft permit, fact sheet, and related documents are available for inspection and copying between the hours of 8:00 a.m. and 5:00 p.m. weekdays, by appointment, at the regional office listed below. Written comments should be mailed to:

Water Quality Permit Administrator
Department of Ecology
Southwest Regional Office
P.O. Box 47775
Olympia, WA 98504-7775.

Any interested party may comment on the draft permit or request a public hearing on this draft permit within the 30-day comment period to the address above. The request for a hearing shall indicate the interest of the party and reasons why the hearing is warranted. The Department will hold a hearing if it determines there is a significant public interest in the draft permit (WAC 173-216-100). Public notice regarding any hearing will be circulated at least 30 days in advance of the hearing. People expressing an interest in this permit will be mailed an individual notice of hearing.

Comments should reference specific text followed by proposed modification or concern when possible. Comments may address technical issues, accuracy and completeness of information, the scope of the facility's proposed coverage, adequacy of environmental protection, permit conditions, or any other concern that would result from issuance of this permit.

The Department will consider all comments received within 30 days from the date of public notice of draft indicated above, in formulating a final determination to issue, revise, or deny the permit. The Department's response to all significant comments is available upon request and will be mailed directly to people expressing an interest in this permit.

Further information may be obtained from the Department by telephone, (360) 407-6554, or by writing to the address listed above.

This permit was written by Eric Schlorff.

APPENDIX B--GLOSSARY

Ambient Water Quality--The existing environmental condition of the water in a receiving water body.

Ammonia--Ammonia is produced by the breakdown of nitrogenous materials in wastewater. Ammonia is toxic to aquatic organisms, exerts an oxygen demand, and contributes to eutrophication. It also increases the amount of chlorine needed to disinfect wastewater.

Average Monthly Discharge Limitation--The average of the measured values obtained over a calendar month's time.

Best Management Practices (BMPs)--Schedules of activities, prohibitions of practices, maintenance procedures, and other physical, structural and/or managerial practices to prevent or reduce the pollution of waters of the State. BMPs include treatment systems, operating procedures, and practices to control: plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. BMPs may be further categorized as operational, source control, erosion and sediment control, and treatment BMPs.

BOD_5--Determining the Biochemical Oxygen Demand of an effluent is an indirect way of measuring the quantity of organic material present in an effluent that is utilized by bacteria. The BOD_5 is used in modeling to measure the reduction of dissolved oxygen in a receiving water after effluent is discharged. Stress caused by reduced dissolved oxygen levels makes organisms less competitive and less able to sustain their species in the aquatic environment. Although BOD is not a specific compound, it is defined as a conventional pollutant under the federal Clean Water Act.

Bypass--The intentional diversion of waste streams from any portion of the collection or treatment facility.

Chlorine--Chlorine is used to disinfect wastewaters of pathogens harmful to human health. It is also extremely toxic to aquatic life.

Compliance Inspection - Without Sampling--A site visit for the purpose of determining the compliance of a facility with the terms and conditions of its permit or with applicable statutes and regulations.

Compliance Inspection - With Sampling--A site visit to accomplish the purpose of a Compliance Inspection - Without Sampling and as a minimum, sampling and analysis for all parameters with limits in the permit to ascertain compliance with those limits; and, for municipal facilities, sampling of influent to ascertain compliance with the 85 percent removal requirement. Additional sampling may be conducted.

Composite Sample--A mixture of grab samples collected at the same sampling point at different times, formed either by continuous sampling or by mixing discrete samples. May be "time-composite"(collected at constant time intervals) or "flow-proportional" (collected either as a constant sample volume at time intervals proportional to stream flow, or collected by increasing the volume of each aliquot as the flow increased while maintaining a constant time interval between the aliquots.

Construction Activity--Clearing, grading, excavation and any other activity which disturbs the surface of the land. Such activities may include road building, construction of residential houses, office buildings, or industrial buildings, and demolition activity.

Continuous Monitoring –Uninterrupted, unless otherwise noted in the permit.

Distribution Uniformity--The uniformity of infiltration (or application in the case of sprinkle or trickle irrigation) throughout the field expressed as a percent relating to the average depth infiltrated in the lowest one-quarter of the area to the average depth of water infiltrated.

Engineering Report--A document, signed by a professional licensed engineer, which thoroughly examines the engineering and administrative aspects of a particular domestic or industrial wastewater facility. The report shall contain the appropriate information required in WAC 173-240-060 or 173-240-130.

Fecal Coliform Bacteria--Fecal coliform bacteria are used as indicators of pathogenic bacteria in the effluent that are harmful to humans. Pathogenic bacteria in wastewater discharges are controlled by disinfecting the wastewater. The presence of high numbers of fecal coliform bacteria in a water body can indicate the recent release of untreated wastewater and/or the presence of animal feces.

Grab Sample--A single sample or measurement taken at a specific time or over as short period of time as is feasible.

Industrial Wastewater--Water or liquid-carried waste from industrial or commercial processes, as distinct from domestic wastewater. These wastes may result from any process or activity of industry, manufacture, trade or business, from the development of any natural resource, or from animal operations such as feed lots, poultry houses, or dairies. The term includes contaminated storm water and, also, leachate from solid waste facilities.

Interference -- A discharge which, alone or in conjunction with a discharge or discharges from other sources, both:

Inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal and;

Therefore is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued there under (or more stringent State or local regulations): Section 405 of the Clean Water Act, the Solid Waste Disposal Act (SWDA) (including title II, more commonly referred to as the Resource Conservation and Recovery Act (RCRA), and including State regulations contained in any State sludge management plan prepared pursuant to subtitle D of the SWDA), sludge regulations appearing in 40 CFR Part 507, the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection, Research and Sanctuaries Act.

Maximum Daily Discharge Limitation--The highest allowable daily discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. The daily discharge is calculated as the average measurement of the pollutant over the day.

Method Detection Level (MDL)--The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is above zero and is determined from analysis of a sample in a given matrix containing the analyte.

Pass Through -- A discharge which exits the POTW into waters of the State in quantities or concentrations which, alone or in conjunction with a discharge or discharges from other sources, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation), or which is a cause of a violation of State water quality standards.

pH--The pH of a liquid measures its acidity or alkalinity. A pH of 7 is defined as neutral, and large variations above or below this value are considered harmful to most aquatic life.

Quantitation Level (QL)-- A calculated value five times the MDL (method detection level).

Soil Scientist--An individual who is registered as a Certified or Registered Professional Soil Scientist or as a Certified Professional Soil Specialist by the American Registry of Certified Professionals in Agronomy, Crops, and Soils or by the National Society of Consulting Scientists or who has the credentials for membership. Minimum requirements for eligibility are: possession of a baccalaureate, masters, or doctorate degree from a U.S. or Canadian institution with a minimum of 30 semester hours or 45 quarter hours professional core courses in agronomy, crops or soils, and have 5,3,or 1 years, respectively, of professional experience working in the area of agronomy, crops, or soils.

State Waters--Lakes, rivers, ponds, streams, inland waters, underground waters, salt waters, and all other surface waters and watercourses within the jurisdiction of the state of Washington.

Stormwater--That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes, and other features of a storm water drainage system into a defined surface water body, or a constructed infiltration facility.

Technology-based Effluent Limit--A permit limit that is based on the ability of a treatment method to reduce the pollutant.

Total Coliform Bacteria--A microbiological test which detects and enumerates the total coliform group of bacteria in water samples.

Total Dissolved Solids--That portion of total solids in water or wastewater that passes through a specific filter.

Total Suspended Solids (TSS)--Total suspended solids is the particulate material in an effluent. Large quantities of TSS discharged to a receiving water may result in solids accumulation. Apart from any toxic effects attributable to substances leached out by water, suspended solids may kill fish, shellfish, and other aquatic organisms by causing abrasive injuries and by clogging the gills and respiratory passages of various aquatic fauna. Indirectly, suspended solids can screen out light and can promote and maintain the development of noxious conditions through oxygen depletion.

Water Quality-based Effluent Limit--A limit on the concentration of an effluent parameter that is intended to prevent pollution of the receiving water.

APPENDIX C--TECHNICAL CALCULATIONS

APPENDIX D--RESPONSE TO COMMENTS

ADDENDUM TO THE FACT SHEET
FOR THE 2007 REAUTHORIZATION
FOR STATE WASTE DISCHARGE
PERMIT NO. ST 6031

I. GENERAL INFORMATION

Facility: City of Forks Wastewater Treatment Plant
10 Nottingham Way
Forks, WA 98331

II. APPLICATION REVIEW

An application for permit reissuance was submitted to the Department of Ecology (Department) on March 8, 2007, and accepted by the Department on April 5, 2007. The scope and manner of any review of an application for replacement of permit by the Department shall be sufficiently detailed as to insure the following:

- That the Permittee is in substantial compliance with all of the terms, conditions, requirements and schedules of compliance of the expired permit;
- That the Department has up-to date information on the Permittee's production levels; Permittee's waste treatment practices; nature, content, and frequencies of Permittee's discharge; either pursuant to the submission of new forms and applications or pursuant to monitoring records and reports resubmitted to the Department by the permittee; and
- That the discharge is consistent with applicable effluent standards and limitations, water quality standards, and other legally applicable requirements listed in WAC 173-216 and WAC 173-200.

The application for City of Forks Wastewater Treatment Plant was reviewed and indicates that no changes in the treatment characteristics of the effluent process or volume of wastewater has occurred.

III. PERMIT REAUTHORIZATION

This fact sheet addendum accompanies the draft permit, which is to be reauthorized to City of Forks Wastewater Treatment Plant for the discharge of wastewater to the ground. The previous fact sheet is also part of this administrative record and explains the basis for the discharge limitations and conditions of the reauthorized permit.

The existing permit requirements, including discharge limitations and monitoring, do not need to be changed to protect the receiving water quality. The previous fact sheet addressed conditions and issues at the facility at the time when the previous permit was issued, and statements made reflected the status in 2001. Since the issuance of the current permit, the Department has not received any information which indicates that environmental impacts from the discharge that were not evaluated at the time of the last permit issuance is persuasive enough to undertake a complete renewal of the permit. The reauthorized permit is virtually identical to the previous permit issued on August 8, 2002.

The discharge limits and conditions in effect at the time of expiration of the previous permit are carried over unchanged to this reauthorized permit. Assessment of compliance and inspections of the facility during the previous permit term indicate that the facility should not be placed on a high priority for permit renewal. The Department assigns a high priority for permit renewals in situations where water quality would materially benefit from a more stringent permit during the next five-year cycle.

The permit reauthorization process, in concert with the routine renewal of high priority permits, allows the Department to reissue permits in a timely manner and minimize the number of active permits that have passed expiration dates. A system of ranking the relative significance of the environmental benefit to be gained by renewing a permit rather than reauthorizing a permit is followed during the Department's annual permit planning process. Each permit that is due for reissuance is assessed and compared with other permits that are also due for reissuance. The public is notified and input is sought after the initial draft ranking has tentatively established which permits are likely to be completely renewed and which are likely to be reauthorized. All relevant comments and suggestions are considered before a final decision is made regarding the type of reissuance for each permit.

The only changes to the previous permit are the submittal date requirements. Submittal requirements from the previous permit that were completed and submitted and do not require additional or continued assessment were removed. The submittal dates for the other standard compliance and submittal requirements that have been carried over from the past permit into this reauthorized permit have been adjusted to the proposed permit schedule. The Department considered these submittals necessary in the previous permit and no information has come forward to cause a reconsideration of the submittal requirement.

IV. RECOMMENDATION FOR PERMIT ISSUANCE

The Department proposes that this permit be issued for five years.

APPENDIX A – PUBLIC INVOLVEMENT INFORMATION

The Department has determined to reauthorize a discharge permit to the applicant listed on page 1 of this fact sheet addendum. The permit contains conditions and effluent limitations that are described in the fact sheet.

Public notice of application was published on June 19, 2006, and June 26, 2006, in the *Peninsula Daily News* to inform the public that an application had been submitted and to invite comment on the reauthorization of this permit.

Water Quality Permit Coordinator
Department of Ecology
Southwest Regional Office
P.O. Box 47775
Olympia, WA 98504-7775

Further information may be obtained from the Department by telephone at (360) 407-6279, or by writing to the address listed above.

APPENDIX C

COST ESTIMATES

City of Forks

General Sewer/Wastewater Facility Plan

Mill Creek Pump Station Planning Level Cost Estimate

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	1 LS	$ 4,000	$ 4,000
2	Submersible Centrifugal Pumps w Control Panel	2 EA	$ 13,000	$ 26,000
3	Demolition, Removal and Disposal	1 LS	$ 2,000	$ 2,000
4	Pump and Piping Installation	1 LS	$ 10,000	$ 10,000
7	Electrical	1 LS	$ 7,000	$ 7,000
	Subtotal			$ 49,000
	Tax rate (8.4%)			4,116
	Subtotal			$ 53,100
	Contingency (20%)			$ 10,620
	Total Estimated Construction Cost:			**$ 64,000**
	Engineering and Administrative Costs (25%):			$ 16,000
	Total Estimated Project Cost			**$ 80,000**

City of Forks
General Sewer/Wastewater Facility Plan
Robin Hood East Collection System Planning Level Cost Estimate
Gravity Alternative

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	1	LS	$ 83,000	$ 83,000
2	Locate Existing Utilities	1	LS	$ 17,000	$ 17,000
3	Erosion Control	1	LS	$ 17,000	$ 17,000
4	Trench Safety Systems	6,300	LF	$ 2	$ 12,600
5	8-inch PVC Sewer Pipe	6,300	LF	$ 85	$ 535,500
6	Manholes	23	EA	$ 5,000	$ 115,000
7	Sawcutting	12,600	LF	$ 3	$ 37,800
8	Connections to Existing System	1	EA	$ 3,500	$ 3,500
9	Side Sewer Connections	101	EA	$ 1,500	$ 151,500
10	Traffic Control	300	HRS	$ 95	$ 28,500
Subtotal					$ 1,001,400
Tax rate (8.4%)					84,118
Subtotal:					$ 1,085,500
Contingency (20%)					$ 217,100
Total Estimated Construction Cost:					**$ 1,303,000**
Engineering and Administrative Costs (25%):					$ 326,000
Total Estimated Project Cost:					**$ 1,629,000**

City of Forks
General Sewer/Wastewater Facility Plan
Robin Hood East Collection System Planning Level Cost Estimate
STEP Alternative

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	1	LS	$ 83,000	$ 83,000
2	Locate Existing Utilities	1	LS	$ 17,000	$ 17,000
3	Erosion Control	1	LS	$ 17,000	$ 17,000
4	Trench Safety Systems	6,300	LF	$ 2	$ 12,600
5	4-inch Pressure Force Main	6,300	LF	$ 40	$ 252,000
6	Manholes	0	EA	$ 5,000	$ -
7	Sawcutting	12,600	LF	$ 3	$ 37,800
8	Connections to Existing System	1	EA	$ 3,500	$ 3,500
9	Connect to Existing Structure (1,500 gallon Septic Tank, Effluent Filter Cleanout, Simplex Setup Assembly, Including valves and Piping)	101	EA	$ 9,000	$ 909,000
10	Traffic Control	300	HRS	$ 95	$ 28,500
Subtotal					$ 1,360,400
Tax rate (8.4%)					114,274
Subtotal:					$ 1,474,700
Contingency (20%)					$ 294,940
Total Estimated Construction Cost:					**$ 1,770,000**
Engineering and Administrative Costs (25%):					$ 443,000
Total Estimated Project Cost:					**$ 2,213,000**

City of Forks
General Sewer/Wastewater Facility Plan
Robin Hood East Collection System Planning Level Cost Estimate
Grinder Alternative

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	1	LS	$ 83,000	$ 83,000
2	Locate Existing Utilities	1	LS	$ 17,000	$ 17,000
3	Erosion Control	1	LS	$ 17,000	$ 17,000
4	Trench Safety Systems	6,300	LF	$ 2	$ 12,600
5	4-inch Pressure Force Main	6,300	LF	$ 40	$ 252,000
6	Manholes	0	EA	$ 5,000	$ -
7	Sawcutting	12,600	LF	$ 3	$ 37,800
8	Connections to Existing System	1	EA	$ 3,500	$ 3,500
9	Connect Existing Structure via Simplex Grinder Pump (Includes tank, pump, piping and valves)	101	EA	$ 11,000	$ 1,111,000
10	Traffic Control	300	HRS	$ 95	$ 28,500
Subtotal					$ 1,562,400
Tax rate (8.4%)					131,242
Subtotal:					$ 1,693,600
Contingency (20%)					$ 338,720
Total Estimated Construction Cost:					**$ 2,032,000**
Engineering and Administrative Costs (25%):					$ 508,000
Total Estimated Project Cost:					**$ 2,540,000**

City of Forks
General Sewer/Wastewater Facility Plan
Robin Hood West Collection System Planning Level Cost Estimate
Gravity Alternative

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	1	LS	$ 76,000	$ 76,000
2	Locate Existing Utilities	1	LS	$ 16,000	$ 16,000
3	Erosion Control	1	LS	$ 16,000	$ 16,000
4	Trench Safety Systems	5,500	LF	$ 2	$ 11,000
5	8-inch PVC Sewer Pipe	5,500	LF	$ 85	$ 467,500
6	Manholes	22	EA	$ 5,000	$ 110,000
7	Sawcutting	11,000	LF	$ 3	$ 33,000
8	Connections to Existing System	1	EA	$ 3,500	$ 3,500
9	Side Sewer Connections	105	EA	$ 1,500	$ 157,500
10	Traffic Control	300	HRS	$ 95	$ 28,500
Subtotal					$ 919,000
Tax rate (8.4%)					77,196
Subtotal:					$ 996,200
Contingency (20%)					$ 199,240
Total Estimated Construction Cost:					**$ 1,195,000**
Engineering and Administrative Costs (25%):					$ 299,000
Total Estimated Project Cost:					**$ 1,494,000**

City of Forks
General Sewer/Wastewater Facility Plan
Robin Hood West Collection System Planning Level Cost Estimate
STEP Alternative

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	1	LS	$ 76,000	$ 76,000
2	Locate Existing Utilities	1	LS	$ 16,000	$ 16,000
3	Erosion Control	1	LS	$ 16,000	$ 16,000
4	Trench Safety Systems	5,500	LF	$ 2	$ 11,000
5	4-inch Pressure Main	5,500	LF	$ 40	$ 220,000
6	Manholes	0	EA	$ 5,000	$ -
7	Sawcutting	11,000	LF	$ 3	$ 33,000
8	Connections to Existing System	1	EA	$ 3,500	$ 3,500
9	Connect to Existing Structure (1,500 gallon Septic Tank, Effluent Filter Cleanout, Simplex Setup Assembly, Including valves and Piping)	105	EA	$ 9,000	$ 945,000
10	Traffic Control	300	HRS	$ 95	$ 28,500
Subtotal.....					$ 1,349,000
Tax rate (8.4%)…...					113,316
Subtotal:.....					$ 1,462,300
Contingency (20%)……					$ 292,460
Total Estimated Construction Cost:...					**$ 1,755,000**
Engineering and Administrative Costs (25%):...					$ 439,000
Total Estimated Project Cost:.....					**$ 2,194,000**

City of Forks
General Sewer/Wastewater Facility Plan
Robin Hood West Collection System Planning Level Cost Estimate
Grinder Alternative

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	1	LS	$ 76,000	$ 76,000
2	Locate Existing Utilities	1	LS	$ 16,000	$ 16,000
3	Erosion Control	1	LS	$ 16,000	$ 16,000
4	Trench Safety Systems	5,500	LF	$ 2	$ 11,000
5	4-inch Pressure Main	5,500	LF	$ 40	$ 220,000
6	Manholes	0	EA	$ 5,000	$ -
7	Sawcutting	11,000	LF	$ 3	$ 33,000
8	Connections to Existing System	1	EA	$ 3,500	$ 3,500
9	Connect Existing Structure via Simplex Grinder Pump (Includes tank, pump, piping and valves)	105	EA	$ 11,000	$ 1,155,000
10	Traffic Control	300	HRS	$ 95	$ 28,500
Subtotal					$ 1,559,000
Tax rate (8.4%)					130,956
Subtotal:					$ 1,690,000
Contingency (20%)					$ 338,000
Total Estimated Construction Cost:					**$ 2,028,000**
Engineering and Administrative Costs (25%):					$ 507,000
Total Estimated Project Cost:					**$ 2,535,000**

City of Forks
General Sewer/Wastewater Facility Plan
Bogachiel East Collection System Planning Level Cost Estimate
Gravity Alternative

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM		$ 70,000	$ 70,000
2	Locate Existing Utilities	LUMP SUM		$ 14,000	$ 14,000
3	Erosion Control	LUMP SUM		$ 14,000	$ 14,000
4	Trench Safety Systems	5,940	LF	$ 2	$ 11,880
5	8-inch PVC Sewer Pipe	5,940	LF	$ 85	$ 504,900
6	10-inch PVC Sewer Pipe	0	LF	$ 90	$ -
7	Manholes	15	EA	$ 5,000	$ 75,000
8	Sawcutting	11,880	LF	$ 3	$ 35,640
9	Connections to Existing System	1	EA	$ 3,500	$ 3,500
10	Side Sewer Connections	58	EA	$ 1,500	$ 87,000
11	Traffic Control	300	HRS	$ 95	$ 28,500
Subtotal					$ 844,420
Tax rate (8.4%)					70,931
Subtotal:					$ 915,400
Contingency (20%)					$ 183,080
Total Estimated Construction Cost					**$ 1,098,000**
Engineering and Administrative Costs (25%):					$ 275,000
Total Estimated Project Cost					**$ 1,373,000**

City of Forks
General Sewer/Wastewater Facility Plan
Bogachiel East Collection System Planning Level Cost Estimate
STEP Alternative

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM		$ 70,000	$ 70,000
2	Locate Existing Utilities	LUMP SUM		$ 14,000	$ 14,000
3	Erosion Control	LUMP SUM		$ 14,000	$ 14,000
4	Trench Safety Systems	5,940	LF	$ 2	$ 11,880
5	4-inch Pressure Force Main	5,940	LF	$ 40	$ 237,600
6	Manholes	15	EA	$ 5,000	$ 75,000
7	Sawcutting	11,880	LF	$ 3	$ 35,640
8	Connections to Existing System	1	EA	$ 3,500	$ 3,500
9	Connect to Existing Structure (1,500 gallon Septic Tank, Effluent Filter Cleanout, Simplex Setup Assembly, Including valves and Piping)	58	EA	$ 9,000	$ 522,000
10	Traffic Control	300	HRS	$ 95	$ 28,500
Subtotal.....					$ 1,012,120
Tax rate (8.4%)…...					85,018
Subtotal:.....					$ 1,097,100
Contingency (20%)……					$ 219,420
Total Estimated Construction Cost:...					**$ 1,317,000**
Engineering and Administrative Costs (25%):...					$ 329,000
Total Estimated Project Cost:.....					**$ 1,646,000**

City of Forks
General Sewer/Wastewater Facility Plan
Bogachiel East Collection System Planning Level Cost Estimate
Grinder Alternative

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$ 70,000	$ 70,000
2	Locate Existing Utilities	LUMP SUM	$ 14,000	$ 14,000
3	Erosion Control	LUMP SUM	$ 14,000	$ 14,000
4	Trench Safety Systems	5,940 LF	$ 2	$ 11,880
5	4-inch Pressure Force Main	5,940 LF	$ 40	$ 237,600
6	Manholes	15 EA	$ 5,000	$ 75,000
7	Sawcutting	11,880 LF	$ 3	$ 35,640
8	Connections to Existing System	1 EA	$ 3,500	$ 3,500
9	Connect Existing Structure via Simplex Grinder Pump (Includes tank, pump, piping and valves)	58 EA	$ 11,000	$ 638,000
10	Traffic Control	300 HRS	$ 95	$ 28,500
Subtotal.....				$ 1,128,120
Tax rate (8.4%)…...				94,762
Subtotal:.....				$ 1,222,900
Contingency (20%)……				$ 244,580
Total Estimated Construction Cost:...				**$ 1,467,000**
Engineering and Administrative Costs (25%):...				$ 367,000
Total Estimated Project Cost:.....				**$ 1,834,000**

City of Forks
General Sewer/Wastewater Facility Plan
Bogachiel West Collection System Planning Level Cost Estimate
Gravity Alternative

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM		$ 156,000	$ 156,000
2	Locate Existing Utilities	LUMP SUM		$ 29,000	$ 29,000
3	Erosion Control	LUMP SUM		$ 29,000	$ 29,000
4	Trench Safety Systems	9,220	LF	$ 2	$ 18,440
5	8-inch PVC Sewer Pipe	9,220	LF	$ 85	$ 783,700
6	10-inch PVC Sewer Pipe	0	LF	$ 90	$ -
7	6-inch DI Force Main, w/Fittings	2,120	LF	$ 95	$ 201,400
8	Pump Station, Submersible Grinder, 60 GPM	1	EA	$ 290,000	$ 290,000
9	Manholes	25	EA	$ 5,000	$ 125,000
10	Sawcutting	18,440	LF	$ 3	$ 55,320
11	Connections to Existing System	1	EA	$ 3,500	$ 3,500
12	Side Sewer Connections	98	EA	$ 1,500	$ 147,000
13	Traffic Control	500	HRS	$ 95	$ 47,500
Subtotal					$ 1,885,860
Tax rate (8.4%)					158,412
Subtotal:					$ 2,044,300
Contingency (20%)					$ 408,860
Total Estimated Construction Cost:					**$ 2,453,000**
Engineering and Administrative Costs (25%):					$ 613,000
Total Estimated Project Cost:					**$ 3,066,000**

City of Forks
General Sewer/Wastewater Facility Plan
Bogachiel West Collection System Planning Level Cost Estimate
STEP Alternative

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM	$	156,000	$ 156,000
2	Locate Existing Utilities	LUMP SUM	$	29,000	$ 29,000
3	Erosion Control	LUMP SUM	$	29,000	$ 29,000
4	Trench Safety Systems	9,220 LF	$	2	$ 18,440
5	4-inch Pressure Force Main	9,220 LF	$	40	$ 368,800
6	Manholes	0 EA	$	5,000	$ -
7	Sawcutting	18,440 LF	$	3	$ 55,320
8	Connections to Existing System	1 EA	$	3,500	$ 3,500
9	Connect to Existing Structure (1,500 gallon Septic Tank, Effluent Filter Cleanout, Simplex Setup Assembly, Including valves and Piping)	98 EA	$	9,000	$ 882,000
10	Traffic Control	500 HRS	$	95	$ 47,500
Subtotal					$ 1,589,560
Tax rate (8.4%)					133,523
Subtotal:					$ 1,723,100
Contingency (20%)					$ 344,620
Total Estimated Construction Cost:					**$ 2,068,000**
Engineering and Administrative Costs (25%):					$ 517,000
Total Estimated Project Cost:					**$ 2,585,000**

City of Forks
General Sewer/Wastewater Facility Plan
Bogachiel West Collection System Planning Level Cost Estimate
Grinder Alternative

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT
1	Mobilization, Cleanup, and Demobilization	LUMP SUM		$ 156,000	$	156,000
2	Locate Existing Utilities	LUMP SUM		$ 29,000	$	29,000
3	Erosion Control	LUMP SUM		$ 29,000	$	29,000
4	Trench Safety Systems	9,220	LF	$ 2	$	18,440
5	4-inch Pressure Force Main	9,220	LF	$ 40	$	368,800
6	Manholes	0	EA	$ 5,000	$	-
7	Sawcutting	18,440	LF	$ 3	$	55,320
8	Connections to Existing System	1	EA	$ 3,500	$	3,500
9	Connect Existing Structure via Simplex Grinder Pump (Includes tank, pump, piping and valves)	98	EA	$ 11,000	$	1,078,000
10	Traffic Control	500	HRS	$ 95	$	47,500
Subtotal					$	1,785,560
Tax rate (8.4%)						149,987
Subtotal:					$	1,935,500
Contingency (20%)					$	387,100
Total Estimated Construction Cost:					**$**	**2,323,000**
Engineering and Administrative Costs (25%):					$	581,000
Total Estimated Project Cost:					**$**	**2,904,000**

City of Forks
General Sewer/Wastewater Facility Plan
Trillium North Collection System Planning Level Cost Estimate
Gravity Alternative

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	1	LS	$ 68,000	$ 68,000
2	Locate Existing Utilities	1	LS	$ 14,000	$ 14,000
3	Erosion Control	1	LS	$ 14,000	$ 14,000
4	Trench Safety Systems	5,760	LF	$ 2	$ 11,520
5	8-inch PVC Sewer Pipe	3,560	LF	$ 85	$ 302,600
6	10-inch PVC Sewer Pipe	2,200	LF	$ 90	$ 198,000
7	Manholes	14	EA	$ 5,000	$ 70,000
8	Sawcutting	11,520	LF	$ 3	$ 34,560
9	Connections to Existing System	1	EA	$ 3,500	$ 3,500
10	Side Sewer Connections	54	EA	$ 1,500	$ 81,000
11	Traffic Control	300	HRS	$ 95	$ 28,500
Subtotal					$ 825,680
Tax rate (8.4%)					69,357
Subtotal:					$ 895,000
Contingency (20%)					$ 179,000
Total Estimated Construction Cost					**$ 1,074,000**
Engineering and Administrative Costs (25%):					$ 269,000
Total Estimated Project Cost					**$ 1,343,000**

City of Forks
General Sewer/Wastewater Facility Plan
Trillium North Collection System Planning Level Cost Estimate
STEP Alternative

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	1	LS	$ 68,000	$ 68,000
2	Locate Existing Utilities	1	LS	$ 14,000	$ 14,000
3	Erosion Control	1	LS	$ 14,000	$ 14,000
4	Trench Safety Systems	3,560	LF	$ 2	$ 7,120
5	4-inch Pressure Force Main	3,560	LF	$ 40	$ 142,400
6	Manholes	14	EA	$ 5,000	$ 70,000
7	Sawcutting	7,120	LF	$ 3	$ 21,360
8	Connections to Existing System	1	EA	$ 3,500	$ 3,500
9	Connect to Existing Structure (1,500 gallon Septic Tank, Effluent Filter Cleanout, Simplex Setup Assembly, Including valves and Piping)	54	EA	$ 9,000	$ 486,000
10	Traffic Control	200	HRS	$ 95	$ 19,000
Subtotal					$ 845,380
Tax rate (8.4%)					71,012
Subtotal:					$ 916,400
Contingency (20%)					$ 183,280
Total Estimated Construction Cost:					**$ 1,100,000**
Engineering and Administrative Costs (25%):					$ 275,000
Total Estimated Project Cost:					**$ 1,375,000**

City of Forks
General Sewer/Wastewater Facility Plan
Trillium North Collection System Planning Level Cost Estimate
Grinder Alternative

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	1	LS	$ 68,000	$ 68,000
2	Locate Existing Utilities	1	LS	$ 14,000	$ 14,000
3	Erosion Control	1	LS	$ 14,000	$ 14,000
4	Trench Safety Systems	3,560	LF	$ 2	$ 7,120
5	4-inch Pressure Force Main	3,560	LF	$ 40	$ 142,400
6	Manholes	14	EA	$ 5,000	$ 70,000
7	Sawcutting	7,120	LF	$ 3	$ 21,360
8	Connections to Existing System	1	EA	$ 3,500	$ 3,500
9	Connect Existing Structure via Simplex Grinder Pump (Includes tank, pump, piping and valves)	54	EA	$ 11,000	$ 594,000
10	Traffic Control	200	HRS	$ 95	$ 19,000
Subtotal					$ 953,380
Tax rate (8.4%)					80,084
Subtotal:					$ 1,033,500
Contingency (20%)					$ 206,700
Total Estimated Construction Cost:					**$ 1,240,000**
Engineering and Administrative Costs (25%):					$ 310,000
Total Estimated Project Cost:					**$ 1,550,000**

City of Forks
General Sewer/Wastewater Facility Plan
Trillium South Collection System Planning Level Cost Estimate
Gravity Alternative

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	1	LS	$ 47,000	$ 47,000
2	Locate Existing Utilities	1	LS	$ 10,000	$ 10,000
3	Erosion Control	1	LS	$ 10,000	$ 10,000
4	Trench Safety Systems	3,560	LF	$ 2	$ 7,120
5	8-inch PVC Sewer Pipe	3,560	LF	$ 85	$ 302,600
6	10-inch PVC Sewer Pipe	0	LF	$ 90	$ -
7	Manholes	14	EA	$ 5,000	$ 70,000
8	Sawcutting	7,120	LF	$ 3	$ 21,360
9	Connections to Existing System	1	EA	$ 3,500	$ 3,500
10	Side Sewer Connections	50	EA	$ 1,500	$ 75,000
11	Traffic Control	200	HRS	$ 95	$ 19,000
Subtotal					$ 565,580
Tax rate (8.4%)					47,509
Subtotal:					$ 613,100
Contingency (20%)					$ 122,620
Total Estimated Construction Cost					**$ 736,000**
Engineering and Administrative Costs (25%):					$ 184,000
Total Estimated Project Cost					**$ 920,000**

City of Forks
General Sewer/Wastewater Facility Plan
Trillium South Collection System Planning Level Cost Estimate
STEP Alternative

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	1	LS	$ 47,000	$ 47,000
2	Locate Existing Utilities	1	LS	$ 10,000	$ 10,000
3	Erosion Control	1	LS	$ 10,000	$ 10,000
4	Trench Safety Systems	3,560	LF	$ 2	$ 7,120
5	4-inch Pressure Main	3,560	LF	$ 40	$ 142,400
6	Manholes	0	EA	$ 5,000	$ -
7	Sawcutting	7,120	LF	$ 3	$ 21,360
8	Connections to Existing System	1	EA	$ 3,500	$ 3,500
9	Connect to Existing Structure (1,500 gallon Septic Tank, Effluent Filter Cleanout,Simplex Setup Assembly, Including valves and Piping)	50	EA	$ 9,000	$ 450,000
10	Traffic Control	200	HRS	$ 95	$ 19,000
Subtotal					$ 710,380
Tax rate (8.4%)					59,672
Subtotal:					$ 770,100
Contingency (20%)					$ 154,020
Total Estimated Construction Cost:					**$ 924,000**
Engineering and Administrative Costs (25%):					$ 231,000
Total Estimated Project Cost:					**$ 1,155,000**

City of Forks
General Sewer/Wastewater Facility Plan
Trillium South Collection System Planning Level Cost Estimate
Grinder Alternative

NO.	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	1	LS	$ 47,000	$ 47,000
2	Locate Existing Utilities	1	LS	$ 10,000	$ 10,000
3	Erosion Control	1	LS	$ 10,000	$ 10,000
4	Trench Safety Systems	3,560	LF	$ 2	$ 7,120
5	4-inch Pressure Main	3,560	LF	$ 40	$ 142,400
6	Manholes	0	EA	$ 5,000	$ -
7	Sawcutting	7,120	LF	$ 3	$ 21,360
8	Connections to Existing System	1	EA	$ 3,500	$ 3,500
9	Connect Existing Structure via Simplex Grinder Pump (Includes tank, pump, piping and valves)	50	EA	$ 11,000	$ 550,000
10	Traffic Control	200	HRS	$ 95	$ 19,000
Subtotal					$ 810,380
Tax rate (8.4%)					68,072
Subtotal:					$ 878,500
Contingency (20%)					$ 175,700
Total Estimated Construction Cost:					**$ 1,054,000**
Engineering and Administrative Costs (25%):					$ 264,000
Total Estimated Project Cost:					**$ 1,318,000**

City of Forks
General Sewer/Wastewater Facility Plan
UGA Service Collection System Planning Level Cost Estimate

NO.	ITEM	QUANTITY		UNIT PRICE		AMOUNT
1	Mobilization, Cleanup, and Demobilization	1 LS	$	1,644,000	$	1,644,000
2	Locate Existing Utilities	1 LS	$	100,000	$	100,000
3	Survey	1 LS	$	150,000	$	150,000
4	Erosion Control	1 LS	$	342,000	$	342,000
5	Trench Safety Systems	113,175 LF	$	2	$	226,350
6	8-inch PVC Sewer Pipe	87,000 LF	$	65	$	5,655,000
7	12-inch PVC Sewer Pipe	26,175 LF	$	80	$	2,094,000
8	2-inch DI Force Main, w/Fittings	3,150 LF	$	75	$	236,250
9	4-inch DI Force Main, w/Fittings	35,400 LF	$	95	$	3,363,000
10	Pump Station, Submersible Grinder	7 EA	$	400,000	$	2,800,000
11	48-inch Diameter Manhole	266 EA	$	4,000	$	1,064,000
12	Sawcutting	226,350 LF	$	3	$	679,050
13	Connections to Existing System	7 EA	$	4,000	$	28,000
14	Side Sewer Connections	478 EA	$	2,000	$	956,000
15	Traffic Control	6,000 HRS	$	95	$	570,000
Subtotal					$	19,907,650
Tax rate (8.4%)						1,672,243
Subtotal:					$	21,579,900
Contingency (25%)					$	5,394,975
Total Estimated Construction Cost:					**$**	**26,975,000**
Engineering and Administrative Costs (25%):					$	6,744,000
Total Estimated Project Cost:					**$**	**33,719,000**

City of Forks
General Sewer/Wastewater Facility Plan
Headworks Improvements Planning Level Cost Estimate

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	1 LS	$ 15,000	$ 15,000
2	Fine Screen (Inc. Control Panel)	1 LS	$ 112,500	$ 112,500
3	Manual Bar Screen	1 EA	$ 4,500	$ 4,500
4	Electrical	1 LS	$ 29,000	$ 29,000
Subtotal:				$ 161,000
Sales Tax (8.4%):				$ 13,524
Subtotal:				$ 174,524
Contingency (20%):				$ 34,905
TOTAL ESTIMATED CONSTRUCTION COST:				$ 209,429
Engineering and Construction Management (25%):				$ 52,357
TOTAL ESTIMATED PROJECT COST (ROUNDED):				**$ 261,800**

City of Forks
General Sewer/Wastewater Facility Plan
Aerated Lagoon Improvements Planning Level Cost Estimate

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	1 LS	$ 23,000	$ 23,000
2	Demo Existing	1 LS	$ 15,000	$ 15,000
3	Sludge Removal/Disposal	61 dTN	$ 800	$ 48,800
4	Aerators - 25 hp	2 LS	$ 22,500	$ 45,000
5	Mixer - 25 HP	1 EA	$ 22,500	$ 22,500
6	HDPE Liner (w Leak Detection)	1 LS	$ 78,200	$ 78,200
7	Bypass Pumping/Temp Piping Modifications	1 LS	$ 30,000	$ 30,000
8	Electrical	1 LS	$ 57,000	$ 57,000

Subtotal:	$	319,500
Sales Tax (8.4%):	$	26,838
Subtotal:	$	346,338
Contingency (20%):	$	69,268
TOTAL ESTIMATED CONSTRUCTION COST:	$	415,606
Engineering and Construction Management (25%):	$	103,901
TOTAL ESTIMATED PROJECT COST (ROUNDED):	**$**	**519,600**

City of Forks
General Sewer/Wastewater Facility Plan
Clarifier No. 2 and Associated Improvements Planning Level Cost Estimate

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	1 LS	$ 31,580	$ 31,580
2	Earthwork	1 LS	$ 15,000	$ 15,000
3	Demo/Removal/Disposal	1 LS	$ 5,000	
4	Concrete Clarifier	200 CY	$ 1,000	$ 200,000
5	Foundation Gravel	100 CY	$ 30	$ 3,000
6	Clarifier Mechanism	1 EA	$ 125,000	$ 125,000
7	RAS/WAS Submersible Pumps w Control Panel	2 EA	$ 13,000	$ 26,000
8	48X48 Access Hatch	1	$ 2,800	$ 2,800
9	Valve Vault (including hatch)	2	$ 6,000	$ 12,000
10	Magnetic Flow Meter	2	$ 5,000	$ 10,000
11	Scum Pump Submersible Pump w Control Panel	1 LS	$ 13,000	$ 13,000
12	48-inch Scum Pump Wet Well	1 LS	$ 6,000	$ 6,000
13	Splitter Box Modifications	1 LS	$ 10,000	$ 10,000
14	Piping/Valves	1 LS	$ 30,000	$ 30,000
15	Metals (Bridge/Stairs)	1 LS	$ 20,000	$ 20,000
16	Electrical	1 LS	$ 58,000	$ 58,000

Subtotal:	$	562,380
Sales Tax (8.4%):	$	47,240
Subtotal:	$	609,620
Contingency (20%):	$	121,924
TOTAL ESTIMATED CONSTRUCTION COST:	$	731,544
Engineering and Construction Management (25%):	$	182,886
TOTAL ESTIMATED PROJECT COST (ROUNDED):	**$**	**914,500**

City of Forks
General Sewer/Wastewater Facility Plan
RAS/WAS Pump Station No. 1 Improvements Planning Level Cost Estimate

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	1 LS	$ 8,000	$ 8,000
2	Submersibel Centrifugal Pumps w Control Panel	2 EA	$ 13,000	$ 26,000
3	Demolition, Removal and Disposal	1 LS	$ 2,000	$ 2,000
4	48" X 48" Access Hatch	1 EA	$ 2,750	$ 2,750
5	Valve Vault	1 EA	$ 6,000	$ 6,000
6	Magnetic Flow Meter	2 EA	$ 5,000	$ 10,000
7	Pump and Piping Installation	1 LS	$ 15,000	$ 15,000
8	Electrical	1 LS	$ 14,000	$ 14,000
Subtotal:				$ 83,750
Sales Tax (8.4%):				$ 7,035
Subtotal:				$ 90,785
Contingency (20%):				$ 18,157
TOTAL ESTIMATED CONSTRUCTION COST:				$ 108,942
Engineering and Construction Management (25%):				$ 27,236
TOTAL ESTIMATED PROJECT COST (ROUNDED):				**$ 136,200**

City of Forks
General Sewer/Wastewater Facility Plan
In Plant Pump Station Planning Level Cost Estimate

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	1 LS	$ 4,000	$ 4,000
2	Submersible Centrifugal Pumps w Control Panel	2 EA	$ 13,000	$ 26,000
3	Demolition, Removal and Disposal	1 LS	$ 2,000	$ 2,000
4	Pump and Piping Installation	1 LS	$ 10,000	$ 10,000
5	Electrical	1 LS	$ 7,000	$ 7,000

Subtotal:	$	49,000
Sales Tax (8.4%):	$	4,116
Subtotal:	$	53,116
Contingency (20%):	$	10,623
TOTAL ESTIMATED CONSTRUCTION COST:	$	63,739
Engineering and Construction Management (25%):	$	15,935
TOTAL ESTIMATED PROJECT COST (ROUNDED):	**$**	**79,700**

City of Forks
General Sewer/Wastewater Facility Plan
Digester Planning Level Cost Estimate

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	1 LS	$ 30,000	$ 30,000
2	Earthwork	1 LS	$ 15,000	$ 15,000
3	Concrete Tanks	204 CY	$ 800	$ 163,200
4	Foundation Gravel	101 CY	$ 30	$ 3,030
5	Aeration Diffusion Equipment	1 LS	$ 15,000	$ 15,000
6	Aeration Blowers	1 LS	$ 97,500	$ 97,500
7	Sludge Pumps	2 EA	$ 15,000	$ 30,000
8	Piping/Valves	1 LS	$ 20,000	$ 20,000
9	Metals (Bridge/Stairs)	1 LS	$ 55,000	$ 55,000
10	Instrumentation (DO Meters)	2 EA	$ 6,900	$ 13,800
11	Electrical	1 LS	$ 58,000	$ 58,000

Subtotal:	$	500,530
Sales Tax (8.4%):	$	42,045
Subtotal:	$	542,575
Contingency (20%):	$	108,515
TOTAL ESTIMATED CONSTRUCTION COST:	$	651,089
Engineering and Construction Management (25%):	$	162,772
TOTAL ESTIMATED PROJECT COST (ROUNDED):	**$**	**813,900**

City of Forks
General Sewer/Wastewater Facility Plan
Backup Generator Planning Level Cost Estimate

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	1 LS	$ 18,000	$ 18,000
2	250 KW generator w Enclosure and Transfer Switch	1 LS	$ 150,000	$ 150,000
3	Electrical	1 LS	$ 23,000	$ 23,000

Subtotal:	$	191,000
Sales Tax (8.4%):	$	16,044
Subtotal:	$	207,044
Contingency (20%):	$	41,409
TOTAL ESTIMATED CONSTRUCTION COST:	$	248,453
Engineering and Construction Management (25%):	$	62,113
TOTAL ESTIMATED PROJECT COST (ROUNDED):	**$**	**310,600**

City of Forks
General Sewer/Wastewater Facility Plan
FKC Screw Press Modifications Planning Level Cost Estimate

NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT
1	Mobilization, Cleanup, and Demobilization	1 LS	$ 42,975	$ 42,975
2	Sludge Tanks	2 EA	$ 43,750	$ 87,500
3	Sludge Feed Pump	1 LS	$ 5,250	$ 5,250
4	Polymer System	1 LS	$ 18,000	$ 18,000
5	Flocculation Tank	1 LS	$ 8,750	$ 8,750
6	Screw Press	1 LS	$ 187,500	$ 187,500
7	Boiler Skid	1 LS	$ 112,500	$ 112,500
8	Sludge Conveyor	1 LS	$ 30,000	$ 30,000
9	Building Remodel	1 LS	$ 10,000	$ 10,000
10	Electrical (including Control Panel Changes)	1 LS	$ 63,000	$ 63,000

Subtotal:	$	565,475
Sales Tax (8.4%):	$	47,500
Subtotal:	$	612,975
Contingency (20%):	$	122,595
TOTAL ESTIMATED CONSTRUCTION COST:	$	735,570
Engineering and Construction Management (25%):	$	183,892
TOTAL ESTIMATED PROJECT COST (ROUNDED):	**$**	**919,500**

City of Forks
General Sewer/Wastewater Facility Plan
WATER RECLAIMATION IMPROVEMENTS
TOTAL ESTIMATED PROJECT COST

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 442,000	$442,000
2	Polymer Equipment	1	LS	$ 84,000	$84,000
3	Filtration Equipment	1	LS	$ 335,000	$335,000
4	Tanks	1	LS	$ 35,000	$35,000
5	Pump Station	1	LS	$ 152,000	$152,000
6	UV System	1	LS	$ 200,000	$200,000
7	Storage Ponds	1	LS	$ 2,400,000	$2,400,000
8	SCADA Modifications	1	LS	$ 76,000	$76,000
9	Bypass Valves and Piping	1	LS	$ 53,000	$53,000
10	Reclaimed Water Pump Station	1	LS	$ 189,000	$189,000
11	Reclaimed Water Pipeline	10,000	LF	$ 65	$650,000
12	Electrical	1	LS	$ 250,000	$250,000
				Subtotal:	$4,424,000
				Construction Contingency (25%):	$1,106,000
				Construction Subtotal	$5,530,000
				Washington State Sales Tax (8.4%)	$465,000
				Construction Total:	$5,995,000
				Design & Construction Engineering (25%):	$1,499,000
				Total Estimated Project Cost:	$7,494,000

APPENDIX D

RECYCLE STREAM MASS BALANCE

Design Year 2034 Maximum Month Flow and Load

Influent Flows

Flow Description	Flow (MGD)
Summer Average	
Annual Average	0.23
Maximum Month	0.50
Peak Day	
Peak Hour	0.98

Influent Loadings (from Facility Plan)

Parameter	Load (lb/d)
BOD_5	860
TSS	678
NH_4-N	
TKN	133

Assumptions: M&E Table 8-10 & 8-11

Y_H (heterotrophic yield)	0.4	lb/lb COD
Y_n (autotrophic yield)	0.12	lb/lb
f_d (fraction of cell mass remaining as cell debris)	0.15	lb/lb
$k_{d,20}$ (endogenous heterotrophic decay coefficient)	0.12	d^{-1}
$k_{dn,20}$ (endogenous nitrogenous decay coefficient)	0.08	d^{-1}
$\mu_{m,\,max,\,20}$ (heterotrophic growth rate)	6.0	g/g*d
$\mu_{n,\,max,\,20}$ (autotrophic growth rate)	0.9	d-1
K_s (substrate half-saturation coefficient)	20	g/m^3
$K_{n,20}$ (ammonia half-saturation coefficient)	0.74	g/m^3
K_o (oxygen half-saturation coefficient)	0.5	g/m^3

Additional Calculated Loadings for Use in Mass Balances

Parameter	Load (lb/d)	Comment	
COD	1,892	Assumes COD/BOD_5 Ratio =	2.2
bCOD (biodegradeable COD)	1,376	Assumes bCOD/BOD_5 Ratio =	1.6
nbCOD (non-biodegradeable COD)	516		
$sBOD_5$ (soluble BOD_5)	301	Assumes $sBOD_5$/BOD_5 Ratio =	0.35
rbCOD (readily biodegradeable COD)	301	Assumes rbCOD = $sBOD_5$	
sCOD (soluble COD)	662	Assumes sCOD/COD ratio =	0.35
$sCOD_e$ (effluent soluble COD)	181	sCOD - (1.6*$sBOD_5$)	
VSS	576	Assumes VSS/TSS Ratio =	0.85
nbVSS (non-biodegradeable VSS)	157		
*i*TSS (inert TSS)	102		
TKN	133		
nbTKN (non-biodegradeable TKN)	7	Assumes nbTKN/TKN Ratio =	0.05
bTKN (biodegradeable TKN)	126		

where bCOD/BOD5 = (ultimate BOD/BOD_5)/(1-1.42(f_d)(Y_H)) Not Used

Liquid Stream

Solids Stream

Plant Recycle

Max Mo Flow (MGD)	
COD	
bCOD	
BOD_5	
NH_4-N	
bTKN	
TSS	
VSS	
nbVSS	
*i*TSS	

Secondary Treatment Process

Sludge Production

S (effluent bCOD)	1.02	g/m^3
S (effluent bCOD)	4	lb/d
$P_{x,bio}$ (biomass production)	299	lb/d
$P_{x,VSS}$ (VSS production)	456	lb/d
$P_{x,TSS}$ (TSS production)	610	lb/d

Waste Activated Sludge

TSS	610	
VSS	456	
nbVSS	157	
*i*TSS	154	
bTKN	36	assumes bTKN/$P_{x,bio}$ ratio 0.12
WAS Flowrate (gpm)	5	assumes %TSS 1
WAS Flowrate (gpd)	7317	

Kinetic and Stoichiometric Constants

Design Temperature	10	°C
$\mu_{m,\,max,\,t}$ (heterotrophic growth rate)	3.05	g/g*d
$k_{d,t}$ (endogenous heterotrophic decay coefficient)	0.081	d^{-1}
$\mu_{n,\,max,\,t}$ (autotrophic growth rate)	0.45	g/g*d
$k_{dn,t}$ (endogenous nitrogenous decay coefficient)	0.054	d^{-1}
$k_{n,t}$ (ammonia half satruation coefficient)	0.442	
$\mu_{n,}$ (specific nitrofier growth rate)	0.195	5.123885
inf BOD/VSS produced=	0.8	
assumes bTKN/$P_{x,bio}$ ratio	0.12	
$K_{n,t}$ (ammonia half-saturation coefficient)	0.442	g/m^3
assumes %TSS	4	

Aerobic Sludge Digestion

assumed percent solids capture/100	0.90

Solids to Anaerobic Digesters

Waste Activated Sludge Into Digester

Waste Activated Sludge Removed

Waste Activated Sludge Out of Digester

TSS	610	TSS	175	TSS	435	Feed TSS	549		
VSS	456	VSS	160	VSS	296				
nbVSS	157	nbVSS	16	nbVSS	141				
*i*TSS	154	*i*TSS	15	*i*TSS	139				
bTKN	36	bTKN converted to Ammonia	17	bTKN	19				
Flowrate (gpd)	7,317							SRT (solids retention time)	15 days
%TSS to Digester	1.0								
								VSS/TSS fraction of biomass produced	0.85
								Assumed fraction of TKN consumed	0.7
								Assumptions	
		Digested Sludge Dewatering							
								Percent removal of WAS VSS/100	0.35
		Sludge to Screw Press		**Digested Sludge Decant**				Percent removal of WAS nbVSS/100	0.1
								Percent removal of WAS *i*TSS/100	0.1
assumed percent solids capture/100	0.97			BOD_5	4			Percent removal of bTKN	0
TSS	422			TSS	13				
VSS	287			VSS	9				
nbVSS	137			nbVSS	4				
*i*TSS	135			*i*TSS	4				
bTKN	18			bTKN	18	adds bTKN converted to ammonia in digester and released to bulk liquid to bTKN in centrate solids			
Dewatered Sludge Flowrate (gpd)	2,531	Assume 2% solids		Decant Flow Rate	4,786				
		Digested Sludge Screw Press							
		Digested Sludge to Disposal		**Screw Press Drain**					
				Flow Rate (MGD)	0.002	[redacted]		% time operated/day (Design BOD/MM Design BOD)	
				BOD_5	7				
Percent Capture/100	0.95								
TSS	401			TSS	21				
VSS	273			VSS	14				
nbVSS	130			nbVSS	7				
*i*TSS	128			*i*TSS	7				
bTKN	17			bTKN	1				
Sludge Rate (gpd)	192	Assumes 25% solids							
		Plant Recycle							
				Digested Sludge Centrate		**Screw Press Drain**			
				BOD_5	4	BOD_5	7		
				TSS	13	TSS	21		
				VSS	9	VSS	14		
				nbVSS	4	nbVSS	7		
				*i*TSS	4	*i*TSS	7		
				bTKN	18	bTKN	1		
				Flowrate (MGD)	0.0048	Flowrate (MGD)	0.0023		
				Previous Iteration					
		Total Plant Recycle		**Total Plant Recycle**		% Diff			
BOD_5	12			BOD_5	11		1		
TSS	34			TSS	36		-5		
VSS	23			VSS	25		-8		
nbVSS	11	Paste		nbVSS	13		-17		
*i*TSS	11	Values to		*i*TSS	11		1		
bTKN	19	F133 thru		bTKN	20		-6		
NH_4-N	15	F142)		NH_4-N	16		-6		
COD	25			COD	25		1		
bCOD	18			bCOD	18		1		
Flowrate (MGD)	0.007			Flowrate (MGD)	0.008		-5		
				Flowrate (MGD)	0.008				
				COD	25				
				bCOD	18				
				BOD_5	11				
				NH_4-N	16	Paste Values to Plant Recycle			
				bTKN	20	(B41 thru B50)			
				TSS	36				
				VSS	25				
				nbVSS	13				
				*i*TSS	11				