CITY OF BURLINGTON

SKAGIT COUNTY **WASHINGTON**

WASTEWATER COMPREHENSIVE PLAN

G&O #21526
OCTOBER 2023

Gray & Osborne, Inc.
CONSULTING ENGINEERS

CITY OF BURLINGTON

SKAGIT COUNTY WASHINGTON

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WASTEWATER COMPREHENSIVE PLAN

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Appendix H – Reasonable Potential Evaluation
Appendix I – Cost Estimates
Appendix J – General Facility Charge Memorandum

LIST OF ABBREVIATIONS

BMPs	Best Management Practices
BOD	Biological Oxygen Demand
BMC	Burlington Municipal Code
CPESC	Certified Professional in Erosion and Sediment Control
CWA	Clean Water Alliance
CARA	Critical Aquifer Recharge Area
ESA	Endangered Species Act
EPA	Environment Protection Agency
ESA	Equivalent Service Unit
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
GMA	Growth Management Act
HPA	Hydraulic Project Approval
HSPF	Hydrologic Simulation Program-Fortran
IECA	International Erosion Control Association
LA	Load Allocation
LID	Low Impact Development
MEP	Maximum Extent Practicable
MS4	Municipal Separate Storm Sewer System
NFIP	National Flood Insurance Program
NPDES	National Pollutant Discharge Elimination System
NRCS	National Resources Conservation Service
NTU	Nephelometric Turbidity Units
PFAS	Perfluorinated Alkyl Substances
PAH	Polynuclear Aromatic Hydrocarbons
SMP	Shoreline Master Program
SMA	Shorelines Management Act
SMAP	Stormwater Management Action Plan
SWMMWW	Stormwater Management Manual for Western Washington
SWMP	Stormwater Management Program
TDA	Threshold Discharge Area
TMDL	Total Maximum Daily Load
TPH	Total Petroleum Hydrocarbon
TSS	Total Suspended Solids
UGA	Urban Growth Area
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WSU	Washington State University
WLA	Wasteload Allocation
WWHM	Western Washington Hydrology Model

EXECUTIVE SUMMARY

This Wastewater Comprehensive Plan (Plan) for the City of Burlington addresses 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, WAC 173-240-060, Engineering Report, and federal requirements for a Wastewater Facility Plan. Development of the Plan has been coordinated with the City of Burlington Comprehensive Plan.

The Plan is organized into the following chapters:

- Chapter 1 – Introduction
- Chapter 2 – Regulatory Requirements
- Chapter 3 – Land Use, Population Projections, and Service Area Characteristics
- Chapter 4 – Existing Facilities
- Chapter 5 – Wastewater Flow and Loading Projections
- Chapter 6 – Collection System Analysis
- Chapter 7 – Wastewater Treatment Plant Analysis
- Chapter 8 – Biosolids Treatment and Management
- Chapter 9 – Capital Improvement Plan
- Chapter 10 – Financial Program

SEWER SERVICE AREAS

The sewer service area for the City of Burlington (study area for this Plan) consists of the City's Urban Growth Area (UGA) and City limits, and regions west of the City in unincorporated Skagit County as shown on Figure E-1. The City of Burlington uses the term UGA to specifically refer to the areas outside of the current city limits that are within the UGA. Skagit County currently has zoning and land use jurisdiction over these unincorporated areas.

PROJECTED POPULATION, FLOWS, AND LOADINGS

The population has increased an average of about 1.66 percent per year over the past 20 years and 1.26 percent over the past 10 years. The *Skagit Population, Housing and Growth Monitoring Program – 2020 Growth Monitoring Report* (Skagit Council of Governments, June 16, 2021) projects the annual population growth in the City of Burlington to be 1.49 percent over the next 20 years; this growth rate is generally used in this report for the purpose of planning future wastewater facilities; however, because of recent development activities in areas zoned C-1, partially as a result of the closure of the Cascade Mall, an annual growth rate of 2 percent is used for the first 5 years of the

planning period (2021-2026). An annual growth rate of 1.49 percent will be used for the remainder of the planning period (2026-2040. With these growth assumptions, and other assumptions discussed in Chapter 3, the City's population is expected to grow from 9,540 in 2021 to 12,955 in 2040. (Additional residential population and industries are served in the Western Service Area to the west of the City, as well as to the north by the Samish Water District pipeline, as discussed in Chapters 3 and 5.)

Table E-1 summarizes the projected influent flows and loadings to the City's WWTP. As shown, flows and organic (BOD_5) and solids (TSS) loadings to the WWTP are not anticipated to exceed the rated capacity through 2040, but will at buildout.

TABLE E-1

Summary of Projected Influent Flows and Loadings to the WWTP

Parameter	NPDES Permit Limit	Existing (2020)	2025	2030	2035	2040	Buildout
ERUs		8,110	9,280	9,940	10,960	12,260	43,920
Annual Average Flow (mgd)		1.39	1.54	1.63	1.78	1.98	6.48
Maximum Month Flow (mgd)	3.79	2.12	2.29	2.37	2.54	2.78	**7.34**
Peak Day Flow (mgd)		2.62	2.81	2.90	3.09	3.39	8.52
Peak Hour Flow (mgd)		4.46	4.73	4.94	5.26	5.94	16.35
Annual Average BOD_5 (lb/d)		3,080	3,430	3,680	4,050	4,520	16,550
Maximum Month BOD_5 (lb/d)	7,356	3,870	4,670	5,000	5,500	6,130	**21,890**
Annual Average TSS (lb/d)		3,760	4,120	4,410	4,800	5,300	16,590
Maximum Month TSS (lb/d)	7,660	4,220	5,190	5,540	6,040	6,650	**20,750**

(1) Values that exceed the rated NPDES Permit capacity are shaded.

COLLECTION SYSTEM

As discussed in Chapter 4, the City of Burlington wastewater collection system includes gravity sewers, pump stations, and force mains. The existing sewer system, shown on Figure E-2, consists of two distinctly separate systems: the City proper system and the Western Service Area system. The City proper system serves the area bounded by the city limits. The Western Service Area system serves the Bayview Ridge Unincorporated Urban Growth Area, which includes the Port of Skagit County Airport and industrial area, the Skagit Golf and Country Club and a residential development around the golf course, and a few additional commercial and industrial customers in the immediate vicinity of the Port. The City of Burlington purchased the Port sewer system from the Port of Skagit County in 2000.

N

0 2,000 4,000 8,000 Feet

LEGEND:

- CITY LIMITS
- CITY UGA
- BAYVIEW RIDGE UGA
- PARCELS

Western Service Area

City of Burlington

SKAGIT RIVER

WWTP

CITY OF BURLINGTON

WASTEWATER COMPREHENSIVE PLAN
FIGURE E-1
SANITARY SEWER SYSTEM SERVICE AREA

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P.S. #14
P.S. #15
P.S. #21
(PVT) P.S.
P.S. #1
P.S. #2
P.S. #18
P.S. #4
P.S. #5
P.S. #6
P.S. #3
P.S. #8
P.S. #7
P.S. #12
8 GRAVITY
WWTP GRAVITY
WWTP
P.S. #17
P.S. #10
P.S. #11
P.S. #20
P.S. #19
P.S. #13
P.S. #9
P.S. #16

SCALE
1" = 2500'

LEGEND:
- CITY LIMITS
- CITY UGA
- BAYVIEW RIDGE UGA
- SEWER LINE
- PUMP STATIONS
- FORCE MAIN
- (10) EXISTING DRAINAGE BASINS

CITY OF BURLINGTON

SEWER COMPREHENSIVE PLAN
FIGURE E-2
PUMP STATION LOCATIONS

Gray & Osborne, Inc.
CONSULTING ENGINEERS

The City of Burlington also receives wastewater from the Samish Water District (District) through a 12-inch-diameter pipeline from the District's pretreatment lagoon at the south end of Lake Samish in Whatcom County, which flows to Pump Station 6 on Peterson Road in the City of Burlington. Effluent from the District's waste stabilization pond is pumped through this force main. Several pump stations along the District's pipeline alignment discharge wastewater to the pipeline, including a Washington State Department of Transportation rest area, the Thousand Trails Campgrounds, and several residential and commercial customers. The Skagit Valley Resort and Casino is also connected to the pipeline as a backup to their membrane bioreactor treatment system. The District's pipeline and associated pump stations are owned and operated by the District.

The City of Burlington wastewater collection system includes approximately 59 miles of gravity sewer pipes varying in size from 4-inch diameter local connections to 27-inch diameter interceptors. The City owns and operates 21 sewage pump stations. Pump Station 8 serves the Western Service Area exclusively, and the force main from Pump Station 8 conveys the flow from this pump station into two large-diameter interceptors that discharge directly to the wastewater treatment plant. Three of the force mains are common force mains which convey flows from more than one pump station.

INFILTRATION AND INFLOW

As discussed in Chapter 5, the service area is not considered to have "excessive infiltration and inflow" (I/I, storm and surface water entering the collection system. However, both infiltration and inflow levels are over 50 percent of EPA's threshold for being considered "excessive," and some basins have as high as 3,000 gallons per acre per day of I/I, which limits the capacity of the collection system to accommodate sanitary wastewater. The City has been diligent about efforts to reduce I/I; Chapter 6 provides additional recommendations for further evaluation and rehabilitation to limit future I/I.

COLLECTION SYSTEM CAPACITY ANALYSIS

A hydraulic model was developed to analyze the capacity of major gravity lines at year 2040 and buildout conditions at peak hour wet weather flow rates. Figure E-3 shows the locations of the collection system pipes that may have insufficient capacity under 2040 and buildout conditions. The analysis shows that 15 sections of gravity sewer are undersized for projected 2040 peak hour wastewater flows, while 76 sections are undersized for buildout conditions. It is recommended that planning to increase the capacities of sewers that are undersized for 2040 be started within the next 5 years. The sewers undersized for 2040 conditions include portions of the trunk sewer along Burlington Boulevard from approximately Costco Drive to Pump Station 11 and portions of the trunk sewer serving the Port of Skagit County along Ovenell Road to Pump Station 10. (The City will be monitoring these locations during storms to determine the actual amount of surcharging.) In addition, Pump Stations 2, 4, 14, and 17 are undersized for projected 2040 flows.

COLLECTION SYSTEM RECOMMENDATIONS

The following are a list of recommended projects that are recommended for implementation during the planning period as a result of the discussion in this chapter:

High Priority Projects to be Implemented as Soon as Possible (Note: As of late 2023, the two first projects have already been completed.)

- Rio Vista Avenue Pipe Bursting (this project has been designed and is scheduled for construction during the summer of 2022).
- Norris Street Schedule C Sewer Replacement (the design of this project will start soon and is scheduled for construction during the summer of 2022).
- Pump Station 14 capacity upgrade.

Projects to be Implemented Over the Next 5 Years

- Installation of flow meter at Pump Station 11.
- Installation of flow meter at Pump Station 13.
- Smoke testing of areas with high inflow and implementation of inflow reduction measures.
- Continue sewer replacement projects to reduce infiltration.

Projects to be Implemented Over the Next 10 Years

- Installation of a parallel line to the 12-inch and 14-inch Force Main from Pump Station 6 to Sharon Avenue, and upsize force main from Pump Station 5.
- Smoke testing of areas with high inflow and implementation of inflow reduction measures.
- Continue sewer replacement projects to reduce infiltration.

N

Legend

- LIFT STATION
- MODELED SEWER PIPES
- OVER CAPACITY AT 2040
- OVER CAPACITY AT BUILDOUT
- SEWER MAIN
- FORCEMAIN
- CITY LIMITS
- CITY UGA
- BAYVIEW RIDGE UGA
- BASINS

DATA SOURCES:
CITY OF BURLINGTON

CITY OF BURLINGTON

WASTEWATER COMPREHENSIVE PLAN
FIGURE E-3
SEWER MODEL RESULTS

Gray & Osborne, Inc.
CONSULTING ENGINEERS

Projects to be Implemented Over the Next 15 Years

- Installation of flow meter at Pump Station 19.
- Installation of flow meter at Pump Station 20.
- Pump Station 2 capacity upgrade.
- Replace the existing 8- and 10-inch sewer in Burlington Boulevard from Manhole 498 to Manhole 515 with a 15-inch sewer.
- Replace the existing 10- and 12-inch sewer in Burlington Boulevard from Manhole 515 to Pump Station 11 with an 18-inch sewer. (Per discussion with the City, they will verify surcharging during major storm events in the future before implementing.)
- Replace the existing 8-inch sewer in the trunk sewer serving the Port of Skagit County from Manhole 1285 to Manhole 1184 with a 12-inch sewer.
- Replace the existing 10-inch sewer in Ovenell Road from Manhole 1184 to Pump Station 10 with an 18-inch sewer. (Per discussion with the City, they will verify surcharging during major storm events in the future before implementing.)

Projects to be Implemented Over the Next 20 Years

- Installation of the third pump in Pump Station 4.

WASTEWATER TREATMENT PLANT

The City's WWTP is an activated sludge plant with a rated maximum month influent capacity of 3.79 mgd flow, 7,356 lb/d BOD and 7,660 lb/d TSS. As noted in Table E-1, influent flows and loadings are not expected to exceed these rated capacities until after 2040. Figure E-4 shows the WWTP layout. The WWTP includes the following major components:

- Influent Pump Station
- Septage Receiving Station
- Headworks, with Parshall flume flow meter and two mechanical fine screens
- Three circular Primary Clarifiers
- Four Aeration Basins
- Three Secondary Clarifiers
- UV Disinfection System, low pressure, high intensity, horizontal array

- Effluent Pump Station
- Non-Potable Water System
- Outfall in the Skagit River
- Solids Handling Building with Belt Filter Press, a Primary Sludge Gravity Thickener and a Waste Activated Sludge Rotary Drum Thickener
- One Primary and one Secondary Anaerobic Digester
- Sludge Storage Building with Sludge Dryer

Several areas of the WWTP are identified for additional process units when expansion is necessary.

As discussed in Chapter 7, the WWTP has demonstrated good performance, and has consistently been in compliance with the effluent limits in its NPDES permit over the study period. The limits are summarized in Table E-2

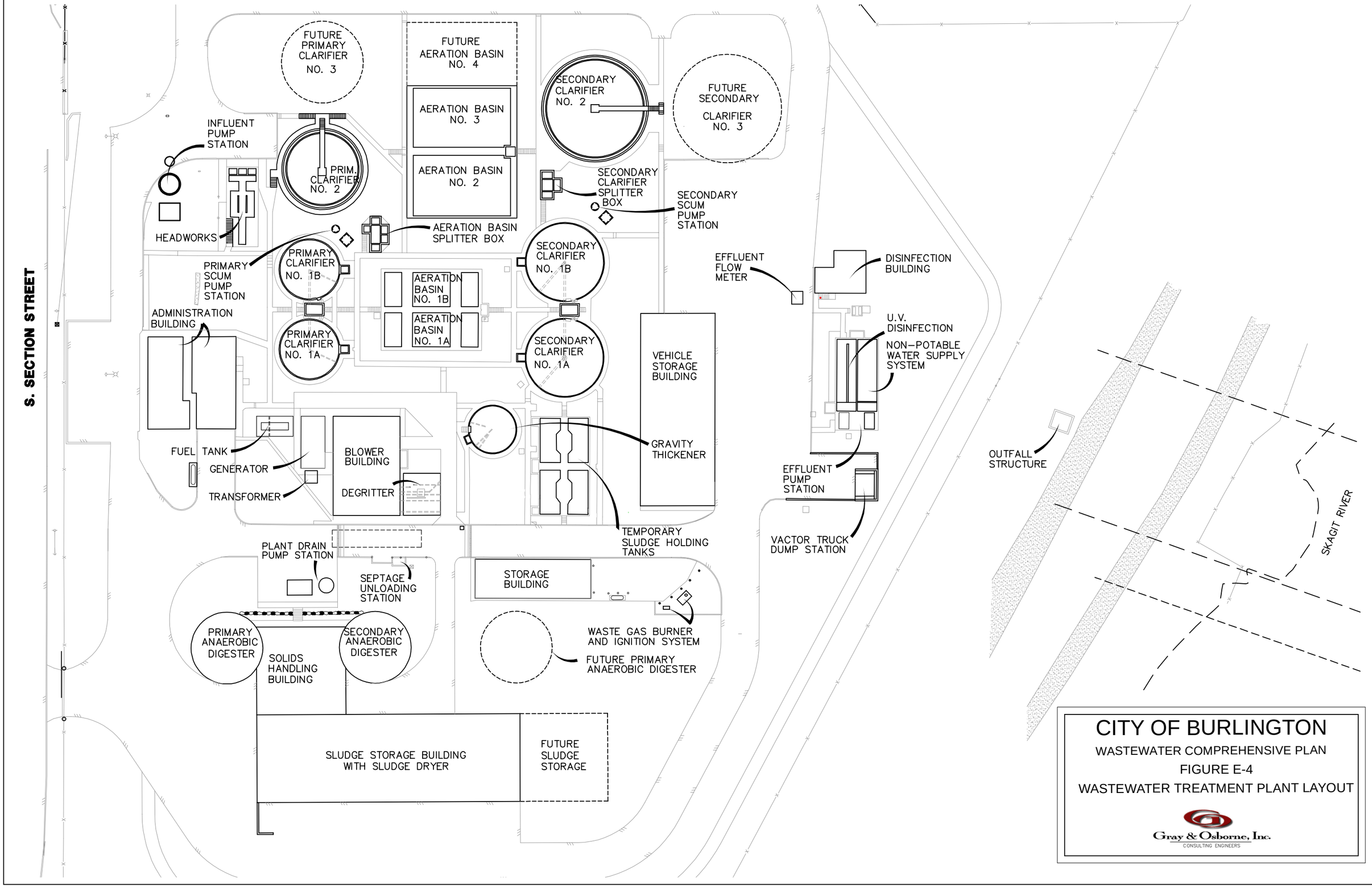
TABLE E-2

Current WWTP Effluent Limits

Parameter	Limit
BOD_5 Monthly Average Concentration	30 mg/l(1)
BOD_5 Monthly Average Load	948 lb/d
BOD_5 Weekly Average Concentration	45 mg/l
BOD_5 Weekly Average Load	1,422 lb/d
TSS Monthly Average Concentration	30 mg/l(1)
TSS Monthly Average Load	948 lb/d
TSS Weekly Average Concentration	45 mg/l
TSS Weekly Average Load	1,422 lb/d
NH_4 Concentration	no limit presently in effect
Fecal Coliform Monthly Geometric Mean Count	200/100 ml
Fecal Coliform Weekly Geometric Mean Count	400/100 ml
Daily Minimum pH	≥6.2
Daily Maximum pH	≤9.0

(1) The monthly average concentration limitation for BOD_5 and TSS shall not exceed 30 mg/L or 15 percent of the respective influent concentrations, whichever is more stringent.

Chapter 7 includes an evaluation of the capacity of the liquid and solids treatment processes to treat the projected flow and loading rates. The resulting process loading rates are compared to accepted design criteria for each treatment process. In general, none of the WWTP unit processes will require capacities upgrades throughout the planning period (through 2040) unless NPDES permit effluent limits become more stringent. Most treatment units will have to be expanded to accommodate buildout conditions. All the treatment units meet Class I Reliability Requirements.



CITY OF BURLINGTON

WASTEWATER COMPREHENSIVE PLAN

FIGURE E-4

WASTEWATER TREATMENT PLANT LAYOUT

Gray & Osborne, Inc.
CONSULTING ENGINEERS

WWTP CONDITION ASSESSMENT

As part of the effort to develop this plan, a site visit and condition assessment was conducted a treatment process engineer, an electrical engineer, an architectural engineer, and a structural engineer) accompanied by plant staff. The findings of the condition assessment are provided in Appendix G and summarized in Chapter 7. Based on this condition assessment, the following major improvements were recommended:

1. Upgrades to the Influent Pump Station.
2. Electrical and instrumentation modifications to the Headworks.
3. Installation of air supply isolation valves and pH monitoring at Aeration Basins 2 and 3.
4. Installation of pH monitoring at Aeration Basins 1A and 1B.
5. Upgrades to the Blower Building.
6. Upgrades to the Grit Classifier.
7. Installation of an access platform around Secondary Clarifier 2.
8. Installation of pH monitoring at the Ultraviolet Disinfection Channel.
9. Upgrades to the Effluent Pump Station.
10. Upgrades to the Non-Potable Water System.
11. Upgrades to the Disinfection Building.
12. Upgrades to the Anaerobic Digester equipment.
13. Upgrades to Sludge Thickening and Dewatering equipment.
14. Electrical upgrades in the Vehicle Storage Building.
15. Electrical Upgrades in the Administration Building.

NITROGEN REMOVAL AND WATER REUSE EVALUATIONS

Ecology is moving forward with efforts to reduce Total Inorganic Nitrogen (TIN) in the Salish Sea, including Puget Sound. In December 2021, Ecology released the Puget Sound Nutrient General Permit (PSNGP). The Nutrient Permit went into effect in January 2022. The permit has been appealed by several dischargers who have filed a legal challenge. The PSNGP would establish annual effluent loads of Total Inorganic Nitrogen (TIN) for WWTPs that discharge to Puget Sound. TIN is the sum of nitrate-nitrogen, nitrite-nitrogen and ammonia-nitrogen. The PSNGP established loading "Action Level" thresholds in terms of pounds per year of TIN. Burlington is not covered by the initial phase of the PSNGP since it does not discharge directly to Puget Sound (although Mount Vernon is covered); however, Ecology has indicated that the Burlington WWTP may be covered in future phases of the PSNGP and thus subject to TIN limits sometime in the future.

Chapter 7 includes evaluation of the improvements that would be necessary for implementing nitrogen removal at the Burlington WWTP. Based on the preliminary evaluation, it appears that constructing selectors, anoxic zones, aerated zones, and mixed liquor recycling entirely within each of the four existing and one additional tank is the most cost-effective method to incorporate nitrogen removal at the Burlington WWTP. It is not known when, or even, if, the Burlington WWTP will be subject to nitrogen limits. Implementation of nitrogen limits is not expected to take place until after 2028. If the City is informed that nitrogen limits are going to be imposed, it is recommended that, following the evaluation of nitrogen sources, modeling of the treatment process be performed as a part of the predesign effort.

In addition to an evaluation of nitrogen removal, Chapter 7 includes an evaluation of water reclamation and reuse. Using treated effluent off-site would require additional treatment, reliability and conveyance improvements and significant capital and operating costs, and it was determined that it is not cost-effective or recommended at this time.

BIOSOLIDS MANAGEMENT

As discussed in Chapter 8, the liquid stream treatment processes at the City's WWTP produce two large waste sludge streams that are managed and treated by the solids handling systems. Primary sludge and waste activated sludge (WAS) are thickened before they are pumped to the anaerobic digestion system, where the volatile fraction of waste sludge is reduced to decrease the overall mass of biosolids leaving the facility and stabilize the sludge. Digested sludge is loaded to the belt press dewatering system to reduce the volume and water content of biosolids sent to the existing dryer system. The WWTP uses an indirect thermal fluid dryer to produce Class A biosolids from its waste solids. Pathogen reduction requirements for Class A biosolids are accomplished through the dryer, which uses heat to drive evaporation of dewatered sludge until the solids percentage of the sludge exceeds 90 percent dry solids by weight. The City successfully distributes Class A biosolids to the public, which is used as soil conditioner, fertilizer, or

fertilizer supplement. The existing dryer, located outdoors under a canopy cover, is approaching the end of its useful life.

Several options for future Class A treatment of biosolids are considered in Chapter 8:

1. Continued Thermal Drying.
2. Alkaline Stabilization.
3. Composting.
4. Gasification.
5. Pyrolysis.
6. Incineration.

The evaluation concludes that Continued Thermal Drying would be the recommended technology if the City wishes to continue to generate Class A biosolids. Chapter 8 concludes with a comparison of Class A (Continued Thermal Drying) versus Class B (Hauling) Biosolids Treatment and Management. For the Class B biosolids alternative, there are minimal additional capital costs associated with sludge loading improvements. As a result, the 20-year net present worth ($7,031,000) is significantly lower than the preferred Class A alternative ($17,023,000), due to the much higher capital cost for the replacement dryer, which is reflected in the 20-year net present worth comparison. However, there are additional non-monetary factors that might affect a decision on whether to continue with Class A biosolids or pursue Class B biosolids production.

The production of Class A biosolids would provide a benefit to the community. Thermally dried biosolids are considered desirable and welcomed by the residential, developer, and agricultural communities. In addition, the reduction in hauling would provide some benefit to the community directly neighboring the WWTP due to the lower traffic and noise from trucks. However, the costs associated with Class A biosolids production and higher sewer rates may diminish the net benefit to the community.

The production of Class A biosolids requires significant labor costs from WWTP staff, including operator attention, maintenance and periodic repair.

Another qualitative factor in this analysis is the long-term reliability of Class B biosolids application. Currently, a limited number of sites in this region will accept Class B biosolids for permitted land application. If fewer sites can accept Class B biosolids for land application or further treatment, contracted hauling costs would likely increase, particularly if permitted sites are only located in Eastern Washington. Thus, significant benefits would result from the continued use of Class A biosolids production, which would be relatively independent from the uncertainties of contracted hauling costs.

The evaluation of these two alternatives showed that they scored similarly overall. Although biosolids drying is the recommended alternative, it is noted that it may be advisable to wait to implement the replacement of the dryer. The issue of chemicals (most notably "PFAS," per- and polyfluoroalkyl substances) in biosolids has upended biosolids planning in many parts of the country, and EPA is fast tracking research regarding issue, with new regulations likely. The City could have third parties haul Class B biosolids until around 2030 (if and when operation of the existing dryer is no longer feasible) and then incorporate actual costs for hauling, and any new relevant regulations, into biosolids management decision-making at that time. Accordingly, replacement of the biosolids dryer is not in the CIP, but will be evaluated again in the future.

CAPITAL IMPROVEMENT AND FINANCIAL PLANS

Table E-3 summarizes the capital improvement plan recommended in Chapter 9. The CIP projects that are currently budgeted for construction within the next 6 years are shown in yellow in Table E-3, along with additional recommended projects (shown in blue). The costs presented in Table E-3 are in 2022 dollars and have been prepared for guidance in project evaluation from the information available at the time of preparation. Descriptions of the projects are provided in Chapter 9.

Chapter 10 provides an evaluation of the financial capacity of the City of Burlington (City) to recover the full cost to construct, operate, maintain, and manage the sewer system on an ongoing basis. The chapter evaluates the financial status of the City's sewer utility, potential funding sources and a plan for funding the recommended 6-year capital improvement program (CIP), and a 6-year financial plan that evaluates revenues, expenses, reserve levels, and the impact on user rates to recover total costs. An evaluation of the affordability of the City's sewer rates is also provided.

The Financial Program includes a conservative estimate for customer growth of about 1.0 percent per year (assuming continued growth at historical levels). GFC collections are conservatively estimated at $350,000 per year. The remaining costs are planned to be funded with a combination of rates, interest earnings and cash reserves.

The 6-year financial plan to support the capital improvements recommended in this Plan was developed and discussed with City staff. The 2022 budget is the base year for financial projections with future year projections identified for the 6-year period 2023 through 2028. Key objectives of the financial plan are to ensure that rates are sufficient to sustain ongoing operations and maintenance (O&M), pay debt service obligations (if any), fund prioritized capital projects, and maintain stable cash reserves and other financial policy objectives. The financial plan evaluates the sufficiency of current utility revenues in meeting the forecasted operating and capital-related expenses and designs a rate adjustment strategy to close any revenue shortfall over the planning period.

Chapter 10 summarizes the financial plan. The annual increase to/(use) of reserves line at the bottom of the table shows that the anticipated revenues and expenditures can be balanced with annual rate increases of 5.0 percent per year for the years 2024-2028. This level of increase is consistent with the City's historical level of increases, including the adopted 5.0 percent rate increase effective January 1, 2023.

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TABLE E-3

Capital Improvement Projects

No.	Estimated Completion Year	Improvements	Budgeted Cost	Unbudgeted Costs	2023	2024	2025	2026	2027	2028	2029-2032
PW-SS-10-2018	2023	Pump Station 8 Generator Replacement	$175,000		$175,000						
PW-SS-16-2018	2023	Pump Station Pump Replacement	$65,000		$65,000						
PW-SS-1-2018	2023	Wastewater Line I&I Mitigation	$125,000		$125,000						
PW-SS-2-2018	2023	WWTP Annual Equipment Replacement	$250,000		$250,000						
PW-SS-3-2018	2023	Wastewater Line Replacement Program	$300,000		$280,000						
PW-SS-16-2018	2023	Pump Station Pump Replacement	$65,000		$65,000						
PS-SS-2029	2029	Pump Station 14		$668,000							$668,000
PW-SS-1-2024	2024	Wastewater Line I&I Mitigation	$125,000			$150,000					
PW-SS-2-2024	2024	WWTP Annual Equipment Replacement	$250,000			$250,000					
PW-SS-3-2024	2024	Wastewater Line Replacement Program	$300,000			$320,000					
PW-SS-16-2024	2024	Pump Station Pump Replacement	$85,000			$85,000					
PW-SS-17-2024	2024	Primary Digester Design Report	$40,000			$40,000					
	2024	Miscellaneous and Emergency Projects				$145,000					
PW-SS-2026	2026	Pump Station 11 Flow Meter		$55,000				$55,000			
PW-SS-2026	2026	Pump Station 13 Flow Meter		$50,000				$50,000			
PW-SS-2026	2026	Smoke Testing		$80,000						$80,000	
PW-SS-1-2025	2025	Wastewater Line I&I Mitigation	$125,000				$150,000				
PW-SS-2-2025	2025	WWTP Annual Equipment Replacement	$250,000				$100,000				
PW-SS-3-2025	2025	Wastewater Line Replacement Program	$300,000				$100,000				
PW-SS-4-2025	2025	Pump Station Pump Replacement	$65,000				$65,000				
PW-SS-2030	2030	Force Main from Pump Station 6		$4,716,000							$4,716,000
PW-SS-2024	2024	Upgrades to Influent Pump Station		$1,974,000		$1,974,000					
PW-SS-2024	2024	Upgrades to Effluent Pump Station		$568,000		$568,000					
PW-SS-2025	2025	Upgrades to HVAC Systems		$500,000			$500,000				
PW-SS-2025	2028	pH Monitoring		$453,000					$453,000		
PW-SS-2025	2025	Blower Building Improvements		$2,690,000			$2,690,000				
PW-SS-2025	2028	Solids Building Improvements		$786,000					$786,000		
PW-SS-2025	2028	Control Building Improvements		$43,000					$43,000		
PW-SS-2028	2028	Secondary Clarifier 2 Access Platform		$205,000						$205,000	
PW-SS-2025	2025	Disinfection Building Upgrades		$350,000			$350,000				
PW-SS-2023	2023	Digester Struvite Mitigation		$50,000	$50,000						
PW-SS-1-2026	2026	Wastewater Line I&I Mitigation	$150,000					$150,000			
PW-SS-2-2026	2026	WWTP Annual Equipment Replacement	$250,000					$250,000			
PW-SS-3-2026	2026	Wastewater Line Replacement Program	$300,000					$300,000			
PW-SS-4-2026	2026	Pump Station Pump Replacement	$65,000					$65,000			

TABLE E-3 – (continued)

Capital Improvement Projects

No.	Estimated Completion Year	Improvements	Budgeted Cost	Unbudgeted Costs	2023	2024	2025	2026	2027	2028	2029-2032
PW-SS-1-2032	2032	New Gravity Sewer across the Umbarger Elementary School Property		$1,725,000							$1,725,000
PW-SS-1-2027	2027	Wastewater Line I&I Mitigation	$150,000						$150,000		
PW-SS-2-2027	2027	WWTP Annual Equipment Replacement	$250,000						$250,000		
PW-SS-3-2027	2027	Wastewater Line Replacement Program	$300,000						$300,000		
PW-SS-4-2027	2027	Pump Station Pump Replacement	$65,000						$65,000		
		Miscellaneous and Emergency Projects							$350,000		
PW-SS-1-2028	2028	Wastewater Line I&I Mitigation	$150,000							$150,000	
PW-SS-2-2028	2028	WWTP Annual Equipment Replacement	$250,000							$250,000	
PW-SS-4-2028	2028	Wastewater Line Replacement Program	$300,000							$300,000	
PW-SS-4-2028	2028	Pump Station Pump Replacement	$65,000							$65,000	
	2028	Miscellaneous and Emergency Projects								$1,725,000	
TOTAL			**$4,815,000**	**$14,913,000**	**$1,010,000**	**$3,532,000**	**$3,955,000**	**$870,000**	**$2,397,000**	**$2,775,000**	**$7,109,000**
TOTAL 6-YEAR CIP					**$14,539,000**						

(1) All costs are in 2022 dollars.

The current sewer bill for this sample customer is $77.00 per 2-month billing cycle. This bill is projected to increase to $98.27 by 2028. This represents an increase of $21.27 per bimonthly bill (or $10.64 per month) over the 6-year period. This is an average increase of approximately $4.25 per 2-month bill (or $2.13 per month).

Table E-4 compares the City's existing rates to neighboring jurisdictions.

TABLE E-4

Residential Sewer Bill Comparison

Residential Sewer Service	Bimonthly Rate(1)	Monthly Rate
Concrete	$220.00	$110.00
Stanwood	$196.36	$98.18
Sedro-Woolley	$141.66	$70.83
La Conner	$137.36	$68.68
Anacortes	$124.53	$62.27
Mount Vernon	$106.90	$53.45
Burlington – Existing	**$77.00**	**$38.50**

(1) Compares bimonthly sewer rates for water consumption for 2023 per website information (as of January 2023).

In addition to a rate analysis, a General Facilities Charge (GFC) Study was completed as a part of this Plan. The Study recommended an increase in the single-family residential sewer GFC from $3,130 to $5,943. Table E-5 shows the existing and proposed GFC relative to neighboring jurisdictions.

TABLE E-5

Single-Family Residential Sewer GFC Comparison

Sewer Service Provider	Inside-City GFC
Anacortes	$10,830
Mount Vernon	$9,258
Sedro-Woolley	$9,256
Burlington – Proposed	**$5,943**
Concrete	$4,492
Burlington – Existing	**$3,130**
La Conner	$2,432

CHAPTER 1

INTRODUCTION

This *Wastewater Comprehensive Plan* (*Plan*) for the City of Burlington addresses 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*, WAC 173-240-060, *Engineering Report*, and federal requirements for a Wastewater Facility Plan. Development of the Plan has been coordinated with the *City of Burlington Comprehensive Plan*.

The Plan provides proposed conceptual designs, cost estimates, schedule, and a financing plan for recommended facility improvements. A State Environmental Policy Act (SEPA) checklist is provided in Appendix A. The projects described in the 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, anti-degradation of surface water and reuse of biosolids. An adopted water quality plan exists for the receiving water (Skagit River). Further discussion on permit limits for the WWTP is provided in Chapter 3.

The City of Burlington is located in Skagit County, along the Skagit River (see Figure 1-1).

SCOPE OF WORK

The Plan addresses the wastewater collection system and the wastewater treatment systems for the City of Burlington. This evaluation includes a collection system/wastewater treatment plant analysis, a capital improvement plan and a cost analysis with an associated schedule. The scope of work for the Plan includes the following items:

- Chapter 1 – Introduction
- Chapter 2 – Regulatory Requirements
- Chapter 3 – Land Use, Population Projections, and Service Area Characteristics
- Chapter 4 – Existing Facilities
- Chapter 5 – Wastewater Flow and Loading Projections
- Chapter 6 – Collection System Analysis
- Chapter 7 – Wastewater Treatment Plant Analysis
- Chapter 8 – Biosolids Treatment and Management
- Chapter 9 – Capital Improvement Plan

- Chapter 10 – Financial Program

RELATED PLANNING DOCUMENTS

The following documents were consulted in the preparation of this Plan.

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

Bayview Ridge Subarea Plan, 2014, Adopted by the Board of County Commissioners

The Bayview Ridge Subarea is a 3,586-acre "non-municipal urban growth area" in Skagit Valley approximately one mile west of the City of Burlington and one-and-a-half miles northwest of the City of Mount Vernon. Burlington provides sewer service to the Bayview Ridge Subarea. The subarea includes the Skagit Regional Airport, several industries, a golf course and residential areas.

Skagit County Comprehensive Plan 2016-2036, Adopted by the Board of County Commissioners

The County's 2016 Comprehensive Plan provided growth projections for the urban growth areas and rural areas within the County. Burlington was projected to have a population of 14,272 and employment of 13, 412 by 2036.

Skagit Population, Housing and Growth Monitoring Program – 2020 Growth Monitoring Report, Skagit Council of Governments, June 16, 2021)

This planning document projects the annual population growth in the City of Burlington to be 1.49 percent over the next 20 years.

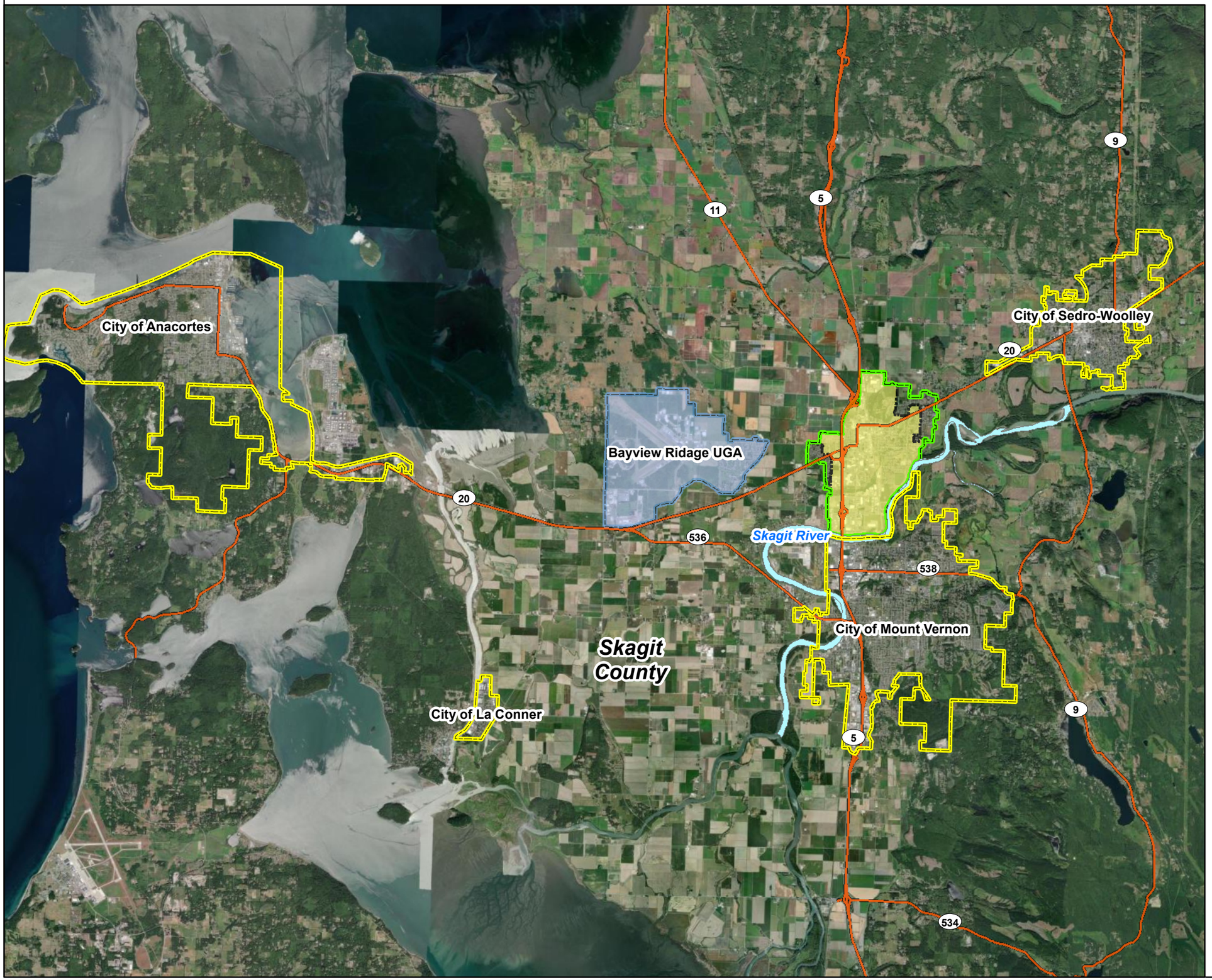
WATER AND WASTEWATER SYSTEM PLANNING

Wastewater Comprehensive Plan, December 2011, Gray and Osborne, Inc.

The *2011 Sewer Comprehensive Plan* provided an analysis of the City's existing sewerage system. The *2011 Plan* provided recommendations for increasing capacity at Pump Stations 4, 6, 10, and 14. In addition, the *2011 Plan* provided many recommendations for WWTP improvements, the most including:

Immediate Actions

1. Increase the capacity of the influent pump station to a peak hour flow rate of 9.31 mgd (6,465 gpm). This should provide adequate capacity through 2030.



Legend

- Regional Highway
- City UGA
- Bayview Ridge UGA
- City of Burlington

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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CITY OF BURLINGTON

WASTEWATER COMPREHENSIVE PLAN
FIGURE 1-1
VICINITY MAP

Gray & Osborne, Inc.
CONSULTING ENGINEERS

2. Install a second influent screen. The screen has been budgeted for and ordered by the City and is scheduled for delivery in September 2011.

3. Implement modifications to the digester gas piping and boiler, digester recirculation pumps, and digester piping valves to eliminate excessive moisture in the digester gas.

4. Conduct an assessment to determine the remaining useful life of the mechanisms for Primary Clarifiers 1A and 1B, Secondary Clarifiers 1A and 1B, and the gravity primary sludge thickener.

Actions to be Taken before 2015

1. Refurbish or replace the mechanisms for Primary Clarifiers 1A and 1B, Secondary Clarifiers 1A and 1B, and the gravity primary sludge thickener, if required.

Actions to be Taken during the Period of 2015 to 2020

1. Prepare a Design Report to add a second primary digester.

Actions to be Taken during the Period of 2020 to 2025

1. Design and construct a second primary digester.

2. Prepare a Predesign Report to increase aeration basin capacity.

Actions to be Taken during the Period of 2025 to 2030

1. Design and construct increased aeration basin capacity.

2. Prepare a Predesign Report to increase secondary clarifier capacity and WAS thickening capacity.

CHAPTER 2

REGULATORY REQUIREMENTS

INTRODUCTION

Wastewater collection system planning includes an analysis of the City's ability to comply with the applicable regulatory requirements while providing a high level of service for existing and future customers. These requirements are outlined in federal, state, and local regulations, and enforced by a number of agencies. This chapter presents the legislation, regulations, permits, agencies, and design standards that may affect City's wastewater operations. The discussion presented here is general in nature; specific issues will be addressed as they occur within the context of following chapters.

FEDERAL AND STATE STATUTES, REGULATIONS, AND PERMITS

In this section, the various state and federal legislation that may affect City's operations are discussed, as well as other relative 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. Though originally enacted in 1948, it was significantly revised in 1972 and 1977, when it was commonly titled the "Clean Water Act" (CWA). The CWA has been amended several times since 1977. The 1987 amendments replaced the Construction Grants program with the State Revolving Fund (SRF), which provides low-cost loans for a range of water quality infrastructure projects.

Effluent Discharge Requirements

The National Pollutant Discharge Elimination System (NPDES) is established by Section 402 of the CWA and subsequent amendments. The Washington State Department of Ecology (Ecology) administers NPDES permits under the authority of the United States Environmental Protection Agency (EPA). Most NPDES permits are valid for 5 years and place limits on the quantity and quality of pollutants that may be discharged. The City of Burlington NPDES permit, which has an expiration date of January 31, 2023, is included in Appendix B (Permit No. WA0020150). The City's current NPDES permit effluent limits are shown in Table 2-1.

TABLE 2-1

NPDES Permit Effluent Limitations

Effluent Limit		
Parameter	**Average Monthly**	**Average Weekly**
BOD_5	30 mg/L, 948 lbs/day 85% Removal of Influent BOD_5	45 mg/L, 1,422 lbs/day
TSS	30 mg/L, 948 lb/d 85% Removal of Influent TSS	45 mg/L, 1,422 lb/d
Fecal Coliform Bacteria	200/100 ml	400/100 ml
pH	Minimum of 6.2 and Maximum of 9.0	

The permit identifies the following limits for influent flow and load:

- Maximum month flow – 3.79 mgd
- Maximum month BOD loading – 7,356 lbs/day
- Maximum month TSS loading – 7,660 lbs/day

As discussed later in this chapter, a reasonable potential analysis conducted for a mixing zone study completed in 2020 indicated that no new permit limits were necessary for toxicants through buildout. However, EPA and Ecology revise water quality standards (typically to be more stringent) on a periodic basis, so it is possible that new permit limits will be implemented. As noted later, effluent limits for nutrients in the future are a distinct possibility. In addition, Ecology has indicated that effluent pathogen limitations may change from fecal coliform to Enterococcus (for marine waters) and E. coli (for fresh waters) in the future, since these were recently adopted as water quality standards.

Industrial Pretreatment/Source Control

Section 307 of the CWA established the National Pretreatment Program; 40 CFR Part 403 lists the federal pretreatment requirements. This program is designed to protect publicly owned treatment works (POTW) from pass-through of pollutants or interference with the treatment process from industrial and non-residential discharges that is not "domestic equivalent" (similar in quality to domestic wastewater).

If considered significant, industrial discharges to municipal wastewater collection/treatment systems are typically addressed in State Waste Discharge Permits (SWDPs). There are three SWDPs issued to facilities in the Burlington area that are currently discharging to the Burlington sewer system: Sakata Seed America (Permit No. ST0501329), Puget Sound Energy (Permit No. ST0005198), Skagit County Inman Landfill (Permit No. ST0007405).

The City's NPDES Permit requires that the City work with Ecology to ensure that all commercial and industrial users of the publicly-owned treatment works (POTW) comply with the pretreatment regulations in 40 CFR Part 403 and any additional regulations that the Environmental Protection Agency (U.S. EPA) may promulgate,

Construction Permits

The City is required to obtain an NPDES Construction Permit for projects greater than 1 acre in size.

A 401 Water Quality Certification is required under the CWA for any activity that may result in discharge to surface water, including excavation activities that occur in streams, wetlands, or other waters of the nation.

Section 404 of the CWA regulates discharges of fill or dredged materials in wetlands, including any related draining, flooding, and excavation. Pipeline and pump station projects in wetlands will require a Section 404 permit in addition to any related local permits. Activities that impact more than 1/3 acre will also require a Section 401 Certification.

Total Maximum Daily Loads

The CWA requires states to establish Total Maximum Daily Loads (TMDL) programs for parameters not meeting applicable surface water quality standards as identified on Section 303(d) water quality impaired lists. A TMDL specifies the maximum amount of a pollutant that a waterbody can receive and still meet the water quality standards. A TMDL also identifies the sum of allowable loads of a pollutant from all point and non-point sources and determines the margin of safety to ensure protection of the waterbody in case there are unknown pollutant sources or unforeseen events that may impair water quality.

A TMDL study for dissolved oxygen and fecal coliform bacteria in the Lower Skagit River was completed in 2000. The study set wasteload allocations for BOD and ammonia, and ultimately determined that technology-based standards for BOD, ammonia and fecal coliform for the Burlington WWTP are protective.

Any effluent limitations in addition to those already stated in the active NPDES permit have not identified for the Burlington WWTP; however, future limitations on ammonia and/or total inorganic nitrogen may be imposed in the future (see below).

Puget Sound Nutrient Source Reduction

The Puget Sound Nutrient Source Reduction Project ("Project") is a collaborative effort with Puget Sound communities and stakeholders to address human sources of nutrients. As noted on its website "this work focuses on using the latest science to find right solutions for regional investments to reduce nutrient sources. Our objective is to improve Puget Sound water quality to support salmon and orca recovery and increase resiliency to climate impacts." The Project includes modeling the effect of nutrients on dissolved oxygen in Puget Sound. Different scenarios, with different assumed nutrient loadings, are modeled, including assumed WWTP effluent Total Inorganic Nitrogen (TIN) levels of 3 mg/l and 8 mg/l. In accordance with discussions with the State of Washington Department of Ecology, there is a significant possibility that the Burlington WWTP will have a future effluent TIN limit in an upcoming NPDES permit in the range of 3 to 10 mg/l.

FEDERAL AND STATE STANDARDS FOR USE OR DISPOSAL OF SLUDGE

The City's wastewater treatment process generates sludge. The sludge is currently treated in the City's anaerobic digestion system, dewatered with a belt filter press, and dried with a thermal dryer. As a backup, the dewatered biosolids meet the Class B biosolids requirements and can be hauled to a permitted land application site or to a composting facility. An evaluation of alternatives for the City's future biosolids treatment and management is provided in a later chapter.

The generation and use of biosolids, and the disposition of solid waste in general generated from wastewater treatment plants (WWTPs), is subject to both federal and state regulations. The following information is provided to guide the City in its biosolids management efforts.

Federal Basis of Regulations

Based on the 1977 and 1987 amendments to the Clean Water Act, the U.S. Environmental Protection Agency (EPA) established requirements for the final use and disposal of municipal sewage sludge, published in 1993 under 40 CFR 503. These regulations identify three methods for legal disposal or final use of sewage sludge: surface disposal, land application, and incineration. For each of the three methods of disposition, EPA has identified pollutant limits, operational standards, management practices, monitoring, and recordkeeping and reporting requirements. Under the 503 regulations, the EPA placed considerable emphasis on the beneficial use of sludge through a properly managed land application program.

Washington State Regulations

Washington State regulates biosolids under Chapter 70.95J of the RCW. Washington does not have fully delegated authority from the EPA, but has the authority to issue separate state permits for biosolids management. Chapter 70.95J recognizes biosolids as a valuable commodity and specifies implementation of a program that maximizes beneficial use. The state requirements are found in Chapter 173-308 of the Washington Administrative Code (WAC). The state program meets federal minimum requirements and has added requirements including, but not limited to, the following:

- Biosolids must not contain a significant amount of manufactured inert materials (e.g., plastics, debris). Typically, and in Burlington's case, this requirement is met by screening the wastewater through a $\leq$ 3/8-inch aperture screen at the municipality's treatment plant.

- For all practical purposes, the state rule does not allow biosolids to be disposed of (e.g., landfill) on a long-term basis.

- Biosolids generators and all entities managing biosolids must obtain a state permit and pay permit fees.

Implementation at State Level

In 1998, the State of Washington promulgated WAC 173-308 "Biosolids Management" governing the use and disposal of sewage sludge. Most of the requirements in the federal regulations pertaining to pollutant limits, pathogen reduction, vector attraction reduction, operational standards, and management practice are in essentially the same form within the state regulation. The state regulation requires that any facility generating municipal sewage sludge or material derived from municipal sewage sludge obtain clearance under the State General Permit for Biosolids Management.

Requirements for Land Application

There are three fundamental elements in the federal and state biosolids management regulations that establish minimum criteria for land application of biosolids:

1. Pollutant Concentrations and Application Rates.

2. Pathogen Reduction Measures.

3. Vector Attraction Reduction Measures.

Pollutant Concentrations

Maximum allowable concentrations for nine heavy metals are listed in Table 2-2. If biosolids exceed the ceiling concentration for any of the nine heavy metals, they cannot be land applied. More restrictive (lower) pollutant threshold concentrations are in effect for Exceptional Quality (EQ) biosolids, as shown in Table 2-2. If biosolids are shown to be below these concentrations, they may be eligible for relatively unrestricted land application, providing they meet the Class A biosolids requirements and vector attraction reduction requirements discussed below. As shown in Table 2-2, the City's biosolids are well below the biosolids threshold concentrations for all nine metals.

TABLE 2-2

Allowable Biosolids Trace Pollutant Concentrations for Land Application(1)

Element	Symbol	Ceiling Concentration (mg/kg)(1)	EQ Limit (mg/kg)(2)	City of Burlington 2020 (mg/kg)
Arsenic	As	75	41	3.1
Cadmium	Cd	85	39	2.0
Copper	Cu	4,300	1,500	397
Lead	Pb	840	300	22
Mercury	Hg	57	17	0.457
Molybdenum	Mo	75	75 (3)	11
Nickel	Ni	420	420	26
Selenium	Se	100	100	2.3
Zinc	Zn	7,500	2,800	1104

(1) WAC-173-308 Table 1.
(2) WAC-173-308 Table 3.
(3) Under review by EPA. Until the EPA completes its review, the effective limit is 75 mg/kg.

Pathogen Reduction Measures

In order for biosolids to be land applied, they must meet specific criteria demonstrating a minimum level of treatment to reduce the density or limit the growth of pathogenic bacteria. By meeting these minimum criteria, a biosolids sample is referred to as meeting Class B pathogen reduction requirements. A higher level of treatment, known as a process to further reduce pathogens (PFRP), will permit biosolids to meet Class A pathogen reduction requirements. When biosolids meet the Class A standard, they may be eligible for relatively unrestricted land application, provided they meet the EQ trace pollutant limits listed above in Table 2-2 and the vector attraction reduction requirements listed in Table 2-5. The City's WWTP meets the Class B standards through digestion and follows that process with thermal drying to meet Class A standards. The pathogen

reduction requirements appropriate for these two processes (anaerobic digestion for Class B and thermal drying for Class A) are shown in Tables 2-3 and 2-4, respectively.

TABLE 2-3

Class B Pathogen Reduction Requirements Relevant for Anaerobic Digestion

Alternative 1	Fecal coliform less than 2,000,000 most probable number (MPN) or 2,000,000 colony-forming units per gram of total solids. Seven samples are collected at each sampling event. Geometric means are used to determine compliance.
Anaerobic Digestion	Biosolids are treated in the absence of air for a specific mean cell residence time at a specific temperature Values for the mean cell residence time and temperature must be between 15 days at 35 to 55 degrees C (95 to 131 degrees F) and 60 days at 20 degrees C (68 degrees F).

TABLE 2-4

Class A Pathogen Reduction Requirements Relevant for Heat Drying

All Alternatives	Fecal coliform <1,000 MPN per gram total solids, or salmonella <3 MPN per 4 grams total solids.
Heat Drying	Biosolids are dried by direct or indirect contact with hot gases to reduce the moisture content to 10 percent or lower. Either the temperature of the biosolids particles exceeds 80 degrees C or the wet bulb temperature of the gas in contact with the biosolids as it leaves the dryer exceeds 80 degrees C.

Vector Attraction Reduction Measures

The third minimum requirement for biosolids to be land applied or distributed is the vector attraction reduction requirement. This measure is designed to make the biosolids less attractive to disease-carrying pests such as rodents and insects. These measures typically reduce the liquid content and/or volatile solids content of the biosolids or make the biosolids relatively inaccessible to vector contact by soil injection or tilling. A total of ten vector attraction reduction alternatives are available for land-applied municipal sewage. Table 2-5 summarizes the Vector Attraction Alternatives relevant for the City's biosolids.

TABLE 2-5

Vector Attraction Reduction Alternatives Relevant for Anaerobic Digestion and Heat Drying

No.	Description
1.	Biosolids digestion process with >38 percent volatile solids reduction.
2.	Test end product of an anaerobic digestion process: 40-day anaerobic test at 30 to 37 degrees C. Acceptable stabilization if <17 percent volatile solids reduction occurs during the test.
3.	Treatment by drying. Can include unstabilized primary wastewater solids. Total solids >90 percent before mixing with other materials.

If biosolids meet the lower pollutant threshold limits (EQ limits), Class A pathogen reduction requirements, and vector attraction reduction requirements, they are eligible for relatively unrestricted application. Biosolids of this type are referred to as "Exceptional Quality." If biosolids meet the higher pollutant threshold limits, Class B pathogen reduction requirements, and vector attraction reduction requirements, they can then be land applied but are subject to a number of restrictions regarding public contact and ultimate crop use.

Permitting

WAC-173-308-310 lists permitting requirements for municipalities managing biosolids. The primary permit required for biosolids management activities is *the State General Permit for Biosolids Management*.

The permittee must carry out public notice as required under WAC 173-308-310(11), and public hearings if required, in accordance with WAC 173-308-310(12), and comply with requirements of the State Environmental Policy Act (SEPA) as stipulated under WAC 173-308-310(030).

Monitoring

Producers of biosolids are required to monitor for pollutant concentrations, pathogen reduction, or vector attraction reduction. The required monitoring frequencies depend on the quantity of biosolids produced. These rates are summarized in Table 2-6. Based on its rate of biosolids production (421.2 tons of dry solids in 2020), the City has a minimum monitoring frequency of once per quarter.

TABLE 2-6

Minimum Frequency of Monitoring

Annual Biosolids Production (dry tons)	Frequency
Greater than zero but less than 320	Once per year
Equal to or greater than 320 but less than 1,653	Once per quarter
Equal to or greater than 1,653 but less than 16,535	Once per 60 days
Equal to or greater than 16,535	Once per month

In WAC 173-308, municipalities, such as the City, are defined as being responsible for the treatment, transport, use, and disposal of the biosolids produced under its management.

Recordkeeping and Reporting

The general permit implements requirements for record keeping and reporting in accordance with proposed WAC 173-308-290 and –295. Permit holders must keep records of the information used to develop applications for coverage under this permit, and must also keep records, including signed certification statements, regarding on-going biosolids management practices. Annual reports are required of all permit holders. In accordance with requirements of federal rules, annual reports from the larger, what are sometimes called "major" facilities, are required to be more comprehensive. The recordkeeping requirement allows for periodic inspection and verification of a facility's performance. The annual reporting function also supports verification of facility practices and allows the collection of information necessary to ensure efficient management of the overall state biosolids program.

SITE SELECTION CRITERIA FOR LAND APPLICATION

Land application is a commonly employed alternative for the ultimate disposition of biosolids. If the City were to need a land application site in the future, either for Class A or Class B biosolids, once all criteria have been met for pathogen reduction, vector attraction reduction and pollutant concentrations, the next step is to select a site suitable for biosolids application.

A biosolids application site must meet certain minimum criteria to meet specific regulatory requirements as well as minimum functional standards.

The WAC-173-308 and EPA 503 regulations have specific requirements for Class B biosolids application sites, including buffers, prohibited areas. There may also be local land use regulations or policies that apply in specific areas. Criteria are published in the State *Biosolids Management Guidelines* and the *Managing Nitrogen from Biosolids* manual for Washington State. They are intended to provide guidance for site selection based on those characteristics of a site that make it suitable for sustaining a cover crop.

Because a primary concern in land application of both Class A and Class B biosolids is prevention of leaching of nitrate to groundwater, a key parameter in determining the agronomic rate for land application is the available nitrogen content. Maintaining a cover crop is absolutely essential for a biosolids application program to be successful. For site-specific cases, it is usually appropriate to consult with a professional soil scientist or agronomist to verify proper application rates or if unique circumstances exist which are not addressed by these general guidelines.

PROPOSED CAPACITY, MANAGEMENT, OPERATION AND MAINTENANCE REGULATIONS

EPA has proposed a new round of regulations titled Capacity, Management Operation and Maintenance (CMOM). Though the regulations are yet to be formally adopted by EPA, some municipalities are anticipating the adoption and have moved forward with implementation. The CMOM regulations have recently been used as a basis for EPA audits for wastewater collection systems including for some facilities within Washington State. CMOM focuses on prevention of failure of collection systems and requires a program for long-term financing and repair. Under its authority granted by the federal Clean Water Act, EPA seeks to address sanitary sewer overflows (SSO) under the CMOM program. It is expected that elements of CMOM could be incorporated into NPDES permits.

In general, the CMOM requirements can be summarized in the following elements:

1. General performance standards including system maps, information management, and odor control.

2. Program documentation including the goals, organizational and legal authority of the organization operating the collection system.

3. An overflow response plan that requires response in less than 1 hour and is demonstrated to have sufficient and adequate personnel and equipment, etc. Estimated volumes and duration of overflows must be accurately measured and reported to the regulatory agency.

4. System evaluation requires that the entire system be cleaned on a scheduled basis (for example, once every 5 years), be regularly TV inspected, and that a program for short- and long-term rehabilitation replacement be generated. EPA has proposed, as a rule of thumb, a 1.5 to 2 percent system replacement rate which implies that an entire collection system is replaced somewhere in the range of a 50- to 70-year time period.

5. A capacity assurance plan that will use flow meters to model I&I, ensure lift stations are properly operated and maintained, and that source control is maintained.

6. A self-audit program to evaluate and adjust performance.

7. A communication program to communicate problems, costs, and improvements to the public and decision-makers.

EPA is considering some changes in design standards for collection systems including requiring that sanitary sewer overflows not occur except in extreme storms.

ENDANGERED SPECIES ACT

The Skagit River supports a variety of fish and wildlife species, including several that are currently listed as Threatened or Endangered under the Federal Endangered Species Act.

ESA listings impact activities that affect salmon and trout habitat, such as water uses, land use, construction activities, and wastewater disposal. Impacts to the City may include longer timelines for permit applications and more stringent regulation of construction impacts on in-water work and riparian corridors. The presence of ESA-listed species and associated critical habitat in the vicinity has the potential to impact future WWTP and outfall improvement projects.

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. If a project involves federal action (through, for example, an Army Corps of Engineers Section 404 permit), and is determined to be environmentally insignificant, a Finding of No Significant Impact (FONSI) is issued; otherwise, an Environmental Assessment (EA) or Environmental Impact Statement (EIS) would be required. NEPA is not applicable to projects that do not include a federal component or nexus. If there is a federal nexus, the City will need to follow NEPA procedures in order to obtain any permits required for upgrades to the WWTP, which are outlined in the Capital Improvement Plan of this document.

When both federal and state licenses or permits are required, then both NEPA and SEPA requirements must be met. WAC 197-11-610 allows the use of NEPA documents to meet SEPA requirements.

FEDERAL CLEAN AIR ACT

The federal Clean Air Act requires all wastewater facilities to plan to meet the air quality needs of the region. The permitting of facilities is based upon a mass balance being performed to review if a facility is required to seek an air permit from a federal and/or local permitting agency. According to the Northwest Air Pollution Control Agency, other than occasional, very localized industry problems at March's Point, this is an air quality attainment area with no identified long-term problems. Outdoor burning is prohibited in the Burlington city limits and Urban Growth Area by state action. An air quality permit for the City's wastewater treatment plant is not currently required. The City has a registration certificate from the Northwest Air Pollution Control Agency to operate their biosolids dryer.

WETLANDS

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

A U.S. Army Corps of Engineers 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 of Engineers 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 the siting of pump stations and sewer lines.

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 RCW 90.48 and WAC 173-220, Ecology issues permits for wastewater treatment facilities, and also land application of wastewater under WAC 173-216.

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 regulation defines a facility plan as described in federal regulations, 40 CFR Part 35, as an engineering report.

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 plants. 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. These design criteria, commonly referred to as the "Orange Book," primarily emphasize unit processes through secondary treatment. Any expansion or modification of the City's collection system and/or treatment plant will require continued conformance with Ecology criteria unless the City demonstrates that alternate standards provide similar reliability and efficacy.

Ecology Reliability Requirements

The Orange Book also presents guidelines for the wastewater treatment component design, including the number of units required for operation during peak flows. These requirements are derived from federal standards developed by the EPA and published in a 1974 document entitled *Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability.* Table 2-7 presents Ecology criteria for designation of WWTPs into three reliability classes based on the nature or their receiving water. Per the NPDES Permit and fact sheet, the Burlington WWTP has a reliability classification of Class I. Reliability criteria for WWTP in Class I are presented in Table 2-8.

TABLE 2-7

Reliability Classifications from the Orange Book

Reliability Class	Guideline
I	These are works whose discharge or potential discharge: (1) is into public water supply, shellfish, or primary contact recreation waters; or (2) as a result of its volume and/or character, could permanently or unacceptably damage or affect the receiving waters or public health if normal operations were interrupted. Examples of Reliability Class I works are those with a discharge or potential discharge near drinking water intakes, into shellfish waters, near areas used for water contact sports, or in dense residential areas.
II	These are works whose discharge, or potential discharge, as a result of its volume and/or character, would not permanently or unacceptably damage or affect the receiving waters or public health during periods of short-term operations interruptions, but could be damaging if continued interruption of normal operations were to occur (on the order of several days). Examples of a Reliability Class II works are works with a discharge or potential discharge moderately distant from shellfish areas, drinking water intakes, areas used for water contact sports, and residential areas.
III	These are works not otherwise classified as Reliability Class I or Class II.

Source: The Orange Book (Ecology, 2008), Paragraph G2-8.

TABLE 2-8

Reliability Requirements for Class I WWTPs

WWTP Component	Class I Requirements
Mechanically Cleaned Bar Screens	A backup bar screen, designed for mechanical or manual cleaning, shall be provided. Facilities with only two bar screens shall have at least one bar screen designed to permit manual cleaning.
Pumps	A backup pump shall be provided for each set of pumps performing the same function. The capacity of the pumps shall be such that, with any one pump out of service, the remaining pumps will have the capacity to handle the peak flow
Comminution Facility	If comminution of the total wastewater flow is provided, an overflow bypass with a manually-installed or mechanically-cleaned bar screen shall be provided. The hydraulic capacity of the comminutor overflow bypass should be sufficient to pass the peak flow with all comminution units out of service.
Primary Sedimentation Basins	The units shall be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 50 percent of the design basin flow.
Final Sedimentation Basins and Trickling Filters	The units shall be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 75 percent of the total design flow.
Activated Sludge Process Components.	Aeration Basin. A backup basin will not be required; however, at least two equal-volume basins shall be provided. (For the purpose of this criterion, the two zones of a contact stabilization process are considered as only one basin.) Aeration Blowers or Mechanical Aerators. There shall be a sufficient number of blowers or mechanical aerators to enable the design oxygen transfer to be maintained with the largest-capacity-unit out of service. It is permissible for the backup unit to be an uninstalled unit, provided that the installed units can be easily removed and replaced. However, at least two units shall be installed. Air Diffusers. The air diffusion system for each aeration basin shall be designed so that the largest section of diffusers can be isolated without measurably impairing the oxygen transfer capability of the system.

TABLE 2-8 – (continued)

Reliability Requirements for Class I WWTPs

WWTP Component	Class I Requirements
Disinfectant Contact Basins	The units shall be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 50 percent of the total design flow.
Electrical Power Supply	Sufficient to operate all vital components and critical lighting and ventilation during peak wastewater flow conditions. Except that the vital components used to support the secondary processes (i.e., mechanical aerators or aeration basin air compressors) need not be operable to full levels of treatment, but shall be sufficient to maintain the biota.

Source: The Orange Book (Ecology, 2008), Paragraph G2-9 and G2-10.

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 for the overall responsibility of operation of a wastewater treatment plant is defined by WAC 173-230 as the "operator in responsible charge." This individual must be State certified at or above the classification rating of the plant. The City's WWTP is currently assigned a Class III rating and the operating staff assigned to the plant has the required certification. The operator in charge must have at least a Class III certification and any operators in charge of each shift must have a Class II certification.

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

Basis of Regulations

The Washington State Department of Ecology has authority under the federal Water Pollution Control Act, also known as the Clean Water Act (CWA), to establish and administer programs to meet the requirements of the Act. Under RCW 98.40.35, the Washington Department of Ecology has the authority to establish "rules and regulations relating to standards of quality for waters of the state and for substances discharged therein..." The State of Washington also implements the National Pollutant Discharge Elimination System (NPDES) program created under the CWA.

Description of Regulations

WAC 173-201A establishes water quality standards within the State of Washington. The State adopted revised water quality standards in August, 2016. 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 standards assign specific uses, such as aquatic life, recreation, or water supply. Water quality standards have been developed for each use, for parameters such as fecal coliform, dissolved oxygen, temperature, pH, turbidity, and toxic, radioactive, deleterious substances.

The water uses that are defined in the standards for fresh water include:

Aquatic Life Uses

- Char spawning and rearing
- Core summer salmonid habitat
- Salmonid spawning, rearing, and migration
- Salmonid rearing and migration only
- Non-anadromous interior redbrand trout
- Indigenous warm water species

Recreational Uses

- Extraordinary primary contact recreation
- Primary contact recreation
- Secondary contact recreation

Water Supply Uses

- Domestic
- Agricultural
- Industrial
- Stock watering

Miscellaneous Uses

- Wildlife habitat
- Harvesting
- Commerce and navigation
- Boating
- Aesthetics

Water Quality Classifications for Fresh Waters

The City's outfall discharges to the Skagit River at mile 18.1. The Skagit River at the outfall discharge location is classified in WAC 173-201A-602 as having the following uses:

- Aquatic Life Uses: Core Summer Salmonoid Habitat
- Recreation Use: Primary contact recreation
- Water Supply Uses: Domestic water, industrial water, agricultural water, and stock water
- Miscellaneous Uses: Wildlife habitat, harvesting, commerce/navigation, boating, and aesthetics

Water quality criteria for the Skagit River at the City of Burlington WWTP Outfall are shown in Table 2-9.

TABLE 2-9

Water Quality Criteria for Skagit River at the City of Burlington WWTP Outfall

Parameter	Surface Water Criteria Value
Temperature	16 degrees C (7-day average of daily maximum temperatures)
Dissolved Oxygen	>9.5 mg/l (lowest 1-day minimum)
Turbidity	<5 NTU over background (background <50 NTU) <10 percent increase over background (background >50 NTU
Dissolved Gas	<110 percent of saturation at any point of sample collection
pH	Not outside the range of 6.5 to 8.5 standard units, with no human-caused variation >0.2 standard unit
Bacteria	**Primary Contact Recreation:** *E. coli* organism levels must not exceed a geometric mean value of 100 colonies/100 ml, with not more than 10 percent of all samples (or any single sample when less than 10 sample points exist) obtained for calculating the geometric mean value exceeding 320 colonies/100 ml

The water quality standards also have narrative criteria regarding toxic, radioactive, otherwise deleterious materials, or materials that impair aesthetics. These materials are prohibited in concentrations that affect aquatic life, human health, or impair aesthetics.

Numeric criteria for 29 toxic substances are listed in WAC 173-201A-240. Criteria are listed for both an acute and chronic basis and for certain substances (e.g., metals, chlorine, and ammonia), the criteria must be calculated as a function of receiving water pH, hardness, and whether salmonids are present.

Anti-Degradation Policy

The anti-degradation policy aims to maintain the highest possible quality of water in the state by preventing the deterioration of water bodies that currently have higher quality than the water quality standards require. The revised water quality standards define three tiers of waters in the anti-degradation policy.

Tier I water bodies are those with violations of water quality standards, from natural or human-caused conditions. The focus of water quality management is on maintaining or improving current uses and preventing any further human-caused degradation.

Tier II water bodies are those of higher quality than required by the water quality standards. The focus of the policy is on preventing degradation of the water quality and to preserve the excellent natural qualities of the water body. New or expanded actions are not allowed to cause a "measurable change" in the water quality, unless they are demonstrated to be "necessary and in the overriding public interest."

New or expanded actions that may cause a measurable change in water quality must conduct a Tier II review. For increased wastewater treatment plant discharges, this review will take place as part of the NPDES permit modification process. Measurable change, for the purpose of the anti-degradation policy, is defined as follows:

- Temperature increase greater than 0.3 degree C
- Dissolved oxygen concentration decrease greater than 0.2 mg/L
- Bacteria level increase greater than 2 CFU/100 ml
- pH change greater than 0.1 standard unit
- Turbidity increase greater than 0.5 NTU
- Any detectable change in concentration of toxic or radioactive substances, which include ammonia and chloride

A new or expanded action may be determined by Ecology to be necessary and in the overriding public interest based on a review of the following factors:

- Economic benefits, such as job creation
- Providing or contributing to necessary social services
- Status as a demonstration project using innovative technical or management approaches that produce a significant improvement over AKART

- Prevention or remediation of environmental or public health threats
- Societal or economic benefits of better health protection
- The loss of assimilative capacity for future industry or development
- The loss of benefits associated with the current high water quality, such as fishing or tourism uses

The new or expanded action would be allowed to measurably reduce the water quality only if it is demonstrated that the action has selected the combination of site, technical, and managerial approaches that will minimize the effect on water quality.

Tier III water bodies are specially designated as outstanding resource waters. The revised standards do not initially define Tier III water bodies; however, the standards allow the public or Ecology to nominate water bodies for inclusion in the Tier III class. There are two classes within Tier III: Tier III(A) prohibits all future degradation, while Tier III(B) allows future degradation that does cause a "measurable change" to occur from well-controlled activities.

Discharge Permits

Discharging to surface water requires an NPDES permit issued by Ecology under WAC 173-220. Wastewater treatment plants must generally, at a minimum, meet technology-based limits that include 30 mg/L total suspended solids (TSS) and 30 mg/L 5-day biochemical oxygen demand (BOD_5) (typically termed "30-30 limits"). Additionally, under WAC 173-201A-060, State Water Quality Standards, Ecology is authorized to condition NPDES permits so that the discharge meets water quality standards. Therefore, other permit conditions in addition to or more stringent than the 30-30 limits could be added to ensure that the water quality of the receiving water is not degraded.

Compliance Schedules

When it is not possible to achieve compliance with the standards in WAC 173-201A on an immediate basis, Ecology may issue an order with a compliance schedule to allow for further water quality studies, implementation of best management practices, or construction of necessary treatment capability. Compliance schedules may only be issued for existing discharges.

Mixing Zone

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 a 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. Modeling is used to estimate the amount of mixing within the mixing zone. A mixing zone is the defined area in the receiving water surrounding the discharge port(s), where wastewater mixes with the receiving water. Within mixing zones, the pollutant concentrations may exceed water quality numeric standards, so long as the discharge does not interfere with the designated uses of the receiving water body. The pollutant concentrations outside of the mixing zones must meet water quality numeric standards. The Water Quality Standards (WAC 173-201A-400) allow the Washington State Department of Ecology to authorize mixing zones around a point of discharge in establishing surface water quality-based effluent limits. Both "acute" and "chronic" mixing zones may be authorized for pollutants that can have a toxic effect on the aquatic environment near the point of discharge. The concentration of pollutants at the boundary of these mixing zones may not exceed the numerical criteria for that type of zone.

Through modeling, the potential for violating the water quality standards at the edge of the mixing zone and any necessary effluent limits are determined (see Table 2-10). Steady-state models are the most frequently used tools for conducting mixing zone analyses. The mixing zones are defined in the Permit as:

- Acute mixing zone – 100 feet upstream and 308 feet downstream of the outfall. The dilution factor at the boundary of the acute mixing zone during the critical condition is 41.6.

- Chronic mixing zone – 10 feet upstream and 31 feet downstream of the outfall. The dilution factor at the boundary of the chronic mixing zone during critical condition is 15.2.

TABLE 2-10

Mixing Zone Dilution Factors, Burlington WWTP

Criteria	Acute	Chronic
Aquatic Life	15.2	41.6
Human Health, Carcinogen	--	41.6
Human Health, Non-carcinogen	--	41.6

The City of Burlington completed an Outfall Evaluation and Mixing Zone Study in September of 2020. This study concluded that there is no reasonable potential to exceed water quality criteria in the Skagit River for the pollutants listed in Table 2-9 and metals.

RECLAIMED WATER STANDARDS

Reclaimed water is the effluent derived from a wastewater treatment system that has been adequately and reliably treated, such that it is suitable for a beneficial use or a controlled use. 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." Consideration of the feasibility of reclaimed water is required in General Sewer Plans; therefore, it is relevant to this Plan.

On January 23, 2018, the Department of Ecology adopted a new rule, Chapter 173-219 WAC, Reclaimed Water. The Departments of Ecology and Health cooperatively developed this Rule with significant input from stakeholders and technical advisory groups. The Rule sets forth minimum standards for reclaimed water projects. The agencies may incorporate additional enforceable conditions into a reclaimed water permit issued under the Rule as needed to protect public health and the environment.

The *Reclaimed Water Rule (WAC-173-219)* defines the water quality standards for reclaimed water. The Reclaimed Water Regulations define three classes of reclaimed water: Class A+, Class A, and Class B. The beneficial use of reclaimed water is limited by its classification. Classes of reclaimed water are defined as follows:

> "Class A+ reclaimed water" is the highest quality of reclaimed water and can be used for Class A and Class B uses. Class A can be used for Class A and Class B beneficial uses. Class B water can be used only for Class B beneficial uses. "Class A+ reclaimed water" means a water resource that meets the treatment requirements for Class A reclaimed water and any additional criteria determined necessary on a case-by-case basis by Washington State Department of Health (WDOH) for direct potable reuse. Class A+ reclaimed water is required for direct potable reuse.
>
> "Class A reclaimed water" means a water resource that meets the treatment requirements of this chapter, including, at a minimum, oxidation, coagulation, filtration, and disinfection. Membrane Filtration is acceptable in lieu of coagulation and filtration. Class A reclaimed water may be used for: commercial, industrial, or institutional toilet and urinal flushing, laundry, public water features where public contact may occur; landscape irrigation with direct or indirect public access; irrigation of food crops, trees, and fodder in pastures accessed by milking animals; discharge to Category II wetlands without characteristics provided application rate and supplemental performance standards are met, Category III or IV wetlands, constructed wetlands with public access; direct groundwater recharge; or recovery of reclaimed water stored in an aquifer.

"Class B reclaimed water" means a water resource that meets the treatment requirements of this chapter, including, at a minimum, oxidation, and disinfection. Class B Reclaimed water may be used for: commercial, industrial, and institutional uses with environmental contact or where there is restricted access; landscape irrigation with restricted access and no human contact; frost protection of orchard crops; irrigation of non-food crops, irrigation of orchards, vineyards, process food crops, trees or seed crops in pastures not accessed by milking animals.

The salient performance standards for Class A and Class B reclaimed water are defined in Tables 2-11 and 2-12. Class A+ reclaimed water requirements must be established by jurisdictional health department on a case-by-case basis, and must have approval of the WDOH before reclaimed water can be beneficially used for direct potable reuse.

TABLE 2-11

Minimum Biological Oxidation Performance Standards

Biological Oxidation		
Parameter	**Minimum Biological Oxidation Performance Standard**	
Dissolved Oxygen	Must be measurably present	
Parameter	**Month Average**	**Weekly Average**
BOD_5	30 mg/L	45 mg/L
$CBOD_5$	25 mg/L	40 mg/L
TSS	30 mg/L	45 mg/L
Parameter	**Minimum**	**Maximum**
pH	6 s.u.	9 s.u.
pH (groundwater recharge)	6.5 s.u.	8.5 s.u.

TABLE 2-12

Class A and B Performance Standards

Parameter	Class A Reclaimed Water		Class B Reclaimed Water	
	Monthly Average	Sample Maximum	Monthly Average	Sample Maximum
Coagulation/Filtration				
Turbidity	2 NTU	5 NTU	Not Applicable	Not Applicable
Membrane Filtration				
Turbidity	0.2 NTU	0.5 NTU	Not Applicable	Not Applicable
Disinfection				
Total Coliform	2.2 MPN/100 mL or CFU/100 mL	23 MPN/100 mL or CFU/100 mL	23 MPN/100 mL or CFU/100 mL	240 MPN/100 mL or CFU/100 mL
Virus Removal	See disinfection process standards in WAC 173-219-340		Not Applicable	Not Applicable
Denitrification				
Total Nitrogen	10 mg/L	15 mg/L	Not Applicable	Not Applicable

Note: Numerical values for parameter represent maximum values for monthly average and single sample results.

STATE ENVIRONMENTAL POLICY ACT

The WAC 173-240-050 requires a statement in all wastewater comprehensive plans regarding proposed projects in compliance with the State Environmental Policy Act (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 (DNS) is issued; however, if a project will have a probable significant adverse environmental impact, an Environmental Impact Statement (EIS) will be required.

GROWTH MANAGEMENT ACT

The Washington State Growth Management Act (GMA) was enacted in 1990 and requires certain counties and local governments (including Skagit County and Burlington) to plan for the population growth that will occur over the next 20 years within an established Urban Growth Area. The GMA also requires cities and the county to classify critical areas (wetlands, aquifer recharge areas, fish and wildlife habitat areas, geologically hazardous areas, and frequently flooded areas) and to establish development regulations to protect these areas.

ACCREDITATION OF ENVIRONMENTAL LABORATORIES (WAC 173-050)

The State of Washington recently established a requirement that all laboratories reporting data to comply with NPDES and state water discharge (SWD) permits must be generated by an accredited laboratory. This accreditation program establishes specific tasks for quality assurance and quality control (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 commercial laboratories may be used for analyses reported for compliance with NPDES or SWD permits. In planning for an on-site laboratory, staffing must be sufficient to allow for QA/QC procedures to be performed. Based on Ecology's lab accreditation website, the Burlington WWTP laboratory is accredited for D.O., TSS, pH, BOD and fecal coliform.

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

Grit and screenings are not subject to the sludge regulations in WAC 173-308, but its disposal is regulated under the state solid waste regulations in 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 and screenings must pass the paint filter test, which determines the amount of free liquids associated with the solids, and the toxic characteristics leachate procedure (TCLP) test, which determines if the waste has hazardous characteristics.

SHORELINE SUBSTANTIAL DEVELOPMENT PERMIT

Shoreline substantial development (SSD) permits are required for projects in which the total cost or fair market value, whichever is higher, exceeds $5,000. 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, depending on the proximity to the water, and preserve or enhance public access to the water. Specific details about exemptions from this permit are listed in WAC 173-27-040(2) and include development for which the total cost or fair market value, whichever is higher, does not exceed $5,000, normal maintenance or repair of existing structures (including damages by accident), construction of normal protective bulkheads common to single-family residences, emergency construction necessary to protect property from damage by the elements, construction and practices normal for farming and agriculture, construction or modification of navigational aids, single-family development, and the construction of docks for personal and/or community use.

Shorelines are defined by lakes or reservoirs of 20 acres or greater, streams with a mean annual flow of 20 cubic feet per second 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.

Local shoreline master programs are developed in accordance with guidelines from Ecology.

FLOODPLAIN DEVELOPMENT PERMIT

Local governments that are participating in the National Flood Insurance Program are required to review projects (including wastewater collection facilities) 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 (HPA)

Under the Washington State Hydraulic Code (WAC 220-110), the Washington State Department of Fish and Wildlife requires a Hydraulic Project Approval 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, a Hydraulic Project Approval will be required, and must include provisions necessary to minimize project-specific and cumulative impacts to fish.

ON-SITE SEPTIC SYSTEMS

In some cases, wastewater may be treated and disposed of on-site either by individual septic systems or community on-site systems. The City indicates there are a few septic systems remaining within the sewer service area. Options for providing sewer service to areas currently unsewered are discussed later in this Plan.

Municipalities, such as cities and counties, are required under the GMA to eventually provide wastewater collection services to all residents of the Urban Growth Area that are currently not connected. On-site septic systems should be designed to meet the DOH design standards. Approval of the systems will be made either by Skagit County Health Department for systems with a capacity of less than 3,500 gpd, by DOH for systems with a capacity between 3,500 gpd and 100,000 gpd, or by Ecology for systems with a capacity greater than 100,000 gpd. The State Board of Health statute that provides the authority for DOH to adopt rules for sewage treatment is RCW 43.20.

SEWER ORDINANCES AND PLANNING POLICIES

The City operates its sewer system as described in the City's Municipal Code Chapter 13.04, Sewage Disposal, Chapter 13.08, Sewer Rates, and Chapter 13.12, Septic Tank Sludge. In addition to the City's municipal code, the siting of any wastewater facilities outside of the city limits, such as pump stations, will have to adhere to Skagit County's planning and zoning policies at the time of construction.

CHAPTER 3

LAND USE, POPULATION PROJECTIONS AND SERVICE AREA CHARACTERISTICS

INTRODUCTION

This chapter defines the sewer service area and the sewer basins used for evaluation in this Plan and presents population projection and land use. Various natural features of the service area are discussed, such as topography, geology, soils, climate, sensitive areas, floodplains, wetlands, air quality, and surface and ground water resources. Information on the public utilities available in the area is also presented.

The planning period for this *Wastewater Comprehensive Plan* is from 2020 through 2040 to provide consistency with population projections and other planning documents

SERVICE AREA

The City of Burlington is located in the northwest region of Washington State in Skagit County near the junction of Interstate 5 and Highway 20. The City is located on the Skagit River as shown in Figure 1-1.

The City currently provides sewer service to the majority of the area within the current city limits; an estimated 35 homes within city limits are served by on-site septic systems.

The sewer service area for the City of Burlington (study area for this Plan) consists of the City's Urban Growth Area (UGA) and City limits, and regions west of the City in unincorporated Skagit County as shown on Figure 3-1. The City of Burlington uses the term UGA to specifically refer to the areas outside of the current city limits that are within the UGA. Skagit County currently has zoning and land use jurisdiction over these unincorporated areas. The City limits encompass approximately 2,762 acres and the UGA consists of an additional 473 acres, for a total City area of 3,235 acres. The City's sewer service area encompasses an additional 3,586 acres, located in the Western Service Area, for a total sewer service area of 6,821acres, excluding the area served by the Samish Water District pipeline (described below).

SERVICE AREA HISTORY

The City of Burlington was incorporated in 1902 with a population of 260. The original wastewater treatment plant and collection system were constructed in 1946. In 1977, the City expanded the sanitary sewer system to serve development to the west of the City (Port of Skagit County and Bayview Ridge) and constructed a secondary treatment plant located on Section Street, adjacent to the Skagit River. A pipeline was also constructed

at this time, bringing wastewater from the Samish Water District in Whatcom County, Washington State Department of Transportation rest stop near Alger, Whatcom Meadows Campgrounds, and several businesses near Cook Road. The pipeline also can accept standby capacity from the Skagit Valley Resort and Casino.

NATURAL FEATURES OF THE SEWER SERVICE AREA

Various natural features of the service area are discussed below, including climate and precipitation, soils, geology, and site-sensitive areas, such as floodplains, and wetlands. The natural features of the service area will have an impact on the design and siting of wastewater collection and treatment facilities.

TOPOGRAPHY

The geography of the City of Burlington is, with a few exceptions, generally quite flat, with elevations ranging from 20 to 40 feet within the city limits. Figure 3-2 shows the topography of the Burlington area based on United States Geological Survey (USGS) maps. There are a few higher elevation areas within the City including Burlington Hill, which is located on the north side of the City. The elevations of Burlington Hill are up to 450 feet. In addition, the service area west of the City includes higher elevation areas, with elevations up to 140 feet.

SOILS AND GEOLOGY

Surface geology will determine the stability, strength, and permeability of soils, which impacts the suitability of land for building construction and on-site sewage systems. Figure 3-3 provides a map of the soil types, based on the United States Department of Agriculture, Soils Conservation Service. As shown, there are a wide variety of soils in the area, predominantly different types of loam.

CLIMATE

The National Oceanic and Atmospheric Administration (NOAA) collects data from a nearby weather station in Bellingham. Climate data from this station averaged over a 30-year period is summarized in Table 3-1. Winters are wet and mild. Snow falls occasionally, but usually melts within a few days.

N

0 2,000 4,000 8,000 Feet

LEGEND:

- CITY LIMITS
- CITY UGA
- BAYVIEW RIDGE UGA
- PARCELS

Western Service Area

City of Burlington

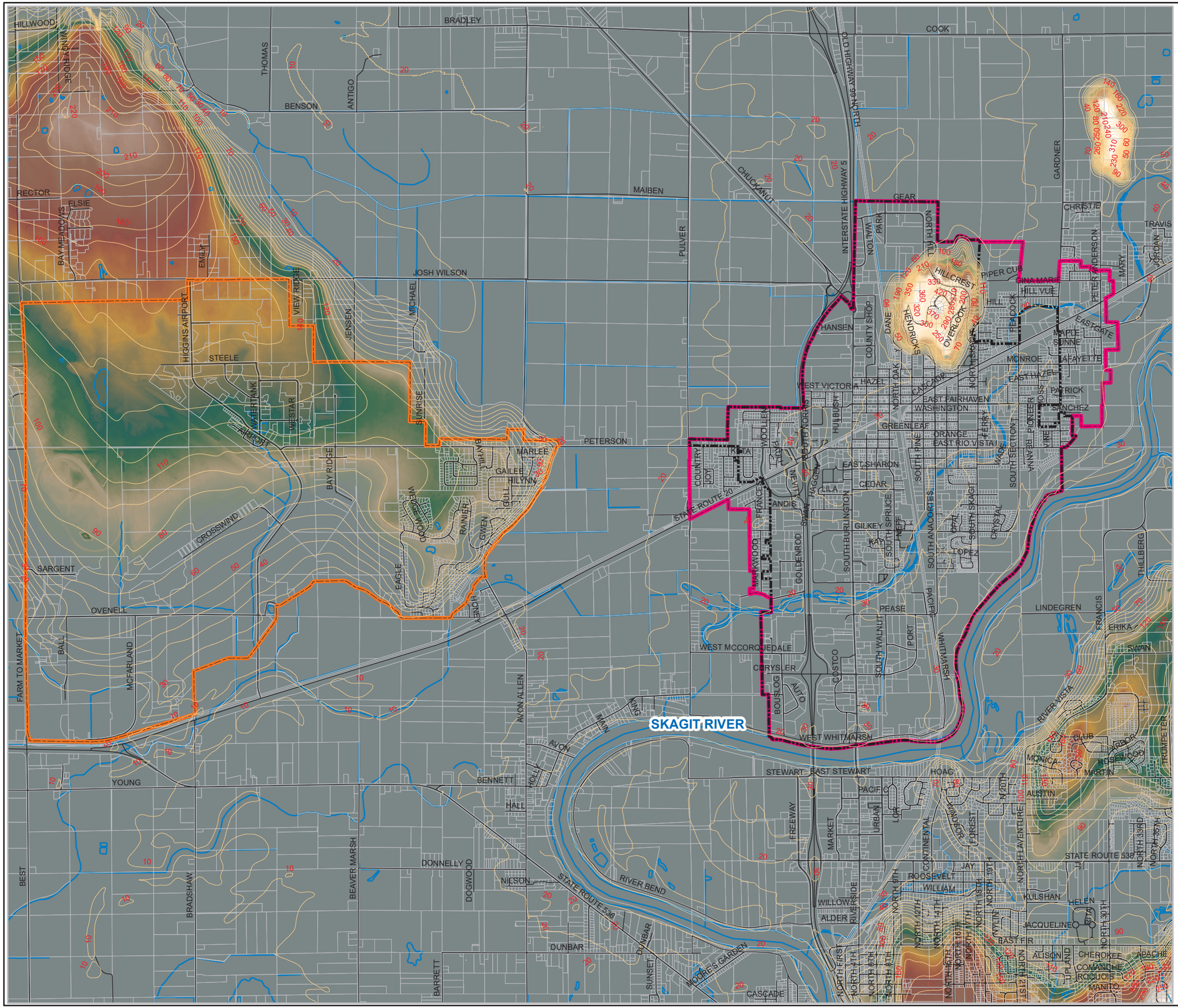
SKAGIT RIVER

WWTP

CITY OF BURLINGTON

WASTEWATER COMPREHENSIVE PLAN
FIGURE 3-1
SANITARY SEWER SYSTEM SERVICE AREA

Gray & Osborne, Inc.
CONSULTING ENGINEERS



N

0 1,500 3,000 6,000 Feet

LEGEND

- 10' CONTOURS - USGS (INTERPOLATED)
- CITY LIMITS
- CITY UGA
- BAYVIEW RIDGE UGA
- PARCELS
- WATER

Source: USGS 10m DEM 2019

CITY OF BURLINGTON

WASTEWATER COMPREHENSIVE PLAN
FIGURE 3-2
TOPOGRAPHY

Gray & Osborne, Inc.
CONSULTING ENGINEERS

N

0 1,500 3,000 6,000 Feet

LEGEND

- CITY LIMITS
- CITY UGA
- BAYVIEW RIDGE UGA
- PARCELS
- 4 Andic Xerochrepts, warm-Rock outcrop complex, 65 to 90 percent slopes
- 5 Barneston gravelly loam, 0 to 8 percent slopes
- 6 Barneston very gravelly sandy loam, 8 to 30 percent slopes
- 10 Bellingham silt loam
- 16 Bow gravelly loam, 0 to 3 percent slopes
- 17 Bow gravelly loam, 3 to 8 percent slopes
- 20 Bow-Urban land complex, 0 to 8 percent slopes
- 21 Briscot fine sandy loam
- 46 Dystric Xerochrepts, 45 to 70 percent slopes
- 55 Fidalgo-Lithic Xerochrepts-Rock outcrop complex, 3 to 30 percent slopes
- 56 Field silt loam
- 57 Field silt loam, protected
- 67 Hoogdal silt loam, 8 to 15 percent slopes
- 85 Laconner very gravelly loamy sand, 0 to 8 percent slopes
- 87 Larush fine sandy loam
- 96 Mt. Vernon very fine sandy loam
- 98 Mukilteo variant muck
- 102 Norma silt loam
- 104 Pilchuck loamy sand
- 105 Pilchuck variant fine sandy loam
- 106 Pits
- 108 Riverwash
- 118 Sedrowoolley silt loam
- 123 Skagit silt loam
- 124 Skipopa silt loam, 0 to 3 percent slopes
- 130 Snohomish silt loam
- 136 Sumas silt loam
- 137 Swinomish gravelly loam, 0 to 8 percent slopes
- 138 Swinomish gravelly loam, 8 to 15 percent slopes
- 139 Swinomish gravelly loam, 15 to 30 percent slopes
- 143 Terric Medisaprists, 0 to 2 percent slopes
- 146 Tokul gravelly loam, 0 to 8 percent slopes
- 147 Tokul gravelly loam, 8 to 15 percent slopes
- 152 Urban land-Mt. Vernon-Field complex
- 153 Vanzandt very gravelly loam, 0 to 15 percent slopes
- 165 Xerorthents, 0 to 5 percent slopes
- 168 Water

Source: U.S. DEPARTMENT OF AGRICULTURE

CITY OF BURLINGTON

WASTEWATER COMPREHENSIVE PLAN
FIGURE 3-3
SOILS MAP

Gray & Osborne, Inc.
CONSULTING ENGINEERS

TABLE 3-1

Average Precipitation and Temperature(1)

Month	Average Precipitation (inches)	Average Normal Temperature (°F)
January	4.47	41.3
February	3.04	42.1
March	3.38	46
April	2.79	50.4
May	2.42	55.8
June	1.66	60.2
July	0.96	64
August	1.12	64.2
September	1.93	59.2
October	3.87	52
November	5.88	45.2
December	4.33	40.5
Annual Total	**35.85**	**N/A**
Annual Average	**N/A**	**51.7**

(1) Climate data is from the Bellingham weather station, NOAA *Climatological Data, Annual Summary, Washington*, for the years 1980 through 2020.

SURFACE WATER

The primary surface water affected by the Burlington WWTP is the Skagit River. The Skagit River originates in the north Cascades, flowing southwesterly and ending in Skagit Bay. The City of Burlington's wastewater outfall is located in the Skagit River, adjacent to the treatment plant at River Mile 18.1.

Average monthly flow rates recorded for the Skagit River are shown below in Table 3-2. These flows were recorded from the Mount Vernon gauging station and available from USGS Surface Water Daily Statistics for Washington.

TABLE 3-2

Average Monthly Flow Rates for the Skagit River(1)

Month	Average Flow (cfs)
January	19,800
February	17,700
March	15,600
April	15,400
May	19,300
June	21,700
July	18,100
August	10,300
September	9,000
October	12,600
November	21,500
December	17,500

(1) Flow data is from the Mount Vernon gauging station, USGS Water Daily Statistics for Washington, for the time period January 1, 1980 through October 31 30, 2020.

SENSITIVE AREAS

In 2018, the City of Burlington updated its Critical Areas Ordinance in accordance with the GMA. These regulations are compliant with the GMA and were developed and adopted using the best available science. Critical areas within the sewer service area include those classified as wetlands, flood hazard areas, fish and wildlife habitat, geologically hazardous areas including steep slopes, and groundwater recharge areas.

Flood hazard areas have been defined by Federal Emergency Management Agency (FEMA) floodplain boundary maps. Sensitive areas within the City of Burlington are shown on Figure 3-4. Much of the City and surrounding area are located within the 100-year floodplain as designated by FEMA.

DRAINAGE BASINS

The existing sewer service area currently includes 28 sewer drainage basins, as shown on Figure 3-5. The drainage basins will be used for evaluation of projected population and wastewater flow rates. The drainage basins were identified as areas that flow by gravity sewer either to pump stations or the WWTP. Because of the flat nature of much of the City, the majority of the system is served by gravity sewer which drains to pump stations. The majority of the pump stations discharge through a force main to a gravity sewer system which drains to another pump station, eventually draining to the WWTP. A

N

0 1,500 3,000 6,000 Feet

LEGEND:

- CITY LIMITS
- CITY UGA
- BAYVIEW RIDGE UGA
- PARCELS
- WATER

NATIONAL WETLANDS INVENTORY:

- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Riverine

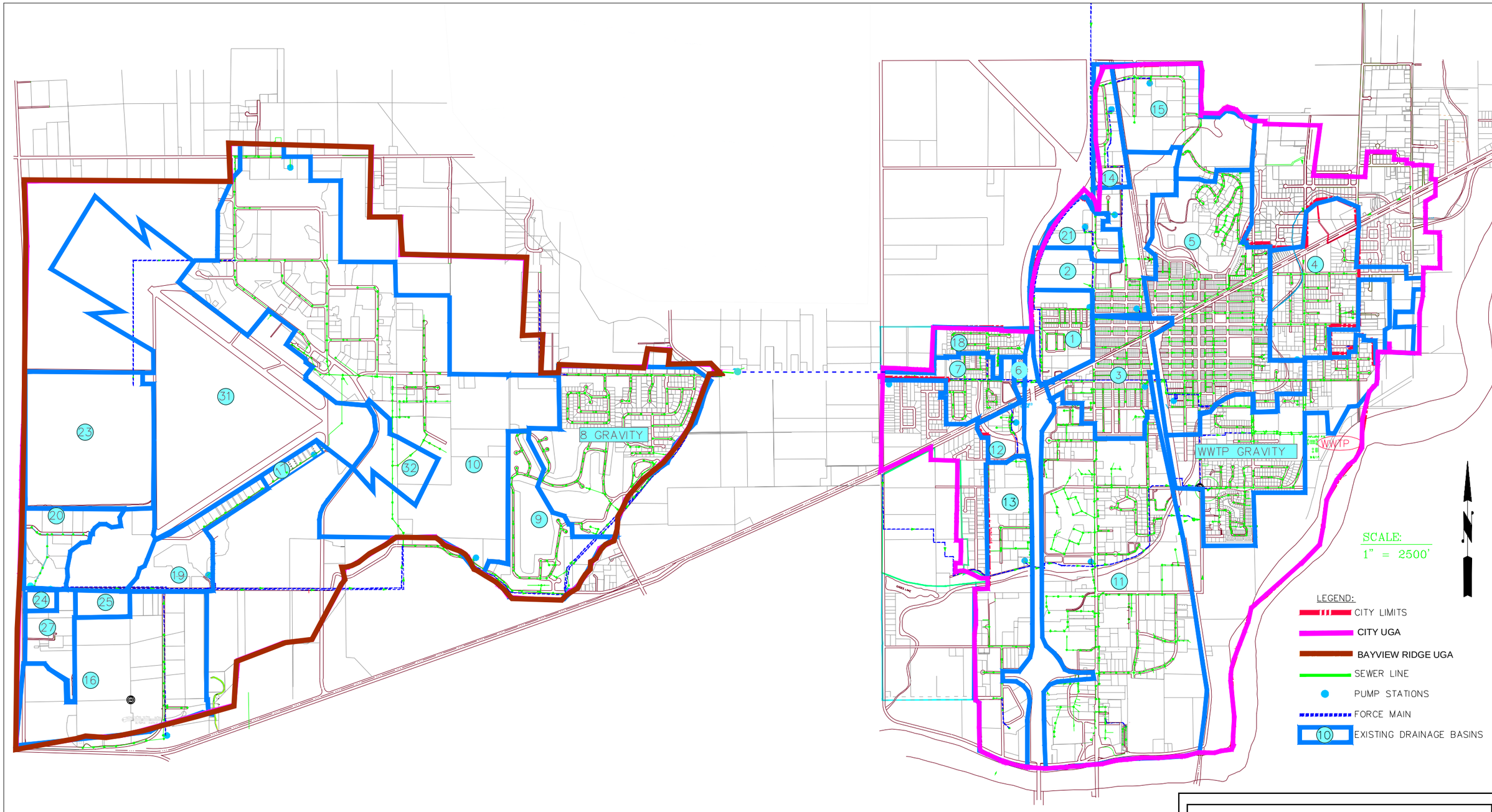
FEMA ZONE

- 100-YEAR FLOODPLAIN

CITY OF BURLINGTON

WASTEWATER COMPREHENSIVE PLAN
FIGURE 3-4
SENSITIVE AREAS MAP

Gray & Osborne, Inc.
CONSULTING ENGINEERS



CITY OF BURLINGTON

SEWER COMPREHENSIVE PLAN

FIGURE 3-5

EXISTING DRAINAGE BASINS

Gray & Osborne, Inc.
CONSULTING ENGINEERS

schematic representation of the City's existing pump stations and drainage basins is presented in Figure 3-6. Each drainage basin was assigned a number to help with identification on figures and tables. Table 3-3 provides the existing gravity drainage basins and the existing gravity area which currently drains to each basin.

TABLE 3-3

Sewer Drainage Basin Areas(1)

Drainage Basin No.	Drainage Basin Name	Gravity Area (acres)
1	Pump Station 1	76.04
2	Pump Station 2	137.25
3	Pump Station 3	137.45
4	Pump Station 4	152.91
5	Pump Station 5	370.49
6	Pump Station 6	4.79(2)
7	Pump Station 7	68.21
8	Pump Station 8	265.17
9	Pump Station 9	149.75
10	Pump Station 10	837.44
11	Pump Station 11	738.58
12	Pump Station 12	25.96
13	Pump Station 13	214.26
14	Pump Station 14	48.93
15	Pump Station 15	149.67
16	Pump Station 16	334.41
17	Pump Station 17	10.17
18	Pump Station 18	33.27
19	Pump Station 19	82.39
20	Pump Station 20	64.25
21	Pump Station 21	47.37
22	Gravity to WWTP	242.81
23	PACCAR	242.47
24	Skagit County Recovery Facility	11.04
25	PSE	20.99
27	Dahlstead	51.95
31	Airport Runway 1	601.47
32	Airport Runway 2	57.47

(1) The sewer basin areas may not match values in other tables due to rounding.

(2) Also receives flow from the Samish Water District pipeline.

Because many of the drainage basins receive flows from pump stations as well as gravity sewer, flow analysis must include the upstream service areas which pump into the drainage basin. Future flow projections are developed in Chapter 5. In addition, the Pump Station 6 drainage basin receives flow from the Samish Water District pipeline. This pipeline was originally constructed in 1976 to convey effluent from the Samish Water District wastewater treatment lagoon to the City sewer system for further treatment at the City's wastewater treatment plant. Since its original construction, several other customers have been added to the pipeline. Some of the major customers include the Washington State Department of Transportation rest stop near Alger, Whatcom Meadows Campgrounds, and several businesses near Cook Road. The pipeline also can accept standby capacity from the Skagit Valley Resort and Casino. A full inventory of customers and pump stations and a map of the pipeline service area are provided in Appendix C. The Samish Water District has contracted for conveyance and treatment of an annual average flow of 250,000 gpd with the City of Burlington. This contracted capacity includes the Samish Water District and all the additional customers, except the Skagit Valley Resort and Casino. The Casino has a separate agreement with the City for the conveyance and treatment of 60,000 gpd annual average flow.

The Casino is served by its own membrane bioreactor wastewater treatment facility and does not discharge wastewater to the Samish Water District pipeline. They do, however, maintain and cover the cost for a 60,000 gpd standby capacity in the City of Burlington wastewater conveyance and treatment system in the event the membrane bioreactor plant becomes inoperable.

WATER SYSTEM

The Skagit County PUD operates a water system that supplies potable water to the Cities of Burlington, Mount Vernon, Sedro-Woolley, and surrounding unincorporated areas. The water source is surface water entering the Judy Reservoir, a 1.45-billion-gallon reservoir located above the Town of Clear Lake. Water could also be pumped from the Skagit River to Judy Reservoir during critical periods. Water from Judy Reservoir is treated by coagulation, flocculation, filtration, disinfection, and pH adjustment before it is introduced to the water distribution system.

ZONING AND LAND USE

The City has designated zoning classifications for areas within the city limits. Skagit County currently has zoning and land use jurisdiction over unincorporated areas that are provided sewer service by the City, including the areas within the City's UGA. The City and County zoning and land use designations are not identical so each are calculated separately.

SAMISH WATER DISTRICT (PRIVATE)

AIRPORT RUNWAY 1 (31)

AIRPORT RUNWAY 2 (32)

PACCAR (23)

P.S. NO. 17 (17)

P.S. NO. 19 (19)

P.S. NO. 10 (10)

P.S. NO. 20 (20)

PSE (25)

P.S. NO. 8 (8)

SKAGIT CO. RECOVERY (24)

P.S. NO. 9 (9)

DAHLSTEAD (27)

P.S. NO. 16 (16)

P.S. NO. 18 (18)

P.S. NO. 7 (7)

P.S. NO. 6 (6)

P.S. NO. 12 (12)

P.S. NO. 13 (13)

P.S. NO. 15 (15)

P.S. NO. 14 (14)

P.S. NO. 21 (21)

P.S. NO. 1 (1)

P.S. NO. 2 (2)

RASPBERRY RIDGE UNITS I, II, AND III

P.S. NO. 4 (4)

GRAVITY TO WWTP (22)

WWTP

P.S. NO. 3 (3)

P.S. NO. 5 (5)

P.S. NO. 11 (11)

LEGEND:

= PUMPED FLOW

= GRAVITY FLOW

CITY OF BURLINGTON

WASTEWATER COMPREHENSIVE PLAN

FIGURE 3-6

EXISTING WASTEWATER SYSTEM DRAINAGE BASINS SCHEMATIC

Gray & Osborne, Inc.
CONSULTING ENGINEERS

EXISTING CITY ZONING

Figure 3-7 provides a map of current City zoning. The breakdown of the existing City zoning can be seen in Table 3-4. Residential zoning makes up about 34 percent of the total land area and approximately 28 percent of the residential zoning consists of single-family residential zones. The existing commercial zoning in Burlington is concentrated along Burlington Boulevard and includes the Cascade Mall as well as a number of factory outlets. Another 15 percent of the total area is for public use or open spaces. This area includes city parks, schools, and highway right-of-way as well as privately owned land that is limited for development, such as in floodplains.

TABLE 3-4

Existing Zoning in City(1)

Land Use Designation	Land Use Category	Acreage	% of Total Acreage
R-1-6.0	Single-Family Residential	118	4.3%
R-1-7.6	Single-Family Residential	85	3.1%
R-1-8.4	Single-Family Residential	318	11.5%
R-1-9.6	Single-Family Residential	285	10.3%
R-2	Two-Family Residential	57	2.1%
R-3	Multi-Family Residential	123	4.4%
R-S	Semipublic District	25	0.9%
M-1	Industrial District	239	8.6%
B-P	Business Park District	118	4.3%
C-1	General Commercial District	630	22.8%
C-2	Heavy Commercial	314	11.4%
B-1	Business District	13	0.5%
MR-NB	Medium Residential and Neighborhood Business	41	1.5%
OSPA	Open Space, Parks, and Agriculture	216	7.8%
T-C	Transportation Corridor	182	6.6%
Total		**2,762**	**100%**

(1) The zoning areas may not match other tables due to rounding.

The City of Burlington is currently in the process of revising its zoning classifications. However, since the new classifications are not yet adopted, this plan will use the classifications shown in Table 3-4 to establish future wastewater characteristics. The proposed revisions to the zoning classifications have been reviewed. The proposed change that will have the greatest impact on the future characterization of wastewater will be the reclassification of the General Commercial District (C-1) to Mixed Use Commercial – Large Scale (MUC-2), to encourage more residential development. This proposed reclassification will be considered for projections of future wastewater characteristics for areas presently zoned C-1 (see Chapters 5 and 6).

EXISTING COUNTY ZONING

Figure 3-8 provides a map of current County zoning. The breakdown of the existing County zoning within the Western Service Area can be seen in Table 3-5. As shown, the Western Service Area is predominantly zoned for aviation related activities and heavy and light industrial, with a relatively small amount of residential.

TABLE 3-5

Existing County Zoning in the Western Sewer Service Area[(1)(2)]

Land Use Designation	Land Use Category	Acreage	% of Total Acreage
AVR	Aviation Related	768	21.4%
AVR-L	Aviation Related - Limited	394	11.0%
BR-HI	Bayview Ridge Heavy Industrial	908	25.3%
BR-LI	Bayview Ridge Light Industrial	1,104	30.8%
BR-R	Bayview Ridge Residential	412	11.5%
Total		**3,586**	**100%**

(1) The zoning areas may not match other tables due to rounding.
(2) Excludes rights-of-way.

FUTURE LAND USE

The areas surrounding the City not in the sewer service area are mostly agricultural farmland. The City has worked with Skagit County and other organizations to design a program to protect the agricultural resource land at the edge of the City and to encourage higher density development in the existing city limits, with a focus on the downtown area. In addition, development outside of the city limits in the sewer service area is focused on the Bayview Ridge and Port of Skagit County areas.

The City expects that unincorporated UGAs will be annexed into the City as development occurs.

POPULATION PROJECTIONS

CURRENT POPULATION

The 2020 census data were released in April 2021 and are accounted for in the subsequent tables and calculations. The City Planning Department has provided historical population for the years 2000 through 2021 as seen in Table 3-6.

N

0 900 1,800 3,600 Feet

LEGEND:

- CITY LIMITS
- CITY UGA
- PARCELS

ZONING:

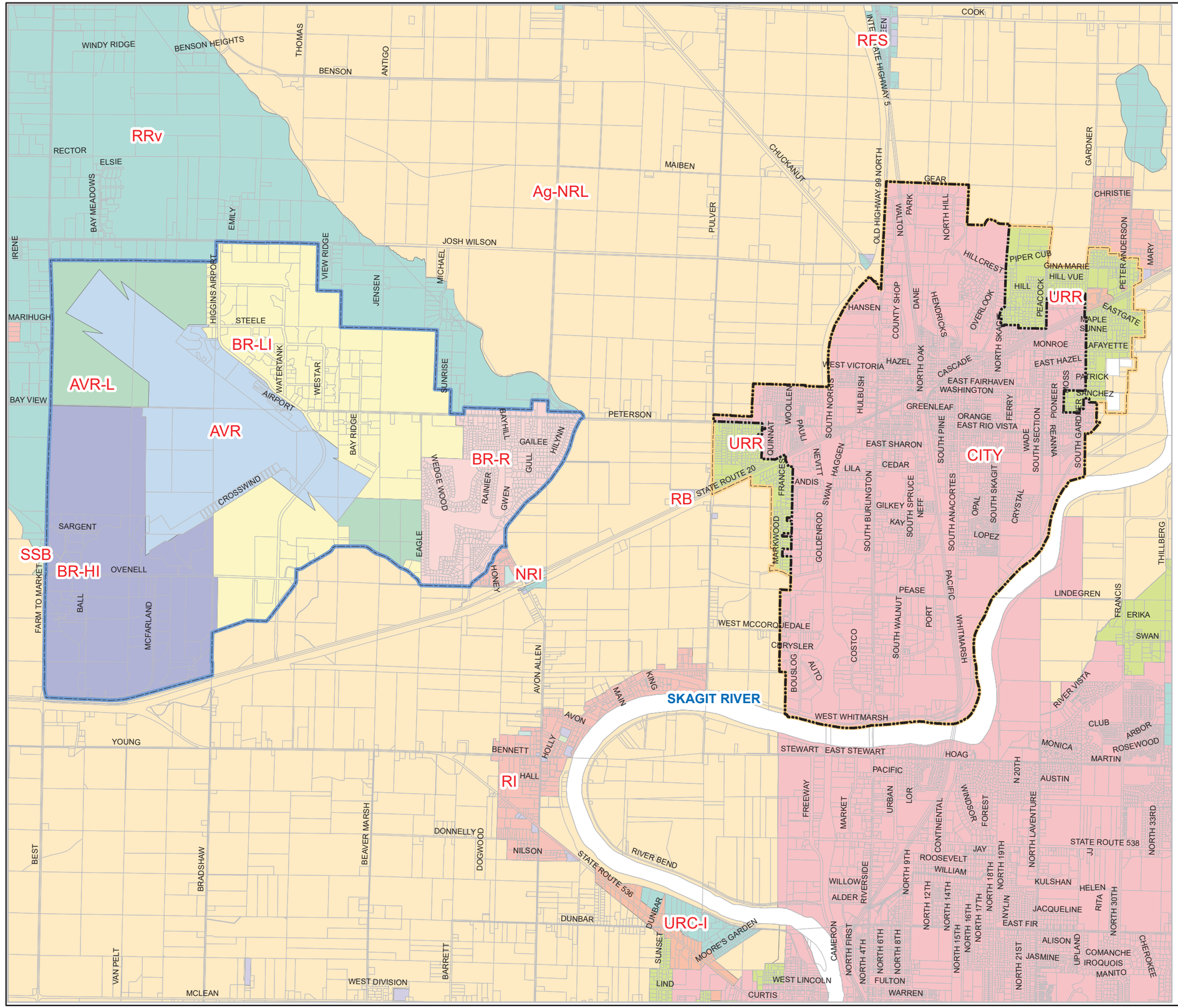
- B-1 BUSINESS DISTRICT
- B-P BUSINESS PARK DISTRICT
- C-1 GENERAL COMMERCIAL DISTRICT
- C-2 HEAVY COMMERCIAL
- M-1 INDUSTRIAL DISTRICT
- MR-NB MEDIUM RESIDENTIAL NEIGHBORHOOD BUSINESS
- OSPA OPEN SPACE, PARKS, AGRICULTURE
- R-1-6.0 SINGLE FAMILY RESIDENCE
- R-1-7.6 SINGLE FAMILY RESIDENCE
- R-1-8.4 SINGLE FAMILY RESIDENCE
- R-1-9.6 SINGLE FAMILY RESIDENCE
- R-2 TWO FAMILY RESIDENCE
- R-3 MULTI- FAMILY RESIDENCE
- R-S SEMI-PUBLIC DISTRICT
- T-C TRANSPORTATION CORRIDOR

DATA SOURCES:
CITY OF BURLINGTON

CITY OF BURLINGTON

WASTEWATER COMPREHENSIVE PLAN
FIGURE 3-7
CITY ZONING MAP

Gray & Osborne, Inc.
CONSULTING ENGINEERS



LEGEND:

- CITY LIMITS
- CITY UGA
- BAYVIEW RIDGE UGA
- PARCELS
- CITY
- [AVR-L]Aviation Related - Limited
- [AVR] Aviation Related
- [Ag-NRL] Agricultural - NRL
- [BR-HI] Bayview Ridge Heavy Industrial
- [BR-LI] Bayview Ridge Light Industrial
- [BR-R] Bayview Ridge Residential
- [NRI] Natural Resource Industrial
- [RB] Rural Business
- [RFS] Rural Freeway Service
- [RI] Rural Intermediate
- [RRv] Rural Reserve
- [SSB] Small-Scale Business
- [UGA] Urban Growth Area
- [URC-I] Urban Reserve Commercial Industrial
- [URR] Urban Reserve Residential

DATA SOURCES:
SKAGIT COUNTY ZONING

CITY OF BURLINGTON

WASTEWATER COMPREHENSIVE PLAN
FIGURE 3-8
COUNTY ZONING MAP

Gray & Osborne, Inc.
CONSULTING ENGINEERS

TABLE 3-6

City Historical Population 2000 to 2021

Year	Population[(1)]	Additions/Subtractions	Annual Growth Rate
2000	6,757	0	
2001	6,952	195	2.9%
2002	7,168	411	3.1%
2003	7,063	-105	-1.5%
2004	7,157	94	1.3%
2005	7,185	28	0.4%
2006	7,723	538	7.5%
2007	7,921	198	2.6%
2008	7,983	62	0.8%
2009	8,321	338	4.2%
2010	8,388	67	0.8%
2011	8,420	32	0.4%
2012	8,435	15	0.2%
2013	8,445	10	0.1%
2014	8,445	0	0%
2015	8,485	40	0.5%
2016	8,675	190	2.2%
2017	8,715	40	0.5%
2018	9,025	310	3.6%
2019	9,140	115	1.3%
2020	9,270	130	1.4%
2021	9,540	270	2.9%
Average			**1.66%**

The population has increased an average of about 1.66 percent per year over the past 20 years and 1.26 percent over the past 10 years. This population increase has been a result of development within the existing city limits as well as annexations, although few annexations occurred during the past 10 years.

PROJECTED FUTURE POPULATION

The *Skagit Population, Housing and Growth Monitoring Program – 2020 Growth Monitoring Report* (Skagit Council of Governments, June 16, 2021) projects the annual population growth in the City of Burlington to be 1.49 percent over the next 20 years; this growth rate will be generally used in this report for the purpose of planning future wastewater facilities; however, because of recent development activities in areas zoned C-1, partially as a result of the closure of the Cascade Mall, an annual growth rate of 2 percent will be used for the first 5 years of the planning period (2021-2026). An annual growth rate of 1.49 percent will be used for the remainder of the planning period

(2026-2040). These growth rates are slightly higher than the growth rate over the past 10 years (1.26 percent).

It is considered highly unlikely that all residentially zoned areas in the City of Burlington will be redeveloped over the next 20 years. However, the proposed growth rate will allow for the service to developed areas presently outside the city limits within the UGA, that are presently served by septic tanks or other types of on-site treatment and disposal. These areas may be annexed to the City, or merely receive sewer service. Areas that are prime candidates for sewer service by the City of Burlington include an area immediately outside the northeast corner of the City and an area immediately west of the western part of the City, around Markwood Lane and East of Pulver Road, between Peterson Road and State Highway 20, all zoned "Urban Reserve Residential" by Skagit County.

The 2 percent per year growth rate that is used for the first five years includes the new population associated redevelopment of the Cascade Mall, which recently ceased operation, as well as providing sewer service to areas within the city limits that are presently not sewered, such as the area along Anacortes Avenue, south of Gages Slough.

Table 3-7 shows the projected future population at 5-year increments for the 20-year planning period for the City of Burlington based on a 2 percent annual growth rate for the first 5 years and a 1.49 percent annual growth rate for the remainder of the planning period.

TABLE 3-7

City of Burlington Projected Population

Year	City Population[(1)]
2021	9,540
2025	10,326
2030	11,174
2035	12,032
2040	12,955

(1) Includes city limits and areas that could potentially be annexed by the City.

CHAPTER 4

EXISTING FACILITIES

WASTEWATER COLLECTION SYSTEM

INTRODUCTION

The City of Burlington wastewater collection system includes gravity sewers, pump stations, and force mains. The existing sewer system, shown on Figure 4-1, consists of two distinctly separate systems: the City proper system and the Western Service Area system. The City proper system serves the area bounded by the city limits. The Western Service Area system serves the Bayview Ridge Unincorporated Urban Growth Area, which includes the Port of Skagit County Airport and industrial area, the Skagit Golf and Country Club and a residential development around the golf course, and a few additional commercial and industrial customers in the immediate vicinity of the Port. The City of Burlington purchased the Port sewer system from the Port of Skagit County in 2000.

The City of Burlington also receives wastewater from the Samish Water District (District) through a 12-inch-diameter pipeline from the District's pretreatment lagoon at the south end of Lake Samish in Whatcom County, which flows to Pump Station 6 on Peterson Road in the City of Burlington. Effluent from the District's waste stabilization pond is pumped through this force main. Several pump stations along the District's pipeline alignment discharge wastewater to the pipeline, including a Washington State Department of Transportation rest area, the Thousand Trails Campgrounds, and several residential and commercial customers. The Skagit Valley Resort and Casino is also connected to the pipeline as a backup to their membrane bioreactor treatment system. The District's pipeline and associated pump stations are owned and operated by the District.

There are twenty-nine additional privately owned pump stations which contribute to the Burlington collection system, as follows:

- Clear Snap at 15218 Josh Wilson Road discharging to Manhole 1269.
- Burlington RV Park discharging to Manhole 486 in Holmgren Lane.
- Skagit Ford at 620 Auto Boulevard discharging to Manhole 466.
- Kar Mart Auto Group at 655 Auto Boulevard discharging to Manhole 466.
- Kar Mart Auto Group at 660 Auto Boulevard discharging to Manhole 466.
- Foothills Toyota at 675 Auto Boulevard discharging to Manhole 466.

- Sunrise Lane, serving six homes, discharging to Manhole 1073.
- Lautenbach discharging to 3-inch force main in Ovenell Road.
- Puget Sound Energy discharging to 3-inch force main in Ovenell Road.
- Skagit County Energy Recovery Facility discharging to 6-inch force main in Ovenell Road.
- Paccar, west of the Port of Skagit County Regional Airport, discharging to Manhole 1256.
- Aspen, Vail, and Miracle Lane, serving nine homes, discharging to Manholes 451 and 452.
- Industrial Park at Josh Wilson Road, discharging to Manhole 1268.
- Sulex at Farm to Market Road, discharging to 3-inch force main.
- Bayview Products at Ovenell Road, discharging to 8-inch force main.
- Keller Supply and TCI at 717 Bennett Road, discharging to Manhole 463.
- Caliber Collision at McCorquedale Road, discharging to Manhole 459.
- Sims Honda at 1615 S Goldenrod Road, discharging to Manholes 454 and 455.
- Rallys and Vans at County Shop Lane, discharging to Manhole 332.
- Curtis Street serving four homes, discharging to Manhole 719.
- Cassandra Court serving five homes, discharging to Manhole 749.
- Cascade Vista serving one home, discharging to Manhole 1A.
- Hughes Farm at Farm to Market Road, discharging to 3-inch force main.
- 15601 Ovenell Road serving two homes, discharging to Manhole 1184.
- Fire District 6 at 16220 Peterson Road, discharging to Manhole 1216.
- Brighton Court serving 10 homes, discharging to Manhole 691 A.

P.S. #14
P.S. #15
P.S. #21
(PVT) P.S.
P.S. #1
P.S. #2
P.S. #18
P.S. #4
P.S. #5
P.S. #6
P.S. #3
P.S. #8
P.S. #7
P.S. #12
8 GRAVITY
WWTP GRAVITY
WWTP
P.S. #17
P.S. #10
P.S. #11
P.S. #20
P.S. #19
P.S. #13
P.S. #9
P.S. #16

SCALE
1" = 2500'

LEGEND:
- CITY LIMITS
- CITY UGA
- BAYVIEW RIDGE UGA
- SEWER LINE
- PUMP STATIONS
- FORCE MAIN
- (10) EXISTING DRAINAGE BASINS

CITY OF BURLINGTON

SEWER COMPREHENSIVE PLAN
FIGURE 4-1
PUMP STATION LOCATIONS

Gray & Osborne, Inc.
CONSULTING ENGINEERS

- Avon-Allen Road, serving two homes, discharging to 10-inch force main.
- Frazier Heights serving one home, discharging to Manhole 1337.
- EDCO at 14508 Ovenell Road, discharging to 6-inch force main.

A small area within the city limits is served by individual septic tanks and drain fields. This area is located along Anacortes Avenue, south of Gages Slough.

Three small farm labor housing developments, located outside the city limits at Sanchez Lane (Raspberry Ridge I) and south of Lafayette Road (Raspberry Ridge II and III) are served by their own community sewer system. The wastewater is discharged to the Burlington sewer system to a new sewer in Lafayette Road, which drains to Drainage Basin 4 (Pump Station 4). Raspberry Ridge I and II were connected in 2019 and Raspberry Ridge III was connected in 2020.

Four additional developments have been added to the sewer system since the preparation of the 2011 Plan:

- Maiben Glenn I and II discharging to Drainage Basin 22 (2017).
- Frazier Heights discharging to Drainage Basin 9 (2017).
- Rivers Edge discharging to Drainage Basin 22 (2019).
- Maiben Glenn III discharging to Drainage Basin 22 (2019).

The original wastewater collection system, installed in 1946, consisted of 6-inch through 15-inch diameter concrete mortar joined pipe, which is still in use in places. An 18-inch diameter concrete outfall pipe carried the wastewater to the Skagit River. The original manholes were brick construction. The collection system service area has gradually increased since 1946, with the Western Service Area added as a part of a major sewer system expansion project in 1977. The pipeline from the Samish Water District was also completed in 1977. Several sections of the original concrete sewers have been replaced with PVC sewers or been rehabilitated by pipe bursting or cured-in-place lining since the 2011 Plan was prepared,

GRAVITY SEWERS

The City of Burlington wastewater collection system includes approximately 59 miles of gravity sewer pipes varying in size from 4-inch diameter local connections to 27-inch diameter interceptors. Many types of pipe material have been used in the construction of the system including clay, concrete, polyvinyl chloride (PVC), high-density polyethylene (HDPE), and ductile iron.

Due to the relatively flat terrain, much of the gravity collection system has been constructed at the minimum slope required to prevent solids from settling out during transport. In some areas, topography allows for greater slopes; however, an extensive system of pump stations and force main piping is required to convey wastewater in areas where topography causes gravity flow sewers to be very deep.

An inventory of the gravity sewer lines is provided in Table 4-1.

TABLE 4-1

Gravity Sewer Inventory

Diameter (inches)	Total Length (feet)	Length (miles)	Portion of System (%)
4	1,970	0.37	0.64
6	32,743	6.20	10.56
8	169,863	32.17	54.77
10	55,032	10.42	17.74
12	37,043	7.02	11.94
15	5,107	0.97	1.65
18	1,610	0.30	0.52
21	6,760	1.28	2.18
Total	**310,128**	**58.74**	**100**

PUMP STATIONS AND FORCE MAINS

The City owns and operates 21 sewage pump stations. Pump Station 8 serves the Western Service Area exclusively, and the force main from Pump Station 8 conveys the flow from this pump station into two large-diameter interceptors that discharge directly to the wastewater treatment plant. Three of the force mains are common force mains which convey flows from more than one pump station. The force main from Pump Station 8, discussed above, also conveys flows from Pump Station 11 and Pump Station 13. The force main from Pump Station 6 also conveys flow from Pump Station 3 and Pump Station 5. The force main from Pump Station 16 also conveys flow from Pump Station 19 and Pump Station 20.

All the high-priority pump stations are connected to the SCADA system. All others are equipped with an auto dialer or red light that will notify City staff of alarms. Pump station locations are shown on Figure 4-1. Design data for the City's sewage pump stations is included in Table 4-2. Where appropriate, the data has been adjusted based on drawdown tests for each pump station performed by City of Burlington staff during the spring of 2020.

TABLE 4-2

City-Owned Sewage Pump Station Design Data

Pump Station	Location (address)	Installed/ Upgraded	Type	Pumps			
				Qty.	Capacity (gpm)[1]	TDH (ft)	hp
1	115 West Victoria Avenue	1952/2006	Submersible	2	532	18	7.5
2	213 North Spruce Street	1946/2001	Submersible	2	357	15.5	3
3[2]	404 East Rio Vista Avenue	1957/1977/ 2010	Submersible	2	1,500 1,695	62 50	40
4	331 South Section Street	1955/1977/ 2019	Submersible Chopper	2	566	22	7.5
5[2]	Olympia Avenue at Railroad Street	1977	Dry Pit	2	713 1,217	45 38	15
6[2]	638 Peterson Road	1977/2018	Submersible	2	1,874 1,580	58 75	40
7	18040 Peterson Road	1977/2000/ 2007	Submersible	2	1,069	62	25
8[3]	17331 Peterson Road	1977/2004	Submersible	2	2,950 3,700	66 60	75
9	16505 Ovenell Road	1977/2019	Submersible	2	511	24	5
10	16059 Ovenell Road	1977/2018	Submersible	2	1,142	87	45
11[3]	1385 South Burlington Boulevard	1981/2004	Submersible	2	1,283 1,650	47 30	25
12	875 Goldenrod Road	1986	Submersible	2	250	42	5
13[3]	Goldenrod Road at Stevens Road	1992	Submersible	2	290 740	37 27	7-1/2
14	Walton Drive	1993	Submersible	2	136	46	10
15	North Hill Boulevard	1996	Submersible	2	228	22	5
16[4]	14654 Ovenell Road	2000	Submersible	2	566	118	30
17[5]	15409 Crosswind Drive	1999	Submersible	2	10	93	2
18	165 Woollen Road	2003	Submersible	2	486	5	5
19[4]	14879 Ovenell Road	2003	Submersible	2	161	18	2
20[4]	14101 Ovenell Road	2005	Submersible	2	289	83	20
21	185 Hanson Place	2007	Submersible	2	63	31	5

(1) The drawdown test for the lowest capacity pump was used to establish the pump station capacity in accordance with Ecology criteria.

(2) Pump Stations 3, 5, and 6 discharge to a common force main. The upper numbers in the capacity and TDH columns indicate the conditions when all three pump stations discharge simultaneously to the force main. These numbers represent the rated capacity of the pump station. The lower numbers indicate the condition when each pump station is discharging by itself to the force main. The actual flow rate at any time would be somewhere between the two conditions.

(3) Pump Stations 8, 11, and 13 discharge to a common force main. The upper numbers in the capacity and TDH columns indicate the conditions when all three pump stations discharge simultaneously to the force main. These numbers represent the rated capacity of the pump station. The lower numbers indicate the condition when each pump station is discharging by itself to the force main. The actual flow rate at any time would be somewhere between the two conditions.

(4) Pump Stations 16, 19, and 20 discharge to a common force main. The stated capacities and TDHs for these pump stations have been obtained from drawdown tests and pump curves. No hydraulic analyses have been made on the force main system for these pump stations and it is unknown whether the pumps were operating alone or simultaneously with other pump stations when the drawdown tests were made.

An inventory of the force mains is shown in Table 4-3. Force mains vary in diameter from 4 to 24 inches, and asbestos-cement (AC), PVC, HDPE, cast iron (CI), and ductile iron (DI) pipe materials are used. The force mains are shown on Figure 4-1.

TABLE 4-3

Force Main Inventory

Diameter (inches)	Length (feet)	Length (miles)
3	2,423	0.46
4	3,150	0.60
6	7,946	1.50
8	12,110	2.29
10	5,143	0.97
12	15,449	2.93
14	1,771	0.34
16	1,580	0.30
20	16,505	3.13
24	4,324	0.82
Total	**70,401**	**13.33**

WASTEWATER TREATMENT PLANT

INTRODUCTION

The first wastewater treatment plant (WWTP) in the City of Burlington was constructed in 1946. This WWTP was located south of Olympia Avenue, between Railroad Street and Pine Street, approximately where the existing Pump Station 5 is now located. The original treatment plant consisted of rectangular primary clarifiers, chlorine disinfection, and anaerobic digestion of biosolids.

In 1976, the construction of a new secondary treatment facility was completed at the location of the existing treatment facility at 900 South Section Street. The original treatment facility at Olympia Avenue was abandoned. The new treatment facility, an activated sludge treatment facility, consisted of an influent pump station, comminutor structure, circular primary clarifiers, aeration basins, circular secondary clarifiers, a chlorine contact chamber, an effluent pump station, and an outfall and diffuser in the Skagit River.

A hydrocyclone and grit classifier removed grit from the primary sludge, which was thickened, together with waste activated sludge, in a gravity thickener before it was digested in an aerobic digester. Digested sludge was thickened in a second gravity

thickener before being dried in sludge drying beds. Dried biosolids were applied to permitted farmlands.

The facility was designed to treat a design flow (maximum month) of 1.61 million gallons per day (mgd) with an organic loading of 3,181 pounds of BOD_5 per day (lb BOD_5/d) and a solids loading of 3,181 pounds of TSS per day (lb TSS/d).

In the late 1980s to early 1990s, a septage receiving station and a belt filter press for sludge dewatering were added to the treatment plant. The septage receiving station consists of a mechanical bar screen, an underground holding tank, and a pump to meter the septage into the influent pump station. The addition of the septage receiving station allowed the treatment plant to receive septage from nearby communities.

The belt filter press was added to gain more capacity from the sludge drying beds. Polymer was added to the thickened digested sludge and pumped to the belt filter press for dewatering. The dewatered sludge was pumped to the sludge drying beds for air drying and storage before being applied to permitted farmlands.

Beginning in 1995, a major upgrade to the Burlington WWTP was initiated. This upgrade took place in several stages and significantly increased the capacity and effluent quality of the WWTP. The first project, "Influent Pump Station and Aeration Basin Modifications" completed in 1995, resulted in replacement of the constant-speed influent pump station pump controls with variable frequency drives (VFDs), addition of selector zones to the aeration basins, replacement of the mechanical mixing/sparge ring aeration system with a state-of-the art fine-bubble diffuser system, and a temporary extension of the chlorine contact basin into the effluent pump station wet well. These improvements allowed the maximum month flow capacity of the WWTP to be upgraded to 2.0 mgd. The organic loading was upgraded to 3,900 lb BOD_5/d and the solids loading was upgraded to 4,200 lb TSS/d.

The second project, "Headworks Modifications," was completed in 1997 and included the construction of a new headworks structure with a Parshall flume influent flow meter, a fine screen with a bypass channel and space for an additional future fine screen, and a primary clarifier splitter box allowing the flow to be split between the existing primary clarifiers and two future primary clarifiers. This project increased the headworks capacity to a peak hour flow of 9.48 mgd, expandable to a future peak hour flow of 12.6 mgd (these peak hour flows correspond to maximum month flows of 3.79 mgd and 5.05 mgd, respectively).

The third project, "Administration Building," also completed in 1997 added administration office space, a lunchroom, and locker room for the Sewer Department staff.

Finally, the fourth project, "Wastewater Treatment Plant Upgrade," increased the maximum month flow capacity of the entire Burlington WWTP to 3.79 mgd, the organic load capacity to 7,356 lb BOD_5/d and the solids load capacity to 7,660 lb TSS/d. The project also added seasonal nitrification in anticipation of a seasonal effluent ammonia limit. Specific improvements included expansion of the influent pump station; the addition of a primary clarifier, aeration basins, and secondary clarifier with a capacity approximately equal to the existing treatment train; installation of new ultraviolet (UV) disinfection facilities to replace the existing chlorine contact tank and chlorination facilities; installation of a new outfall pipe with diffusers to the Skagit River and expansion of the effluent pump station; construction of a new solids handling building, new anaerobic digesters, and sludge storage area. The solids handling building houses a new waste activated sludge rotary screen thickener, the existing belt filter press for digested sludge dewatering, the anaerobic digester boiler and heat exchanger, and various pumps and equipment for the sludge handling process. The sludge drying beds were removed and a new vehicle storage building was constructed in the area left available. The electrical and control systems were upgraded, including a new standby generator. The construction of this project was completed in 2001.

In 2002, the City of Burlington purchased and installed a biosolids dryer that produces Class A biosolids at a suspended solids concentration of 90 percent or more. This treatment allows unrestricted use of the biosolids produced at the Burlington WWTP.

In 2008 the City installed a submersible chopper pump in the space provided for the third influent pump (Pump 2). In 2010 the City replaced Influent Pump 3, installed in 2000, with a submersible chopper pump.

In 2011 a second influent fine screen was installed, increasing the screening capacity to a peak hour flow of 15.98 mgd when both screens are operating.

In 2015 a fourth blower, supplying air to the aeration basins, was installed. This new blower is a positive displacement blower, as opposed to the three original multi-stage centrifugal blowers installed in 2000. Also, in 2015, the primary sludge gravity thickener mechanism was replaced with a stainless steel mechanism.

A major renovation of the Administration Building also took place in 2015. The garage and shop in the original Administration Building was converted to an employee training room and the laboratory casework was replaced.

Construction of the 2016 Wastewater Treatment Plant Improvements was completed in 2017. This project included the replacement of the original Secondary Clarifier 1A and 1B mechanisms, the installation of a new high-intensity low-pressure UV disinfection system, and replacement of the belt filter press dewatering unit. The original UV disinfection system, installed in 2000, was left in place, to be used as a backup to the new system.

Also, in 2017, the City replaced the influent and effluent samplers and the septage receiving station.

In 2021, the original Primary Clarifier 1A and 1B mechanisms were replaced with stainless steel units. The plant effluent limitations, as indicated in the existing NPDES permit are shown in Table 4-4. The NPDES permit, which was issued in 2018, is included in Appendix B.

TABLE 4-4

Current Treatment Plant Effluent Limits

Parameter	Limit
BOD_5 Monthly Average Concentration	30 mg/l[(1)]
BOD_5 Monthly Average Load	948 lb/d
BOD_5 Weekly Average Concentration	45 mg/l
BOD_5 Weekly Average Load	1,422 lb/d
TSS Monthly Average Concentration	30 mg/l[(1)]
TSS Monthly Average Load	948 lb/d
TSS Weekly Average Concentration	45 mg/l
TSS Weekly Average Load	1,422 lb/d
NH_4 Concentration	no limit presently in effect
Fecal Coliform Monthly Geometric Mean Count	200/100 ml
Fecal Coliform Weekly Geometric Mean Count	400/100 ml
Daily Minimum pH	≥6.2
Daily Maximum pH	≤9.0

(1) The monthly average concentration limitation for BOD_5 and TSS shall not exceed 30 mg/L or 15 percent of the respective influent concentrations, whichever is more stringent.

The existing treatment plant layout is provided on Figure 4-2 and the plant flow diagram on Figure 4-3.

SEPTAGE RECEIVING STATION

A septage receiving station is located at the wastewater treatment plant. The receiving station consists of a mechanical bar screen, a holding tank, and a pump to meter the septage into the influent pump station of the treatment plant. The treatment plant receives septage from nearby communities. The holding tank can be injected with a chlorine solution for odor control.

INLUENT PUMP STATION

The influent pump station is located at the treatment plant site and pumps all sewage collected from the City through two parallel 16-inch force mains to the headworks. The pump station contains one large and two smaller submersible centrifugal variable speed

pumps pumping out of a wet well. The rated capacity of the large pump is 4,385 gpm at 43 feet of total dynamic head. The rated capacity of each of the two smaller pumps is 2,300 gpm at 38 feet of total dynamic head. Thus, the nominal capacity of the influent pump station (the capacity with the largest pump out of service) is 4,600 gpm, or 6.624 mgd. An automatic control system maintains a constant liquid level in the wet well by varying the output of the pumps through a variable frequency speed control and an ultrasonic level sensor in the wet well.

HEADWORKS

The headworks contains a Parshall flume flow meter with an ultrasonic level sensor and two automatic mechanical fine screens with a bypass channel. The Parshall flume has a nominal capacity of 21.4 mgd.

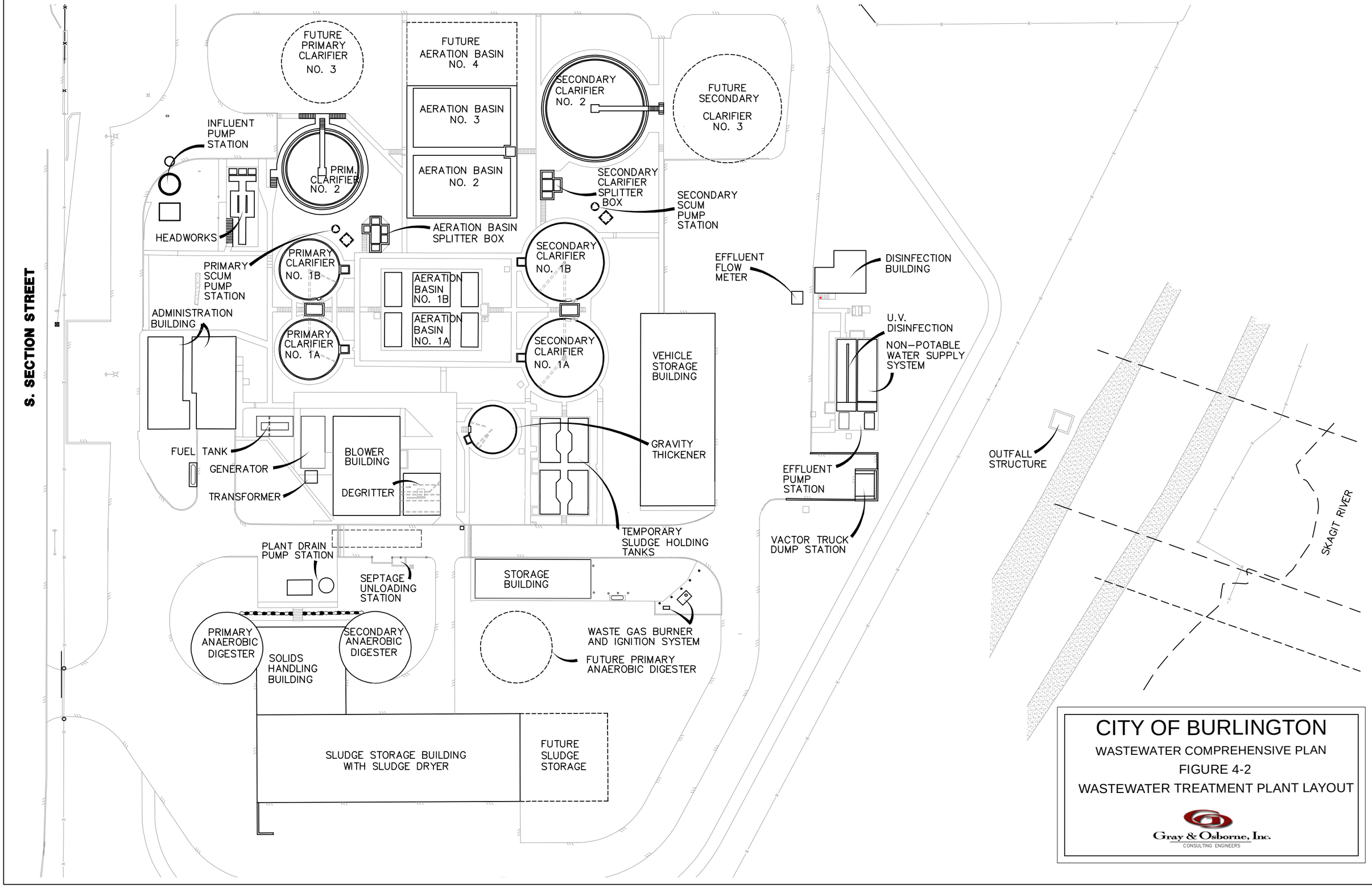
The screens will remove objects larger than 3/8 inches from the wastewater stream and convey them to a dumpster. The dumpster is periodically emptied by the solid waste utility. A manual bar screen is installed in the bypass channel to handle extreme flows or to be utilized when the fine screen is out of service. Each influent screen has a capacity of 7.99 mgd for a total capacity of 15.98 mgd.

The primary clarifier splitter box is also a part of the headworks structure. The splitter box distributes the wastewater flow evenly between two primary clarifier treatment trains. It also allows for flow distribution to a future third primary clarifier treatment train. Discharge from the plant drain pump station enters the primary clarifier splitter box.

PRIMARY CLARIFIERS

Primary clarifiers are provided to reduce the loading to the secondary treatment process by removing a portion of the organic material and solids from the wastewater before it enters the aeration basins. Aeration basins and related equipment such as blowers can be reduced in size when primary clarification is provided. Typical removal efficiency across a primary clarifier is 30 to 35 percent BOD_5 and 60 to 70 percent TSS. One of the two primary clarifier treatment trains consists of two older 35-foot-diameter clarifiers operated in parallel. The other primary clarifier treatment train is a single newer 49-foot-diameter clarifier. At a hydraulic overflow rate of 1,000 gallons per day per square foot (gpd/ft^2), the primary clarifiers have a combined capacity of 3.81 mgd peak month flow. Primary clarifiers could operate at overflow rates as high as 3,000 gpd/ft^2 during peak hour flows. This corresponds to a primary clarifier peak hour flow capacity of 11.43 mgd.

All the clarifiers are center fed and peripheral draw-off. The screened wastewater flows through the influent column and enters the clarifier through submerged ports. A feed well surrounding the center column dissipates the velocity of the wastewater and causes it to flow downward. As the wastewater flows downward and outward, the solids settle out on the bottom while the clarified wastewater flows upward and out over a weir into the



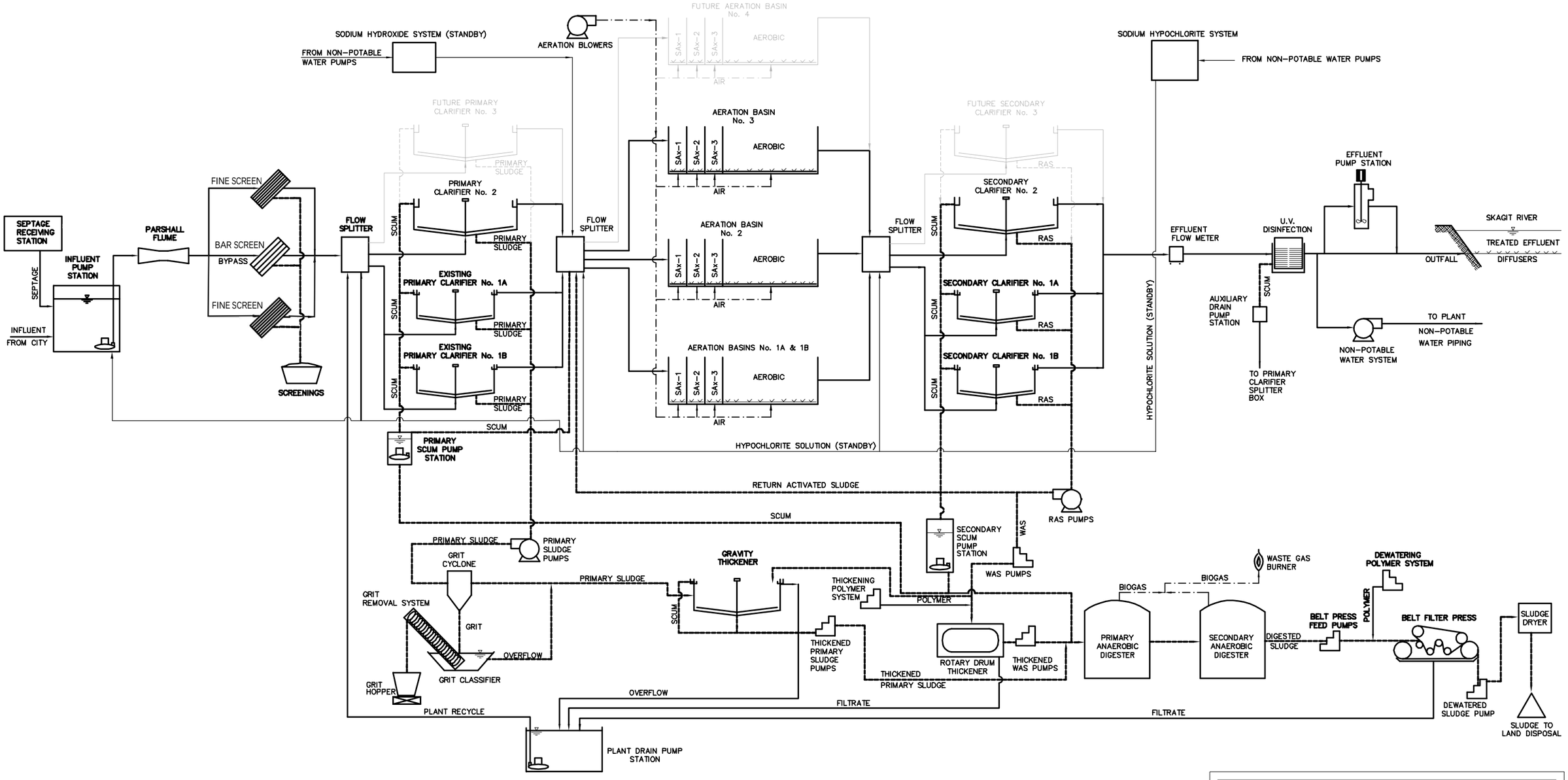
CITY OF BURLINGTON

WASTEWATER COMPREHENSIVE PLAN

FIGURE 4-2

WASTEWATER TREATMENT PLANT LAYOUT

Gray & Osborne, Inc.
CONSULTING ENGINEERS



CITY OF BURLINGTON

WASTEWATER COMPREHENSIVE PLAN

FIGURE 4-3

PROCESS SCHEMATIC

Gray & Osborne, Inc.
CONSULTING ENGINEERS

effluent channel. The clarifiers are equipped with a bottom scraper mechanism to move the settled sludge to the hopper located in the floor at the center of the clarifier. A scum scraper mechanism on the surface removes any floating material including grease. Periodically, the settled sludge is pumped though a grit cyclone to a gravity thickener. The grit cyclone removes the grit from the sludge stream. The centrifugal recessed impeller-type primary sludge pumps are located in the basement of the blower building and have a capacity of 63 gpm for each of two smaller clarifiers, and 125 gpm for the larger clarifier.

AERATION BASINS

The purpose of the activated sludge system is to remove suspended and colloidal solids and dissolved organic matter from the wastewater. This removal is accomplished by the introduction of the wastewater into a biological reactor (aeration basin) containing a high concentration of actively growing microorganisms in the presence of dissolved oxygen. The microorganisms utilize the waste material as a source of food to obtain the energy necessary for their own life processes and growth. The rapid growth of these organisms results in the creation of a flocculant biological mass which can be removed from the liquid stream by sedimentation in the secondary clarifiers, thus creating a clear effluent with a low organic content. In the activated sludge process, the high concentration of active biological mass is maintained by continuously recycling the organisms back into the aeration basins. Effective settling and separation of the biological mass from the liquid stream in the secondary clarifiers is essential to the proper operation of the activated sludge system.

At the City of Burlington wastewater treatment plant, three aeration basin treatment trains are provided. In the aeration basin splitter box, return activated sludge that has settled out in the secondary clarifiers is mixed with the effluent from the primary clarifiers and the combined flow is split between the three treatment trains. One treatment train consists of two older aeration basins operated in parallel. Each of the two older aeration basins has a volume of 21,960 cubic feet. The two other treatment trains each consist of one newer aeration basin with a volume of 43,983 cubic feet. The aeration basin splitter box is configured to add a fourth treatment train. All the aeration basins are complete mixed and aerated with a fine bubble diffused air aeration system. Three multistage centrifugal blowers and one positive displacement blower provide air for the diffuser system. Each centrifugal blower is rated at 2,170 cfm at a pressure of 7.15 psi. The positive displacement blower is rated at 875 cfm at a pressure of 7.0 psi. Each aeration basin is equipped with three selector zones at the inlet to improve the settling characteristics of the activated sludge in the secondary clarifiers.

The capacity of the aeration basins can generally be determined based on a volumetric loading of 40 pounds of BOD_5 per day per 1,000 cubic feet of tank volume. This results in a total capacity of 5,275 pounds of BOD_5 per day in the primary effluent. If a 35 percent BOD_5 removal is assumed in the primary clarifiers, an influent BOD_5 capacity of 8,116 pound per day results, based on peak month loading rates. The BOD_5 removal capacity of aeration basins can be adjusted by operational parameters, such as mixed

liquor suspended solids, solids wasting rate, solids retention time, and food-to-microorganism ratio. Therefore, as the BOD_5 removal capacity of the aeration basins approaches, the operational parameters should be reviewed and analyzed to establish appropriate expansion schemes.

Although the City of Burlington does not have ammonia limits at the present time, future requirements for nitrification in the aeration basin will affect the nominal BOD_5 removal capacity of the aeration basins. This will be discussed in more detail in Chapter 7.

SECONDARY CLARIFIERS

After the organic wastes in the influent wastewater have been converted to a bacterial sludge floc in the aeration basins, it is necessary to separate the sludge floc from the liquid stream. This separation and removal phase is accomplished in the secondary clarifiers.

The mixed liquor from the aeration basins flows by gravity to the secondary clarifier splitter box. The splitter box distributes the wastewater flow evenly between two secondary clarifier treatment trains. It also allows for flow distribution to a future third secondary clarifier treatment train. One of the two secondary clarifier treatment trains consists of two older 45-foot-diameter clarifiers operated in parallel. The other secondary clarifier treatment train is a single newer 65-foot-diameter clarifier. All the clarifiers are center fed and peripheral draw-off. The mixed liquor flows through the influent column and enters the clarifier through submerged ports. A feed well surrounding the center column dissipates the velocity of the mixed liquor and causes it to flow downward. As the mixed liquor flows downward and outward, the solids settle out on the bottom while the clarified effluent flows upward and out over a weir into the effluent channel. The clarifiers are equipped with a bottom scraper mechanism to move the settled sludge to the suction device located in the floor at the center of the clarifier. The majority of this sludge is returned to the aeration basins as return activated sludge (RAS). A smaller portion, the waste activated sludge (WAS), is pumped to the rotary drum thickener. A scum scraper mechanism on the surface removes any floating material including grease.

Secondary clarifiers are typically sized based on hydraulic overflow rates and solids loading rates. A typical peak month hydraulic overflow rate for the secondary clarifiers at the Burlington Wastewater Treatment Plant would be 600 gpd/ft^2. Based on this overflow rate, the combined peak month flow capacity for the secondary clarifiers is 3.90 mgd. Based on a typical peak hour flow overflow rate of 1,200 gpd/ft^2, the peak hour flow capacity of the secondary clarifiers is 7.80 mgd. The solids loading rate for the secondary clarifiers will vary with the mixed liquor suspended solids concentration maintained in the aeration basin and with the sludge recycle rate. Therefore, as the hydraulic capacity of the secondary clarifiers approaches, the solids loading rates should be reviewed and analyzed based on appropriate operational schemes.

ULTRAVIOLET DISINFECTION

Prior to discharge to the outfall line, the treated wastewater undergoes disinfection. Disinfection is the inactivation of potentially harmful (pathogenic) microorganisms from the treatment plant effluent. At the Burlington WWTP, disinfection is accomplished through the application of ultraviolet light. Ultraviolet light will disrupt the organisms' genetic material and will prevent them from reproducing. The ultraviolet disinfection facilities consist of a concrete channel with three banks of ultraviolet lamps, each containing 48 lamps. Two of the banks are capable of disinfecting a peak day flow of 6.64 mgd. This peak day flow corresponds to a peak month flow of 3.79 mgd (the design flow for the existing wastewater treatment facility). One of the banks is a redundant unit. A parallel channel is equipped with the original UV system installed in 2000. This system is no longer supported by the manufacturer, but the City has some spare parts in stock and this system is used as an emergency backup.

EFFLUENT PUMP STATION

The effluent pump station pumps the treated wastewater to the Skagit River during a flood condition and/or during a high instantaneous flow through the treatment plant. The pumps are located in a sump at the end of the ultraviolet disinfection facilities. The pumps are activated by a high water level in the effluent sump, which also closes a slide gate on the gravity line to prevent backflow into the sump. The pumps are vertical turbine pumps with a rated capacity of 9,900 gpm (14.3 mgd) at 37.5 feet total dynamic head.

Under normal plant flow and river water level conditions, effluent flows by gravity from the pump sump to the outfall and diffusers in the river.

RIVER OUTFALL

The river outfall consists of an outfall structure and three separate 10-inch-diameter diffusers and one 20-inch-diameter diffuser in the Skagit River. The flow is either pumped or flows by gravity to the outfall structure, where it is split between the four diffuser pipes. The current hydraulic capacity of the outfall is about 7,750 gpm (11.2 mgd).

SOLIDS HANDLING SYSTEM

The solids handling system consists of a primary sludge gravity thickener, a waste activated sludge rotary drum thickener, primary and secondary anaerobic digesters, a belt filter press dewatering system, and a sludge dryer. Primary sludge from the primary clarifiers is pumped to the grit cyclone and then to the primary sludge gravity thickener. The thickener concentrates the sludge before it enters the anaerobic digester, thereby reducing the required digester volume while still providing adequate solids retention time. The primary sludge thickener is a 26-foot-diameter circular tank with center feed and peripheral draw off. It is equipped with sludge scrapers on the bottom and a scum

scraper on the surface to remove floating materials, similar in design to the clarifiers. At a surface loading rate of 24 pounds per square foot per day, the capacity of the gravity thickener is 12,744 pounds of suspended solids per day, corresponding to a peak month influent suspended solids load of 19,600 pounds per day at a 65 percent suspended solids removal rate through the primary clarifiers. The thickened sludge is pumped to the primary anaerobic digester while the supernatant is pumped to the primary clarifier splitter box via the Plant Drain Pump Station.

The WAS rotary drum thickener is located on the ground floor in the solids handling building. WAS is pumped to the rotary drum thickener, where it is mixed with polymer before entering thickener. The thickener flocculates, conditions, and thickens WAS to about 5 percent solids. The thickened WAS is discharged into a hopper and pumped to the primary anaerobic digester. The rotary drum thickener has a rated WAS flow capacity of 250 gpm at a solids concentration of 1.0 percent solids or higher. If the rotary drum thickener is operated 6 hours every workday, the thickener has a WAS load capacity of 5,140 pounds per day, corresponding to a peak month BOD_5 loading of 8,565 pounds per day if a solids yield of 0.6 pound of waste solids per pound of influent BOD_5 is assumed. The filtrate is pumped to the primary clarifier splitter box via the Plant Drain Pump Station.

The anaerobic digester system includes a primary anaerobic digester and a secondary digester. The primary digester is mixed by a pumped mixing system and heated to about 95 to 100 degrees Fahrenheit by a boiler and heat exchange system. The boiler can be heated by methane gas produced by the digestion process or by natural gas. The volume of each of the two digesters is 39,100 cubic feet, which will provide a hydraulic detention time of 16 days for each digester. The anaerobic digester system was specifically designed to stabilize sludge generated from peak month treatment plant influent BOD_5 and TSS loads of 7,376 and 7,660 pounds per day, respectively. The primary digester is a fixed cover design, while the secondary digester is a floating cover design, allowing for variations in the water surface elevation as a result of batch removal of digested sludge.

The digested sludge is pumped to a belt filter press dewatering unit located on the ground floor of the solids handling building. The digested sludge is mixed with polymer before dewatering. The belt filter press has a hydraulic capacity of about 120 gpm at a solids concentration of 3 percent. If the belt filter press is operated 6 hours every workday, it would have the capacity to dewater digested sludge generated from peak month treatment plant influent BOD_5 and TSS loads of approximately 14,000 and 14,650 pounds per day, respectively. The press will dewater the sludge to a solids concentration of 16 percent or more. The filtrate is pumped to the primary clarifier splitter box via the Plant Drain Pump Station.

The dewatered sludge is pumped to a sludge drying unit. At this unit, the sludge is heated so that the excess water evaporates, and pathogens are reduced. The dried sludge has a solids concentration of 90 percent or more and a fecal coliform count below 1,000 per gram of solids. This process is approved by the regulatory agencies to produce

Class A biosolids which allows unrestricted use of the biosolids. The dried sludge is currently picked up by a local farmer and used as soil amendment.

The sludge drying unit has a capacity of 400 pounds of solids per hour and is presently operated for 240 hours (10 days) at a time. It would take a minimum of 24 hours (2 days) for cool-down and preparation for the next run period. If the dryer is operated on a schedule of 240 hours on/72 hours off, it would dry digested and dewatered sludge generated from peak month treatment plant influent BOD_5 and TSS loads of approximately 14,000 and 14,650 pounds per day, respectively, which is the same capacity as the digested sludge dewatering belt filter press.

SUMMARY OF TREATMENT PLANT COMPONENT CAPACITIES

Table 4-5 summarizes the capacities of the major treatment units, as discussed above.

TABLE 4-5

Summary of Treatment Plant Flow Capacity Limits for Individual Equipment

Treatment Unit	Peak Month Flow Capacity (mgd)	Peak Hour Flow Capacity (mgd)	Peak Month BOD_5 Capacity (lb/d)(1)	Peak Month TSS Capacity (lb/d)(1)
Influent Pump Station	—	6.62	—	—
Influent Flow Meter	—	21.4	—	—
Influent Screen	—	15.98	—	—
Primary Clarifiers	3.81	11.4	—	—
Aeration Basins	—	—	8,116	—
Secondary Clarifiers	3.90	7.80	—	—
UV Disinfection	3.79	—	—	—
Effluent Pump Station	—	14.3	—	—
Outfall	—	11.2	—	—
Gravity Thickener	—	—	—	19,600
WAS Rotary Drum Thickener	—	—	8,565	—
Anaerobic Digesters	—	—	7,356	7,660
Belt Filter Press	—	—	14,000	14,650
Sludge Dryer	—	—	14,000	14,650

(1) These capacities are general guides only. Actual capacities will depend on specific operational parameters in effect at the time, such as aeration basin MLSS, solids retention time, food-to-microorganism ratio, and operational times and frequencies for equipment.

CHAPTER 5

WASTEWATER FLOW AND LOADING PROJECTIONS

INTRODUCTION

Proper design of wastewater treatment and conveyance facilities requires determination of the quantity and quality of wastewater generated from each of the contributing sources. Municipal wastewater is domestic in origin, with additional flows contributed by commercial and industrial businesses and by institutional facilities such as schools, hospitals, and municipal functions. Infiltration and inflow (I/I) contributions result from groundwater and surface water entering the sewer system during periods of high groundwater levels and rainfall, respectively.

In this chapter, wastewater flows and loadings in the City of Burlington's sewer system are estimated. Water consumption data, WWTP daily monitoring reports (DMRs), flow meter records, and lift station run time records from previous years are used to estimate unit quantities for critical parameters related to zoning, land use, and overall land area in the existing service area. These unit quantities are then applied to future zoning to determine the design criteria for selecting and sizing the facilities required to serve the study area in future years.

DEFINITIONS OF TERMS

The terms and abbreviations used in the analysis are described below, listed in alphabetical order.

AVERAGE ANNUAL FLOW

Average annual flow (AAF) 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 (ADWF) is the average wastewater flow rate 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 September. 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. The average dry weather flow is the average daily flow during the three lowest consecutive flow months

of the year. For this study, average flow rates for July through September are used. Average dry weather flow is usually equal to or slightly higher than base flow.

BASE FLOW

Base flow, also known as Sanitary Flow, is wastewater without any infiltration and inflow.

BIOCHEMICAL OXYGEN DEMAND (BOD)

Biochemical oxygen demand (BOD) is a measure of the oxygen required by microorganisms in the biochemical oxidation 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 wastewater is composed of two components—a carbonaceous oxygen demand ($CBOD_5$) and a nitrogenous oxygen demand ($NBOD_5$).

OTHER CONTAMINANTS OF CONCERN

Contaminants of concern in wastewater, in addition to BOD and suspended solids, include nutrients, priority pollutants, heavy metals, and dissolved organics. The aggregate presence of deleterious priority pollutants, heavy metals, or dissolved organics can be measured through the acute toxicity test. This test determines the acute (short-term) effect of the wastewater effluent on marine species. The City's discharge permit includes effluent limitations on biodegradable organics (BOD_5), suspended solids, pathogens (fecal coliform), and pH.

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, in too high a concentration, nutrients, particularly ammonia, can be toxic to aquatic life. The City's discharge permit does not include nutrient limits at this time.

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, including heavy metals, are often present in wastewater due to commercial and industrial activities and may have to be removed if the presence of the metals 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. 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. In Burlington, the groundwater table is strongly influenced by the flow and resulting water level in the Skagit River. The greatest infiltration is observed following significant storm events preceded by 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 (gpad).

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 can be expressed in terms of gallons per capita per day or gallons per acre per day.

Treatment plant flow records are utilized to characterize combined infiltration and inflow in the sewer system in terms of peak hour, maximum day, maximum month, and average annual I/I.

MAXIMUM DAY FLOW

Maximum day flow (MDF) is the highest daily flow during a calendar year. The maximum day flow in western Washington usually occurs in response to a significant storm event preceded by prolonged periods of rainfall or snowmelt, which have previously developed a high groundwater table in the service area. Maximum day flow is used in sizing some treatment processes. Maximum day flow is typically determined from treatment plant flow records and projected future flow rates.

MAXIMUM MONTH FLOW (TREATMENT DESIGN FLOW)

Maximum month flow (MMF) is the highest monthly average flow during a calendar year. In western Washington, the maximum month flow occurs in the winter due to the presence of more I/I. This wintertime flow is composed of the normal domestic, commercial, and institutional 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 commercial or industrial activities, such as restaurants, retail and wholesale stores, service stations, and office buildings. Non-residential wastewater quantities are expressed in this Plan in terms of equivalent residential units (ERUs).

PEAK HOUR FLOW

Peak hour flow (PHF) is the highest 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 flow rates are used in sizing the hydraulic capacity of wastewater collection, treatment, and pumping components. Peak hour flow is typically determined from treatment plant flow records and projected future flow rates.

SANITARY WASTEWATER

Sanitary wastewater, also known as sanitary flow or base flow, refers to the domestic and non-residential wastewater produced by the sewer customers not including any infiltration or inflow.

SUSPENDED SOLIDS

Suspended solids are the solid matter carried in the waste stream. The total suspended solids (TSS) concentration in a wastewater sample is 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; mg/L for concentration and lb/d 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 plant biosolids production rate, treatment and storage requirements, and ultimate disposal requirements.

WASTEWATER

Wastewater is water-carried waste from residential, business, and institutional 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 millions of gallons per day (mgd).

EXISTING WASTEWATER FLOW AND LOADING RATES

Wastewater treatment plant (WWTP) records for the 5-year period from 2016 through 2020 were reviewed and analyzed to determine recent wastewater characteristics and influent loading rates. February 2018 records were also used in developing peak flow rates due to exceptionally high precipitation and flows. Recent wastewater flow and loading rates were then used in conjunction with projected population, zoning classifications, and employment data to determine projected future wastewater flow and loading rates.

HISTORICAL WASTEWATER FLOW RATES

Table 5-1 summarizes the average WWTP flow rates for the 5-year period from January 2016 through December 2020, based on the City's DMRs. Appendix D provides the DMR data for this time period. The reported flow rate is for influent flow and does not include in-plant recycle flow.

The maximum month WWTP flow rates for each year ranged from 1.30 mgd in 2019 to 2.21 mgd in 2018. The increase in estimated City population from 8,675 to 9,270 people over the period did not appear to cause an increase in influent flows. In fact, dry weather flows have generally stayed the same (which may be in part due to water conservation measures) and the annual average flow decreased between 2016 and 2019, which indicates that the ongoing program to reduce the amount of infiltration/inflow has been successful.

TABLE 5-1

Burlington WWTP Historical Flow Rates

Year	Average Sanitary Flow[(1)] (mgd)	Annual Average Flow (mgd)	Maximum Month Flow (mgd)	Maximum Day Flow (mgd)	Peak Hour Flow[(2)] (mgd)
2016	1.09	1.37	1.90	2.63	n.a.
2017	0.95	1.26	1.72	1.94	3.17
2018	1.01	1.34	2.21	2.74	6.19[(3)]
2019	1.01	1.15	1.30	2.20	4.61
2020	1.07	1.38	2.12	2.62	4.46
Average	**1.03**	**1.30**	**1.85**	**2.43**	**4.61**
Maximum	**1.09**	**1.38**	**2.21**	**2.74**	**6.19**

(1) July through September.
(2) Peak hourly flows were estimated from circular flow charts.
(3) Peak instantaneous flows exceeded 7 mgd during the peak hour flow period on Feb. 5, 2018.

Monthly discharge monitoring reports (DMR) data for this period are provided in Appendix D and summarized in Table 5-2. In both February 2018 and February 2020, the Puget Sound region experienced higher than average rainfall, which led to large volumes of infiltration and inflow at treatment facilities throughout the region. The resulting monthly average influent wastewater flows at the Burlington WWTP for those two months were 2.21 mgd and 2.12 mgd, respectively. Including even the high flows in February 2018, the maximum month flow rates have consistently been well below the rated influent capacity of 3.79 mgd.

The peak hour flow on February 5, 2018, was close to the nominal capacity of the influent pump station (6.62 mgd). It is suspected that all three influent pumps were running to accommodate peak instantaneous flows.

TABLE 5-2

Summary of Discharge Monitoring Reports (DMRs)
WWTP Influent Monthly Averages

Month	Avg. Monthly Flow (mgd)	Max. Daily Flow (mgd)	Avg. Monthly BOD_5 (mg/L)	Avg. Monthly BOD_5 (lb/d)	Avg. Monthly TSS (mg/L)	Avg. Monthly TSS (lb/d)
Jan-16	1.53	1.97	271	3,317	261	3,327
Feb-16	1.90	2.63	218	3,375	228	3,566
Mar-16	1.71	1.94	218	3,125	266	3,809
Apr-16	1.42	1.60	297	3,528	289	3,401
May-16	1.20	1.30	327	3,285	354	3,547
Jun-16	1.14	1.39	318	3,000	360	3,433
Jul-16	1.06	1.15	324	2,868	319	2,829
Aug-16	1.04	1.09	326	2,821	370	3,202
Sep-16	1.16	1.72	320	3,048	387	3,698
Oct-16	1.26	1.54	320	3,344	365	3,810
Nov-16	1.52	1.92	245	3,078	272	3,436
Dec-16	1.55	1.80	260	3,294	273	3,513
Jan-17	1.45	1.71	263	3,181	295	3,551
Feb-17	1.39	1.65	256	2,933	286	3,302
Mar-17	1.72	1.94	215	3,042	244	3,504
Apr-17	1.59	1.87	211	2,725	326	4,252
May-17	1.37	1.59	274	3,148	308	3,529
Jun-17	1.17	1.32	349	3,415	341	3,338
Jul-17	0.97	1.08	343	2,691	359	2,862
Aug-17	0.95	1.01	392	3,122	448	3,550
Sep-17	0.94	1.02	397	3,126	443	3,488
Oct-17	0.98	1.30	386	3,145	404	3,295
Nov-17	1.16	1.46	325	3,234	376	3,633
Dec-17	1.37	1.90	284	3,175	314	3,566
Jan-18	1.62	2.19	256	3,525	305	4,095
Feb-18	2.21	2.74	188	3,379	214	3,947
Mar-18	1.64	1.99	267	3,695	276	3,765
Apr-18	1.82	2.53	236	3,555	260	3,954
May-18	1.34	1.55	286	3,214	326	3,648
Jun-18	1.22	1.34	336	3,433	361	3,676
Jul-18	1.07	1.23	361	3,250	470	4,158
Aug-18	0.98	1.03	347	2,841	478	3,916
Sep-18	0.98	1.17	373	3,071	429	3,518
Oct-18	0.93	1.28	421	3,265	454	3,506
Nov-18	1.13	1.76	355	3,326	399	3,730

TABLE 5-2 – (continued)

Summary of Discharge Monitoring Reports (DMRs)
WWTP Influent Monthly Averages

Month	Avg. Monthly Flow (mgd)	Max. Daily Flow (mgd)	Avg. Monthly BOD_5 (mg/L)	Avg. Monthly BOD_5 (lb/d)	Avg. Monthly TSS (mg/L)	Avg. Monthly TSS (lb/d)
Dec-18	1.18	1.71	303	2,911	373	3,601
Jan-19	1.30	1.49	284	3,166	344	3,724
Feb-19	1.27	1.49	283	2,984	291	3,076
Mar-19	1.21	1.46	313	3,189	332	3,360
Apr-19	1.29	1.56	320	3,429	362	3,865
May-19	1.07	1.14	370	3,316	416	3,715
Jun-19	1.00	1.12	409	3,438	426	3,542
Jul-19	0.97	1.08	397	3,163	418	3,383
Aug-19	0.98	1.09	366	3,013	472	3,869
Sep-19	1.09	1.42	331	3,035	383	3,475
Oct-19	1.15	2.20	371	3,495	403	3,977
Nov-19	1.17	1.75	309	3,046	339	3,254
Dec-19	1.25	1.82	293	2,969	333	3,485
Jan-20	1.83	2.39	251	3,867	277	4,217
Feb-20	2.12	2.62	184	3,175	351	6,310
Mar-20	1.61	2.08	221	3,010	273	3,660
Apr-20	1.27	1.58	276	2,923	325	3,436
May-20	1.26	1.56	285	3,008	326	3,414
Jun-20	1.40	1.70	247	2,820	324	3,777
Jul-20	1.16	1.39	332	3,250	357	3,466
Aug-20	1.05	1.14	358	3,132	380	3,324
Sep-20	1.01	1.12	302	2,541	375	3,175
Oct-20	1.13	1.43	280	2,673	349	3,285
Nov-20	1.25	1.50	322	3,374	324	3,394
Dec-20	1.47	2.13	262	3,218	301	3,622
Average	***1.30***	***1.61***	***304***	***3,162***	***345***	***3,613***
Maximum	***2.21***	***2.74***	***421***	***3,867***	***478***	***6,310***
Minimum	***0.93***	***1.01***	***184***	***2,541***	***214***	***2,829***

Figure 5-1 provides a graphical representation of wastewater flow rates measured at the City of Burlington WWTP from 2016 through 2020.



FIGURE 5-1

Burlington WWTP Historical Influent Flows

Historical Flow Rates from the Samish Water District Pipeline

Table 5-3 summarizes the average Samish Water District pipeline flow rates for the period from January 2016 through December 2020, based on readings from a magnetic flow meter on the pipeline as it enters Burlington Pump Station 6.

TABLE 5-3

Samish Water District Pipeline Historical Wastewater Flow Rates (2016 through 2020)

Year	Average Dry Weather Flow[(1)] (gpd)	Annual Average Flow (gpd)	Maximum Month Flow (gpd)
2016	149,000	184,000	239,000
2017	116,000	168,000	214,000
2018	151,000	190,000	236,000
2019	193,000	193,000	218,000
2020	119,000	193,000	285,000
Average	**146,000**	**186,000**	**238,000**
Maximum	**193,000**	**193,000**	**285,000**

(1) July through September.

The Skagit Valley Resort and Casino, which has historically discharged through the same pipeline to Pump Station 6, has constructed its own treatment plant. However, the Casino is still under contract with the City of Burlington to maintain a standby capacity to discharge an average annual flow of 60,000 gpd in case of emergencies. Based on the flow meter readings at the Casino, there has been no flow discharge to the pipeline from the Casino for the 5-year period from January 2016 through December 2020.

The flows received from the Samish Water District pipeline has decreased as compared to the period of January 2007 through May 2010, as presented in the 2011 Plan. This decrease is less than what could be expected by the elimination of the discharge from the Skagit Valley Casino. This indicates that there may have been additional customers connected to this pipeline since 2011.

Historical Flow Rates from the Western Service Area

Table 5-4 summarizes the average flow rates from the Western Service Area for the period from January 2016 through December 2020, based on flow meter readings at Pump Station 8.

TABLE 5-4

Western Service Area Historical Wastewater Flow Rates
(2016 through 2020)

Year	Average Dry Weather Flow[(1)] (gpd)	Annual Average Flow (gpd)	Maximum Month Flow (gpd)
2016	171,000	253,000	367,000
2017	157,000	256,000	425,000
2018	183,000	279,000	451,000
2019	208,000	266,000	345,000
2020	183,000	303,000	533,000
Average	**180,000**	**271,000**	**424,000**
Maximum	**208,000**	**303,000**	**533,000**

(1) July through September.

When comparing the flows from the Western Service Area to the flows recorded from January 2007 through December 2010, as presented in the 2011 Plan, the flows have been increasing significantly over the past 10 years. Most of this increase appears to have taken place during the last 2 to 3 years.

Septage Flow Rates

Septage from septic tanks in Skagit County, outside the City of Burlington sewer service area, is discharged for treatment at the wastewater treatment plant at the influent wet well. The septage is included in the reported WWTP influent flow and loads. Table 5-4 summarizes the average flow rates for septage received for the 5-year from January 2016 through December 2020, based on totalizing the septage volume recorded for each septage hauling contractor.

As can be seen from Table 5-5, the discharge of septage increased between 2016 and 2018, and decreased since then. The flow rates are significantly higher than those presented in the 2011 Plan, however.

TABLE 5-5

Historical Flow Rates for Septage Received at the Burlington WWTP (2016 through 2020)

Year	Average Dry Weather Flow[(1)] (gpd)	Annual Average Flow (gpd)	Maximum Month Flow (gpd)
2016	4,000	3,200	4,800
2017	4,900	4,700	6,300
2018	6,900	5,800	8,000
2019	5,400	5,100	6,700
2020	5,000	4,700	5,800
Average	**5,200**	**4,700**	**6,300**
Maximum	**6,900**	**5,800**	**8,000**

(1) July through September.

City of Burlington Wastewater Flow Rates

By subtracting Western Service Area flows, Samish Water District flows and septage flows (Tables 5-3, 5-4 and 5-5) from the total influent wastewater flows (Table 5-1), the wastewater flows generated within the City of Burlington corporate limits were determined, as shown in Table 5-6, for the 5-year period from January 2016 through December 2020.

TABLE 5-6

Historical Flow Rates for Wastewater Generated within the Burlington City Limits (2016 through 2020)

Year	Average Dry Weather Flow[(1)] (mgd)	Annual Average Flow (mgd)	Maximum Month Flow[(2)] (mgd)	Maximum Day Flow[(3)] (mgd)
2016	0.761	0.934	1.339	1.514
2017	0.676	0.828	1.078	1.208
2018	0.671	0.870	1.547	1.506
2019	0.608	0.682	0.739	1.465
2020	0.766	0.880	1.386	1.451
Average	**0.696**	**0.839**	**1.218**	**1.429**
Maximum	**0.766**	**0.934**	**1.547**	**1.514**

(1) July through September.

(2) Maximum month flows were obtained by subtracting flow from wastewater contributors the same month the WWTP received the maximum month flow.

(3) Maximum Day flows were obtained by subtracting flow from wastewater contributors the same day the WWTP received the maximum day flow. Average month flows were used when daily flow was not available.

HISTORICAL INFLUENT LOADING RATES

Historical Burlington WWTP Wastewater Loading Rates

The annual average and maximum month BOD_5 and TSS mass loading rates for 2016 through 2020 at the Burlington WWTP are listed in Table 5-7 and shown graphically on Figure 5-2. The influent wastewater is sampled in the channel downstream of the influent pump station. The sampled wastewater does not include the in-plant recycle flow.

The unusually high maximum monthly TSS load in 2020 occurred in February that year. The high TSS concentrations and resulting loads were a result of a sewer line collapse creating a sinkhole in Section Street, in front of the wastewater treatment plant. This TSS load will not be used as typical Maximum Month TSS loading in this report. The TSS load of 4,252 lbs/day recorded for April 2017 should be considered a more representative existing Maximum Month TSS loading to the Burlington WWTP.

TABLE 5-7

Burlington WWTP Historical Influent BOD_5 and TSS Loading Rates

Year	Annual Average BOD_5 Loading (lb/d)	Maximum Month BOD_5 Loading (lb/d)	Annual Average TSS Loading (lb/d)	Maximum Month TSS Loading (lb/d)
2016	3,173	3,528	3,464	3,810
2017	3,078	3,415	3,489	4,252
2018	3,289	3,695	3,793	4,158
2019	3,187	3,495	3,560	3,977
2020(1)	3,083	3,867	3,757	4,217
Average	**3,162**	**3,600**	**3,613**	**4,083**
Maximum	**3,289**	**3,867**	**3,793**	**4,252**

(1) The unusually high maximum monthly TSS load of 6,310 lb/d in Feb 2020 was not included in the calculation, as it was not considered representative.

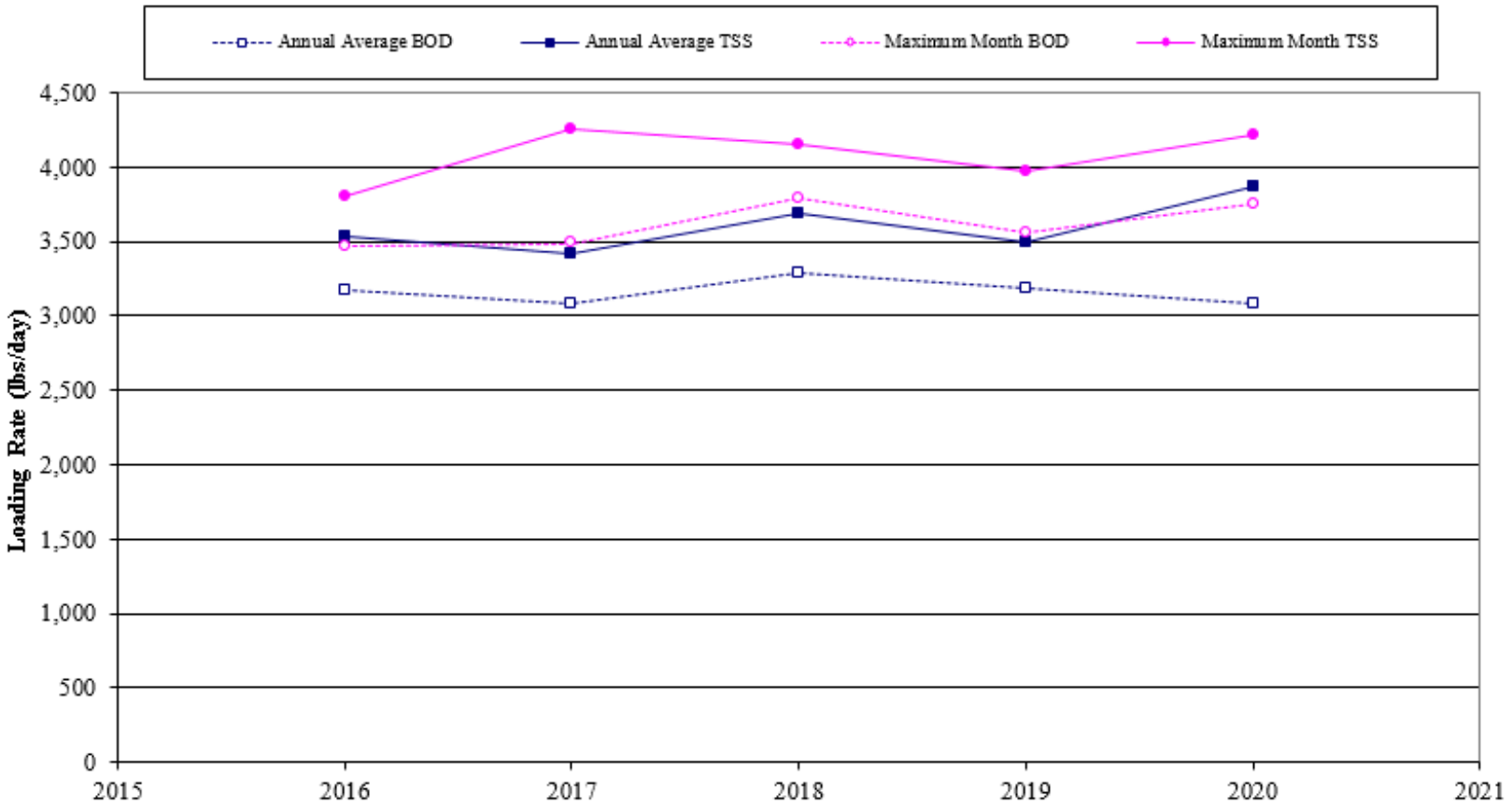


FIGURE 5-2

Burlington WWTP Influent BOD_5 and TSS Loading Rates Chart

Historical Wastewater Loading Rates from the Samish Water District Pipeline

Table 5-8 summarizes the wastewater loading rates from the Samish Water District pipeline from January 2016 through December 2020, based on analysis of samples from an automatic sampler located in Burlington Pump Station 6.

TABLE 5-8

Samish Water District Pipeline Historical Loading Rates (2016 through 2020)

Year	Annual Average BOD_5 Loading (lb/d)	Maximum Month BOD_5 Loading (lb/d)	Annual Average TSS Loading (lb/d)	Maximum Month TSS Loading (lb/d)
2016	121	183	129	178
2017	119	170	158	229
2018	160	221	169	228
2019	224	573	206	295
2020	202	354	173	265
Average	**165**	**300**	**167**	**239**
Maximum	**224**	**573**	**206**	**295**

As noted earlier in the chapter, there has been no discharge from Skagit Valley Resort and Casino to the pipeline for the 5-year period from January 2016 through December 2020, based on flow meter readings at the Casino. Therefore, the Casino has not contributed loadings to the treatment plant for this time period.

The BOD loads received from the Samish Water District pipeline has decreased as compared to the period of January 2007 through May 2010, as presented in the 2011 Plan. This decrease is less than what could be expected by the elimination of the discharge from the Skagit Valley Casino. This confirms the conclusion that there may have been additional customers connected to this pipeline since 2011, as evidenced by the flow records.

Septage Loading Rates

During August and September of 2021, four samples of septage received by the Burlington WWTP were analyzed for BOD_5 and TSS. The average BOD_5 concentration was determined to be 3,319 mg/L, while the maximum BOD_5 concentration was determined to be 5,833 mg/L. The average and maximum TSS were 28,500 mg/L and 52,900 mg/L, respectively.

Table 5-9 summarizes the loading rates for septage received for the 5-year period from January 2016 through December 2020, assuming the average concentrations are present at annual average and maximum month flows. These loading rates are significantly higher than those presented in the 2011 Plan.

TABLE 5-9

Historical Loading Rates(1) for Septage Discharged at the Burlington WWTP (2016 through 2020)

Year	Annual Average BOD_5 Loading (lb/d)	Maximum Month BOD_5 Loading (lb/d)	Annual Average TSS Loading (lb/d)	Maximum Month TSS Loading (lb/d)
2016	89	133	761	1,141
2017	130	174	1,117	1,497
2018	161	221	1,379	1,902
2019	141	185	1,212	1,593
2020	130	161	1,117	1,379
Average	**130**	**175**	**1,117**	**1,502**
Maximum	**161**	**221**	**1,379**	**1,902**

(1) Annual average loading is the product of average concentration and annual average flow; maximum month loading is the product of average concentration and maximum month flow.

Historical Wastewater Loading Rates from the Western Service Area

Four samples taken from the influent at Pump Station 8 during August and September of 2021 were analyzed for BOD_5 and TSS. The average BOD_5 was determined to be 450 mg/L, while the maximum BOD_5 was determined to be 534 mg/L. The average and maximum TSS were 337 mg/L and 432 mg/L, respectively.

Table 5-10 summarizes the average loading rates estimated to be generated in the Western Service Area for the 5-year period from January 2016 through December 2020. Since the samples were taken during the dry weather season, the loading was calculated by multiplying sample concentration with the dry weather flow. As for the recorded flow rate, these loading rates indicate an increase in the number of customers in the Western Service Area over the past 10 years.

TABLE 5-10

Historical Loading Rates(1) for the Western Service Area (2016 through 2020)

Year	Annual Average BOD_5 Loading (lb/d)	Maximum Month BOD_5 Loading (lb/d)	Annual Average TSS Loading (lb/d)	Maximum Month TSS Loading (lb/d)
2016	641	762	480	616
2017	589	699	441	566
2018	686	815	514	659
2019	780	926	584	749
2020	686	815	514	659
Average	**677**	**803**	**507**	**650**
Maximum	**780**	**926**	**584**	**749**

(1) Annual average loading is the product of average concentration (mg/L) and dry weather flow (mgd) (x 8.34); maximum month loading is the product of maximum concentration (mg/L) and dry weather flow (mgd) (x 8.34).

City of Burlington Loading Rates

By subtracting wastewater loadings contributed by the Western Service Area, Samish Water District and septage (Tables 5-8, 5-9 and 5-10), from the total influent wastewater loadings (Table 5-7), the loadings within the City of Burlington corporate limits were determined, as shown in Table 5-11 for the 5-year period from January 2016 through December 2020.

TABLE 5-11

Historical Loading Rates(1) Generated Within the Burlington Corporate Limits (2016 through 2020)

Year	Annual Average BOD_5 Loading (lb/d)	Maximum Month BOD_5 Loading(1) (lb/d)	Annual Average TSS Loading (lb/d)	Maximum Month TSS Loading(1) (lb/d)
2016	2,322	2,677	2,094	2,440
2017	2,240	2,577	1,773	2,536
2018	2,282	2,688	1,731	2,096
2019	2,042	2,350	1,558	1,975
2020	2,064	2,849	1,952	2,448
Average	**2,190**	**2,628**	**1,822**	**2,299**
Maximum	**2,322**	**2,849**	**2,094**	**2,536**

(1) Due to the lack of monthly loading data for the wastewater contributors, and to be conservative, the maximum month loadings were calculated by subtracting the average month loadings of the contributors from the maximum month loadings at WWTP.

Discussion of Wastewater Loading Rate Trends

Table 5-7 and Figure 5-2 show that the BOD_5 and TSS loading rates to the WWTP have been relatively stable between 2016 and 2020. The maximum allowable loading rates in the NPDES permit (7,356 lb/d BOD_5 and 7,660 lb/d TSS) have not been exceeded. Table 5-12 shows the WWTP per capita BOD_5 and TSS loading generated by the population within the Burlington City limits, as determined from Burlington population data and loading rate within the city limits in Table 5-11.

TABLE 5-12

City per Capita BOD_5 and TSS Loading Rates

Year	Estimated Sewered Population	Per Capita Annual Average BOD_5 Loading (lb/cap/d)	Per Capita Annual Average TSS Loading (lb/cap/d)
2016	8,675	0.27	0.24
2017	8,715	0.26	0.20
2018	9,025	0.25	0.19
2019	9,140	0.22	0.17
2020	9,270	0.22	0.21

The per capita values for BOD_5 and TSS shown in Table 5-12 are similar to typical values for communities shown in the literature (0.2 to 0.25 lb/cap/d for both BOD_5 and TSS). These per capita values could be overestimated since the other non-residential commercial and industrial loadings are also included in the total loading. The fact that the per capita loading rates have been low in the past couple of years may be in part due to the commercial/industrial pretreatment program that was implemented by the City of Burlington several years ago. The pretreatment program includes requirements for installation and maintenance of grease traps for restaurants and other industrial or commercial establishments that may discharge fats, oils, and grease (FOG) to the sanitary sewer system. Excessive FOG could clog up sewer lines and increase the organic load to the wastewater treatment plant.

The existing BOD_5 and TSS level determined by the 2020 loading will be used for projection of future waste loads. It is assumed that City's commercial/industrial waste pretreatment program, including the FOG control program, continue as it has, to ensure that the per capita waste loads are maintained at the lower levels.

Five samples taken from the influent at Pump Station 8 during August and September 2021 indicated slightly higher concentration than the WWTP influent, which is attributed to the fact that they were taken during the dry weather season. The Western Service Area is expected to generate wastewater with characteristics similar to the City itself.

As noted above, the Samish Water District is presently under contract with the City of Burlington to discharge an annual average flow of 250,000 gpd to Pump Station 6. The Skagit Valley Resort and Casino has its own wastewater treatment facility and will not be discharging to Burlington under normal operation, although they have requested Burlington maintain 60,000 gpd in capacity for emergencies.

For the purposes of future flow projections, it is assumed that the terms of the contract with the Samish Water District will not change over the next 20 years. The future projected annual average flows from the Samish Water District are assumed to be 250,000 gpd and the loading rates will be calculated from existing data, without the Skagit Valley Resort and Casino.

Skagit County has an ordinance requiring homeowners with septic tanks to have tanks pumped out every 3 years. The amount of septage received at the wastewater treatment plant is expected to be relatively stable in the future. For the purpose of this Plan, it is assumed that the amount of septage to be discharged to the Burlington wastewater treatment facility will be increased at the same rate as the estimated 1.1 percent growth rate of the County population for the next 20 years.

EXISTING EQUIVALENT RESIDENTIAL UNITS

CALCULATION OF EXISTING WASTEWATER ERUS

Equivalent residential units (ERUs) are used to express the amount of water or wastewater use by non-residential customers as an equivalent number of residential customers.

Winter water use is used to estimate the wastewater average sanitary flow rate (wastewater without infiltration and inflow), because the amount of winter water consumption typically is nearly equal to the average sanitary flow except for a minor amount of water that does not enter the sewer system (including evaporation, leaks, and winter irrigation flow).

For the City of Burlington, sewer billings during the summer season are computed based on the average water consumption during the previous winter season.

The wastewater ERU value is calculated by dividing the wastewater average sanitary flow (that is estimated by summing the winter water consumption for single-family residential customers), by the total number of active single-family residential (SFRs) connections. The water system serving the City of Burlington and the surrounding area is operated by Skagit County PUD. The City receives water use records from Skagit County PUD for wastewater billing. Wastewater billing records were available for sewered customers both inside the City as well as outside of the City in the Western Service Area. To determine the number of single-family residences with sewer service

and their corresponding wastewater flows, the City's wastewater billing records were reviewed. Table 5-13 summarizes the City's wastewater ERU value based on wastewater billing data.

The residential units and flow between 2016 and 2021 are summarized in Table 5-14. The units and flow have been relatively stable over the last 5 years. The annual average single-family wastewater flow (which is equivalent to one ERU) has ranged from 122.8 to 130.9 in the period. As for the latest year, 2021, the average daily single-family residential wastewater flow was 126.5 gallons per day for the City and 122.6 gallons per day for the service area outside of the City. For purposes of projecting future demands, the average City single-family winter wastewater flow ERU value of 126.5 gallons per day is used.

TABLE 5-13

2016-2021 Residential Housing Units and Wastewater Flows

Year	Category	Inside City			Outside City			Total
		R-1 (Single-Family Residential)	R-2 (Two-Family Residential)	R-3 (Multi-Family Residential)	R-1 (Single-Family Residential)	R-2 (Two-Family Residential)	R-3 (Multi-Family Residential)	
2016	No. of Units	1,929	74	1,130	654	4	0	3,791
	Flow (gpd)	247,863	7,357	122,405	78,337	316	0	456,278
	Flow/Unit (gpd)	128.5	99.4	108.3	119.8	79.0	0	
2017	No. of Units	1,978	80	1,122	664	4	0	3,848
	Flow (gpd)	258,880	8,758	112,268	77,474	366	0	457,745
	Flow/Unit (gpd)	130.9	109.5	100.1	116.7	91.4	0	
2018	No. of Units	1,969	78	1,135	677	4	0	3,863
	Flow (gpd)	250,325	8,018	96,397	77,941	220	0	432,901
	Flow/Unit (gpd)	127.1	102.8	84.9	115.1	55.1	0	
2019	No. of Units	2,015	82	1,175	681	4	0	3,957
	Flow (gpd)	251,569	7,939	97,201	78,614	270	0	435,594
	Flow/Unit (gpd)	124.8	96.8	82.7	115.4	67.6	0	
2020	No. of Units	2,060	86	1,135	692	4	0	3,977
	Flow (gpd)	252,908	8,687	124,429	80,273	229	0	466,525
	Flow/Unit (gpd)	122.8	101.0	109.6	116.0	57.2	0	
2021	No. of Units	2,064	88	1,246	695	4	0	4,097
	Flow (gpd)	261,146	9,476	123,172	85,235	245	0	479,274
	Flow/Unit (gpd)	126.5	107.7	98.9	122.6	61.3	0	

EXISTING NUMBER OF EQUIVALENT RESIDENTIAL UNITS

In this section, the existing number of ERUs discharging to the City of Burlington sewer system is estimated for residential and non-residential customer classes. Non-residential ERUs are estimated based on winter water consumption records, wastewater flow meter records, and the wastewater ERU value.

Residential ERUs

The number of existing residential ERUs was determined by evaluating the City's wastewater billing records. For this evaluation, the Residential class includes both multi-family and single-family connections. Year 2021 records indicate 3,398 residential units for 3,112 ERUs in the City and 699 residential units for 676 ERUs in the Western Service Area for a total of 3,788 ERUs. (There are fewer ERUs than units because duplexes and multi-family housing usually generate less flow per residential unit. In this case, the wastewater from a R-2 unit is equal to 0.85 ERUs, and the wastewater from an R-3 unit is equal to 0.72 ERUs). As discussed in Chapter 3, the City's 2021 population is estimated to be 9,540 people. The population of the Western Service Area is 2,004. Dividing the City's total residential wastewater flow of 393,794 gallons per day, shown in Table 5-13, by the City's population provides an estimated wastewater average sanitary flow of 41.3 gallons per capita per day. For Western Service Area, the estimated unit flow is 42.7 gallons per capita per day. The residential ERU information is summarized in Table 5-14.

TABLE 5-14

2021 Residential ERUs

Customer	ERUs	Flow (gpd)	Population	Flow/Person (gpd)
Residential – Inside City	3,112	393,794	9,540	41.3
Residential – Outside City	676	85,481	2,004	42.7
Total	3,788	479,274	11,544	41.5

Non-Residential ERUs

The commercial customer class includes commercial, mixed-use, industrial, and institutional connections, such as schools and government buildings.

The commercial flows based on the wastewater billing records between 2016 and 2020 are summarized in Table 5-15. In addition to wastewater billing records, which are based on winter water consumption, some of the larger customers are billed based on actual wastewater flow meter records. The 2020 flow data were used to develop the commercial ERUs. As shown in Table 5-15, year 2020 in-City commercial flow is estimated to be 181,944 gallons per day, while out-of-City flows are estimated to be

40,030 gallons per day. The quantity of commercial ERUs was developed by dividing the average commercial wastewater flows by the wastewater flow ERU value of 126.5 gallons per day.

TABLE 5-15

2016-2020 Commercial Average Sanitary Flows and ERUs

Customer	Flow (gpd)						2020[1] ERUs
	2016	2017	2018	2019	2020	Average	
Commercial – Inside City[1]	300,106	279,249	199,685	189,962	181,944	230,189	1,438
Commercial – Outside City[1]	29,184	37,874	35,680	38,946	40,030	36,343	316
Samish Water District[2]	184,408	168,131	189,833	192,567	193,192	185,626	1,527
Paccar	6,968	3,444	3,032	2,341	2,347	3,626	19
Transfer Station	1	1	2	2	2	2	0.02
Vactor Dump Station	361	316	399	326	461	373	4
Commercial Users with Flow Meter[3]							
Seafood[4]	35,989	17,635	11,674	18,622	14,748	19,734	117
Port1	66,663	69,390	61,036	64,167	46,830	61,617	370
Port2	7,996	8,386	11,808	8,630	9,205	9,205	73
Sierra Pacific	17,248	11,995	16,123	27,644	21,640	18,930	171
Redi-Mix[5]		36	112	45	36	57	0.3
Sulex		65	70	67	45	62	0.4
Hughes Farms		788	648	844	664	736	5
Lautenbach		438	452	144	194	307	2
Gielow Pickles	5,174	7,362	8,324	5,291	6,038	6,438	48
Fredonia			1,055	1,077	1,092	1,075	9
Total	**618,111**	**587,439**	**528,147**	**532,007**	**503,684**	**554,528**	**3,981**

(1) Commercial users included in the sewer billing data with sewage reported the same as the winter water use.
(2) The flows from the Samish Water District and septic tanks contain sewage from both residential and commercial sources. These flows are included in the Commercial customer classes.
(3) Commercial users with its own flow meter measuring the wastewater flow.
(4) Included in Inside City Commercial, excluded from total.
(5) Included in Outside City Commercial, excluded from total.

Summary of Existing Wastewater ERUs

Table 5-16 summarizes current wastewater ERUs for each customer class.

TABLE 5-16

Summary of ERUs for Each Customer Class

Customer	Average Sanitary Flow (gpd)	No. of ERUs	% Total ERUs
Residential	479,274	3,788	48.8%
Commercial[(1)(2)]	503,684	3,981	51.2%
Total	**982,958**	**7,769**	**100%**

(1) Based on 2020 data.
(2) Commercial includes not only facilities with a commercial designation, but also mixed-use, industrial, and institutional connections, such as schools and government buildings.

INFILTRATION AND INFLOW

In addition to residential and commercial flows, sewer systems can carry water from a variety of other sources. During periods of precipitation, increased groundwater levels and surface water flows can contribute significant quantities of water to sanitary sewer systems. This additional flow is termed infiltration and inflow (I/I).

Infiltration refers to groundwater entering a sewer system by means of defective pipes, pipe joints, or manhole walls. High infiltration flows occur when the groundwater levels rise due to significant storm events, prolonged periods of precipitation, or high tides in marine shoreline areas. Infiltration is not associated with any particular water use; it is related not only to groundwater levels, but also to collection system size, condition, and materials. Infiltration is frequently expressed either as gallons per acre served per day (gpad) or as gallons per diameter inch-mile of pipe (gpim).

Inflow refers to surface water entering the sewer system from such sources as yard, roof, and footing drains, cross connections with storm drains, and leaking manhole covers. Peak inflow occurs during heavy storm events when increased flows cause hydraulic backups and local ponding. Particularly high inflow periods may occur when mild weather and heavy rainfall follow a period of heavy snowfall. Inflow is usually expressed in terms of gpad.

Infiltration and Inflow Analysis Using EPA Criteria

Analysis of infiltration and inflow was performed to compare estimates of per capita I/I to EPA criteria. These infiltration and inflow rates are summarized in Table 5-17.

The U.S. EPA manual entitled *I/I Analysis and Project Certification* provides 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 includes domestic wastewater flow, infiltration and nominal industrial and commercial flows. This infiltration value is based on an average daily flow over a seven- to fourteen-day non-rainfall period during seasonal high ground water conditions.

2. To determine if excessive *inflow* is present in a collection system, the USEPA 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. This calculation should exclude major commercial and industrial flows (greater than 50,000 gpd each).

TABLE 5-17

Per Capita WWTP Infiltration and Inflow Based on EPA Criteria

Parameter	EPA Criteria for Excessive I/I (gpcd)	Estimated Burlington I/I Value (gpcd)
EPA Excessive Infiltration Criteria	120	93
EPA Excessive Inflow Criteria	275	167

Infiltration

Rainfall records from the Burlington WWTP DMR data show a 7-day period (December 1 through 7, 2020) during which only trace amounts of rainfall were measured. This would also be a period of relatively high groundwater. The average daily WWTP influent recorded during this time period was 1.274 mgd. Subtracting flows from two Outside-City sources (0.218 mgd) from the Western Service Area and (0.190 mgd from the Samish Water District) during the same time period yields a wastewater flow of 0.866 mgd (866,000 gpd) originating within the city limits. With a total population of sewer users in 2020 of 9,270, the "EPA I/I Infiltration Value" for Burlington is estimated at 93 gpcd which is less than the EPA guideline of 120 gpcd and; therefore, indicates no excessive infiltration. This low per capita wet weather flow suggests that the City of Burlington infiltration reduction program has been successful.

Inflow

The maximum day influent flow at the WWTP between 2016 and 2020 was 2.742 mgd (recorded on February 5, 2018). Subtracting 1.015 mgd from the Western Service Area and 219,000 gpd from the Samish Water District measured on the same date yields a

wastewater flow of 1.508 mgd originating within the city limits. Even without the exclusion of the major commercial and industrial flows, the "EPA I/I Inflow Value" for Burlington is estimated at 167 gpcd based on the total population of sewer users in 2018 of 9,025. Because this value is much lower than the EPA guideline of 275 gpcd, Burlington is not considered to have excessive inflow by EPA criteria. Although the City of Burlington has not had an active program to reduce existing inflow to the sewer system, the City's Sewer Use Ordinance prohibits property owners from connecting inflow sources, such as roof, footing, and area drains, to the sanitary sewer system.

Infiltration Assessment by Plots of Flow vs. Precipitation

There is also another way to determine the infiltration and inflow. The monthly average influent flows to the Burlington WWTP have been plotted against monthly precipitation for the period from January 2016 through December 2020. This plot is shown on Figure 5-3. As can be seen, most of the individual data points on the plot fall between two parallel lines. The lower line represents the periods with no or negligible infiltration, while the upper line represents maximum infiltration. Where the upper line intersects the y-axis, representing no precipitation, will indicate the flow to the wastewater treatment plant containing the maximum amount of infiltration and negligible inflow. The flow to the Burlington WWTP, based on records from January 2016 through December 2020, when inflow is negligible, is 1,550,000 gpd.

A similar analysis was made on the flow meter records from the Samish Water District pipeline to Pump Station 6 and the flow meter records from Pump Station 8, representing the flow from the Western Service Area. The wastewater flows containing the highest amount of infiltration with negligible amounts of inflow from these sources are 199,000 gpd from the Samish Water District pipeline and 369,000 gpd from the Western Service Area. Subtracting these two sources from the total wastewater flow to the wastewater treatment plant yields a wastewater flow of 987,000 gpd originating within the city limits. This flow represents a per capita flow of 106 gpcd, based on 2020 population of 9,270, which is also below the EPA criteria of 120 gpcd for excessive infiltration. The City of Burlington, therefore, does not have excessive infiltration in accordance with EPA definitions.

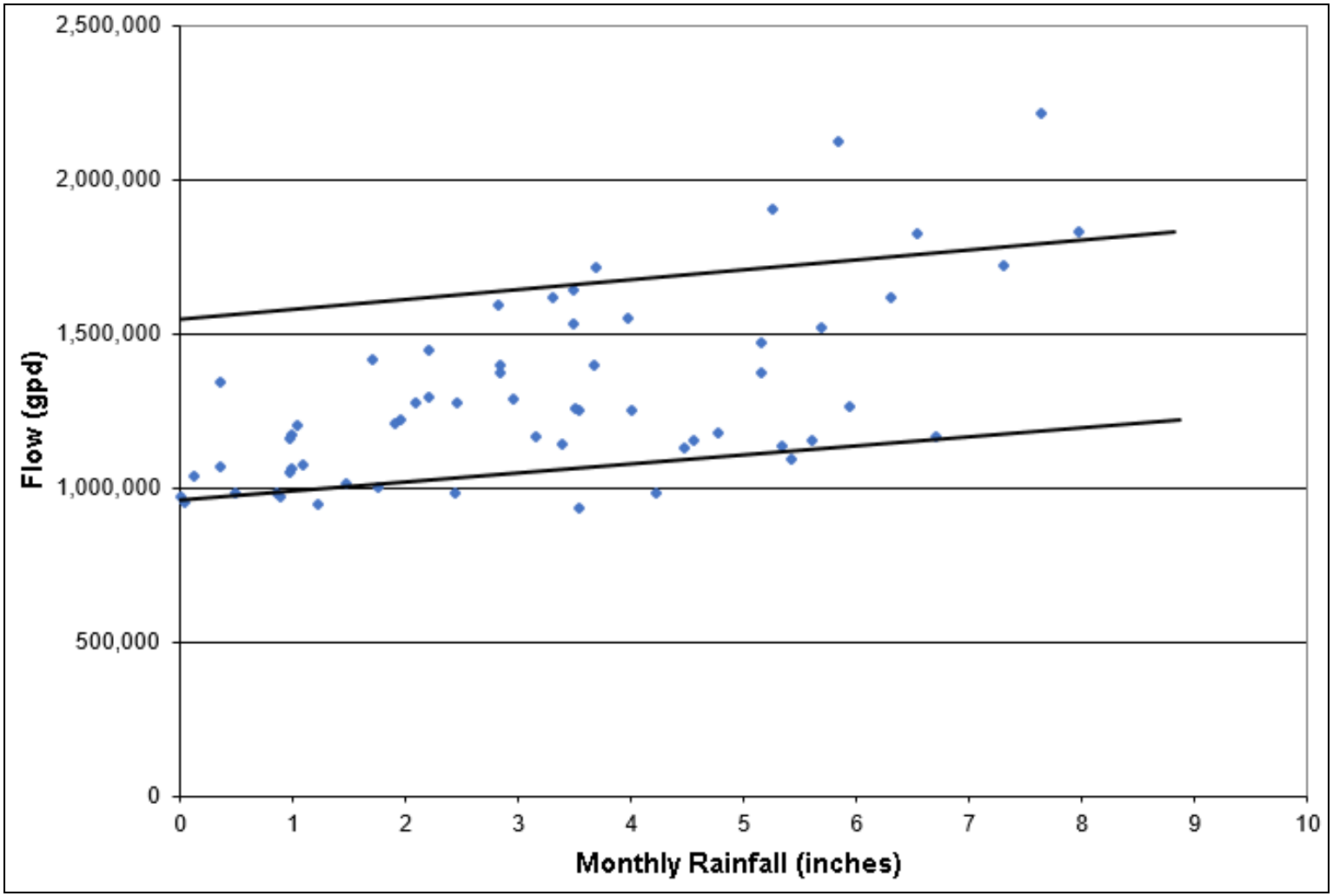


FIGURE 5-3

Variation of Influent Flow with Monthly Rainfall

PROJECTED WASTEWATER FLOWS FOR BUILDOUT CONDITIONS

Per the *draft 2021 City Comprehensive Plan*, mixed used development, infill and redevelopment are strongly encouraged in Burlington. The Comprehensive Plan develops strategies for infill of the City that includes the flexibility in development regulations to encourage a variety of uses and businesses to locate in Burlington. The City must use the land within their existing municipal boundaries before annexing and developing additional land. Furthermore, the development of agricultural land and floodplains are prohibited or strongly discouraged, therefore the amount of land available for development is limited. However, according to the Plan, the existing City land has sufficient capacity to accommodate the growth over the next 20 years.

In addition, the Western Service Area, which is located in unincorporated Skagit County and is comprised of the Bayview Ridge Urban Growth Area, includes large areas of vacant and underdeveloped land. The Bayview Ridge area includes a mix of industrial and business uses, airport and aviation-related uses, pastureland, and a variety of residential uses, with future growth emphasis on industrial/business developments. The development of the Bayview Ridge area is summarized in the 2014 Bayview Ridge Subarea Plan.

Lastly, the Western Service Area also includes the Port of Skagit County, which contains large areas of commercial and industrial land that are currently vacant or underdeveloped.

RESIDENTIAL BUILDOUT PROJECTIONS

The City's land use zoning classifications include a minimum lot size per dwelling unit as shown in Table 5-18 below. Buildout flow projections are based on the full development of the residential areas to the densities shown.

The Commercial zoning C-1 areas were assumed to be mixed use in the future to be in conformance with the proposed Mixed Use Commercial – Large Scale (MUC-2) zoning change for these areas. In addition to the commercial flow, it is also estimated to accommodate multi-family units at capacity of 2,400 square feet per unit. The unit rate was determined by the number of multi-family units identified in the City's wastewater billing records in the C-1 zone and the area of the associated parcels.

For purposes of projecting future wastewater demands, the average City single-family wastewater flow ERU value of 126.5 gallons per day is used. The 2014 *Bayview Ridge Subarea Plan* develops a minimum density of four units per acre, with the potential for development of up to six units per acre with contributions to the Farmland Legacy Program. It was assumed that all of the Bayview Ridge residential areas would be developed at six units per acre which is equivalent to 7,260 square feet per unit. In addition, it was assumed that other County zoning designations including the City and

Urban Reserve Residential would also be developed at the 7,600 square feet per unit density, as shown in Table 5-18.

TABLE 5-18

Residential Land Development Projections

Land Use	Land Use Category	City/County Zoning	Lot Size (ft^2/unit)
R-1-6.0	Single-Family Residential	City	6,000
R-1-7.6	Single-Family Residential	City	7,600
R-1-8.4	Single-Family Residential	City	8,400
R-1-9.6	Single-Family Residential	City	9,600
R-2	Two-Family Residential	City	3,800
R-3	Multi-Family Residential	City	3,000
C-1	Residential Units in Commercial District, Excluding Commercial Flows	City	2,400
BR-R	Bayview Ridge Residential	County	7,260
BR-URv	Bayview Ridge Urban Reserve	County	7,260
CITY	City	County	7,600
URR	Urban Reserve Residential	County	7,600

COMMERCIAL BUILDOUT PROJECTIONS

Commercial and industrial wastewater flow projections are typically based on the land area and expressed as gallons per acre per day (gpad). For non-residential zoned areas, the previous Comprehensive Plan used an estimated wastewater flow of 1,200 gpad for commercial flows and industrial flows in the eastern portion of the service area, and 500 gpad for industrial flows in the western portion of the service area. However, there are nine non-residential land use zoning classifications within the City of Burlington and an additional four non-residential land use zoning classifications within the County service area. To develop more accurate wastewater flows for each of the non-residential land use zoning classifications, the City's wastewater billing records were examined to identify existing high-water users of more than 1,000 gpd consumption within each non-residential zoning classification. Where enough records were available, the billing records and parcel size were used to calculate an average flow in gpad. The businesses for which flows were calculated are summarized in Figure 5-4. The calculated averages were rounded up to the design flow that will be used to calculate buildout commercial and industrial flow projections, summarized in Table 5-19.

As discussed above, areas zoned C-1 are assumed to be mixed use development in the future, as evidenced by the developments presently taking place in the area previously occupied by the Cascade Mall, which ceased operations on June 30, 2020. This area is located between Burlington Boulevard and Interstate 5, between Andis Road and Gages

Slough. Several mixed-use developments that will result in increased future wastewater flows, are presently under construction in this area.

TABLE 5-19

Non-Residential Wastewater Flow Estimates and Design Values

Land Use	Land Use Category	City/County Zoning	Estimated Avg. Flow (gpad)	Design Average Sanitary Flow (gpad)
R-S	Semi-Public District	City	2,563	2,600
M-1	Industrial District	City	3,400	3,400
B-P	Business Park District	City	415	500
C-1	Commercial District (excluding residential flows in mixed use areas)	City	1,039	1,100
C-2	Heavy Commercial	City	1,037	1,100
B-1	Business District	City	1,482	1,500
MR-NB	Medium Residential and Neighborhood Business	City	N/A	600
OSPA	Open Space, Parks and Agriculture	City	N/A	0
T-C	Transportation Corridor	City	N/A	0
AVR	Aviation Related	County	N/A	0 (2)
Ag-NRL	Agricultural – Natural Resource Lands	County	N/A	0
BR-HI	Bayview Ridge Heavy Industrial	County	21(1)	500
BR-LI	Bayview Ridge Light Industrial	County	130(1)	500

(1) No large user (<1,000 gpd) identified in these areas, all available consumption data of the non-residential accounts within the zoning area were used to calculate the unit flow.

(2) Except existing developed areas in Basin 10, 17, and 19 where 500 gpad was applied.

BUILDOUT FLOW PROJECTIONS

The wastewater flow rates developed in this Plan projected for buildout conditions are based on the buildout of all the land in the City's wastewater service area. The residential flows are based on full development (buildout) of residential areas based on the maximum number of lots per acre per the City or County land use zoning. For purposes of projecting future single-family wastewater demands, the average City single-family winter wastewater flow ERU value of 126.5 gallons per day is used. For two-family and multi-family residences, the flow value of 107.7 gallons per day and 98.9 gallons per day per unit, respectively, were used. In addition, all commercial and industrial wastewater flows will be based on full development of all the available land based on the City or County land use zoning. The design flows in gpad as calculated or assumed in the previous section will be used for projecting future commercial wastewater flows. The projected flow rates for full utilization to the maximum densities of all the areas within the City's service area can be seen in Table 5-20.

N

0 1,500 3,000 6,000 Feet

LEGEND:

- CITY LIMITS
- CITY UGA
- BAYVIEW RIDGE UGA
- PARCELS
- DRAINAGE BASINS
- LOT USED FOR ZONING CLASSIFICATION SEWER USAGE CALCULATION

DATA SOURCES:
CITY OF BURLINGTON

CITY OF BURLINGTON

WASTEWATER COMPREHENSIVE PLAN
FIGURE 5-4
HIGHEST WATER CONSUMPTION FACILITIES

Gray & Osborne, Inc.
CONSULTING ENGINEERS

TABLE 5-20

City of Burlington Design Flows

Land Use	Land Use Category	Total Area (acres)	Lot Size (ft^2/unit)	Dwelling Units (DU)	Flow Rate (gpd/unit)	Design Unit Flow Rate (gpad)	Buildout Sanitary Flow (gpd)	ERUs[1]
R-1-6.0	Single-Family Residence	118	6,000	853	126.5	—	108,000	850
R-1-7.6	Single-Family Residence	85	7,600	485	126.5	—	61,300	480
R-1-8.4	Single-Family Residence	318	8,400	1,646	126.5	—	208,200	1,650
R-1-9.6	Single-Family Residence	285	9,600	1,290	126.5	—	163,100	1,290
R-2	Two-Family Residence	57	3,800	657	107.7	—	70,700	560
R-3	Multi-Family Residence	123	3,000	1,778	91.2	—	175,800	1,390
R-S	Semipublic District	25	—	—	—	2,600	63,600	500
M-1	Industrial District	239	—	—	—	3,400	759,700	6,010
B-P	Business Park District	118	—	—	—	500	58,800	460
C-1	Commercial District	630	2,400	10,483	91.2	1,100	1,671,700	13,210
C-2	Heavy Commercial	314	—	—	—	1,100	362,400	2,860
B-1	Business District	13	—	—	—	1,500	18,800	150
MR-NB	Medium Residential and Neighborhood Business	41	—	—	—	600	24,400	190
OSPA	Open Space, Parks and Agriculture	216	—	—	—	—	—	—
T-C	Transportation Corridor	29	—	—	—	—	—	—
AVR	Aviation Related[2]	768	—	—	—	—	62,800	500
AVR-L	Aviation Related – Limited	394	—	—	—	—		
BR-HI	Bayview Ridge Heavy Industrial	908	—	—	—	500	461,800	3,650
BR-LI	Bayview Ridge Light Industrial	1104	—	—	—	500	553,300	4,370
BR-R	Bayview Ridge Residential	412	7,260	2,471	126.5	—	312,600	2,470
URR	Urban Reserve Residential	397	7,600	2,230	126.5	—	282,100	2,230
Total		**6,594**					**5,419,200**	**42,820**

(1) Based on 126.5 gpd/ERU.

(2) 0 gpad unit rate, except existing developed areas in Basin 10, 17, and 19 where 500 gpad was applied.

PROJECTED INFILTRATION AND INFLOW RATES

The projected wastewater flow rates for the City of Burlington WWTP include a sanitary component and an I/I component. The existing I/I in Burlington WWTP influent is primarily due to stormwater connections and defects in the older portions of the sewer system, which includes some areas of the Western Service Area. It is assumed that I/I will be gradually removed as a part of the sewer replacement and I/I control program presently a part of the City of Burlington Capital Improvement Program and as recommended previously in this chapter.

Table 5-21 provides the criteria that will be used to project I/I flow rates from newly sewered, based on benchmark values used in other communities.

TABLE 5-21

Projected Infiltration/Inflow Rates

Parameter	I/I Flow Rate (gpad)[(1)]
Dry Weather Infiltration	60
Annual Average	150
Maximum Month	300
Maximum Day	500
Peak Hour	1,100

(1) Projected I/I flow rates for newly sewered areas are based on benchmarks used by other communities.

For this plan, infiltration and inflow for the *existing* service area is assumed to be constant throughout the 20-year planning period. (In other words, ongoing I/I rehabilitation efforts are assumed to compensate for the increase in new I/I due to deterioration of infrastructure). The I/I rates in Table 5-21 were used for all *new* basins under the AAF, MMF, PDF, and PHF condition during planning period, as well as all basins under buildout condition,

PROJECTED FLOWS FOR THE PLANNING PERIOD

The flow projections up to this point have been made for buildout conditions, which represent the maximum flows to be expected based on the current planning area and land use classifications within the planning area. Since it is not projected that the City will reach buildout within the 20-year planning period, flow and loading projections have been made for the 5-, 10-, 15- and 20-year planning period. The City of Burlington wastewater service area is divided into four components for these projections:

1. City of Burlington UGA.

2. Western Service Area.

3. Samish Water District Pipeline.

4. Septage Received at the WWTP.

CITY OF BURLINGTON UGA

The City of Burlington UGA consists of the area within the existing Burlington corporate limits and the areas immediately surrounding the City designated by Skagit County to be within the City's UGA. As discussed in Chapter 3, the *Skagit Population, Housing and Growth Monitoring Program – 2020 Growth Monitoring Report* it is estimates that the population within the existing city limits will increase by 1.49 percent per year between 2015 and 2036, based on development of existing undeveloped properties. However, the City has been experiencing a faster development in recent years, particularly in the former Cascade Mall area. For the purpose of this plan, during the first 5 years (2021-2025), an average city-wide growth of 2 percent per year will be expected with 90 percent of that growth occurring in Basin 11, mostly in the Cascade Mall area. The remainder of the growth (10 percent of the total) will be distributed over the reminder of the City. During the remainder of the planning period (2026-2040), the overall 1.49 percent growth rate is assumed. These growth rates also include some redevelopment of areas already developed. Also, it is assumed that commercial, industrial, governmental, and institutional activities will increase at the same rate as the population increase.

Table 5-22 summarizes the average sanitary flows and service area in planning years based on the estimated growth rate. Chapter 6, Collection System Analysis, will specify each of the drainage basins in UGA with more details.

TABLE 5-22

Projected Average Sanitary Flows from Drainage Areas within the UGA

UGA	Existing (2020)	2025	2030	2035	2040
ERUs[(1)]	6,090	6,730	7,250	8,120	9,250
Average Sanitary Flows, gpd	771,000	851,000	918,000	1,027,000	1,170,000
Service Area, acres	2,451	2,451	2,451	2,578	2,840

(1) Based on 126.5 gpd/ERU.

WESTERN SERVICE AREA

The entire Western Service Area drains to Pump Station 8, which in turn conveys the flow directly to the large-diameter gravity sewers by the WWTP. According to the *2014 Bayview Ridge Subarea Plan*, only 72 people are expected to infill the residential area

between 2015 and 2036, which is equivalent to the annual growth rate of 0.3 percent. Meanwhile, a substantial annual employee growth of 2.6 percent is projected. For the purpose of this plan, it is assumed that the Western Service Area population will grow at 0.3 percent for residential customers and 2.6 percent for non-residential customers. It is further assumed that this growth will only take place in existing drainage basins and no new drainage area will be connected during the 20-year planning horizon. The wastewater from the Western Service Area would be conveyed directly to the existing wastewater collection and interceptor system.

Table 5-23 shows the projected average sanitary flows and service area within the Western Service Area, based on the assumptions stated above.

TABLE 5-23

Projected Average Sanitary flows from Drainage Areas within the Western Service Area

Western Service Area	Existing (2020)	2025	2030	2035	2040
ERUs(1)	1,450	1,570	1,700	1,850	2,020
Average Sanitary Flows, gpd	183,000	198,000	215,000	234,000	255,000
Service Area, acres	1,696	1,696	1,696	1,696	1,696

(1) Based on 126.5 gpd/ERU.

SAMISH WATER DISTRICT PIPELINE

The future flows from the Samish Water District pipeline are assumed to be based on agreements with the users of this pipeline. The Samish Water District has a contract for discharging an annual average flow of 250,000 gpd to Pump Station 6. This flow includes all dischargers to the pipeline, except the Skagit Valley Resort and Casino (Casino). This agreement is not expected to change over the next 20 years.

The Casino has a separate agreement with the City of Burlington to maintain a reserve capacity for the Casino, in the case of temporary upsets of their treatment facility, or if they generate wastewater in excess of the capacity of their new treatment facility. Based on these considerations, it is assumed the annual average flow from the Samish Water District pipeline will be 250,000 gpd within the planning period.

Historically, the maximum month flow from the Samish Water District pipeline has been 1.28 times the annual average flow. Thus, the projected maximum month flow from the Samish Water District pipeline is assumed to be 1.28 x 250,000 gpd = 320,000 gpd. In the same way, peak day flow peaking factor 1.73 was derived from the historical data and used to estimate the peak day flow to be 1.73 x 250,000 gpd = 432,000 gpd.

SEPTAGE

As discussed previously in this chapter, it is assumed that the amount of septage to be discharged to the Burlington wastewater treatment facility will increase at the same rate of the 1.1 percent County population growth rate, for the next 20 years, and will be double the 2020 level in buildout. Table 5-24 shows the projected septage flows to the Burlington wastewater treatment plant over the planning period.

TABLE 5-24

Projected Septage Flows

Year	Annual Average Septage Flow (gpd)	Maximum Month Septage Flow (gpd)	Peak Day Septage Flow (gpd)
2020 (Existing)	4,700	5,800	10,600
2025	5,000	6,100	11,200
2030	5,200	6,500	11,800
2035	5,500	6,800	12,400
2040	5,800	7,200	13,100
Buildout	9,400	11,600	21,100

WASTEWATER TREATMENT PLANT FLOWS

Tables 5-25, 5-26, 5-27, and 5-28 show the derivation of the total annual average, maximum month, peak day and peak hour flows to the wastewater treatment plant, respectively.

TABLE 5-25

Projected Total Annual Average Flows to the Wastewater Treatment Plant

Wastewater Source	Existing (2020) (gpd)	2025 (gpd)	2030 (gpd)	2035 (gpd)	2040 (gpd)	Buildout (gpd)
Burlington UGA						
ERUs[(1)]	6,090	6,730	7,250	8,120	9,250	31,910
Average Sanitary Flow	771,000	851,000	918,000	1,027,000	1,170,000	4,037,000
I/I (150 gpad for future area)	121,000	121,000	121,000	140,000	179,000	426,000
Total	891,000	972,000	1,038,000	1,166,000	1,349,000	4,463,000
Western Service Area						
ERUs[(1)]	1,450	1,570	1,700	1,850	2,020	10,990
Average Sanitary Flow	183,000	198,000	215,000	234,000	255,000	1,390,000
I/I (150 gpad for future area)	120,000	120,000	120,000	120,000	120,000	366,000
Total	303,000	318,000	335,000	354,000	375,000	1,757,000
Samish Water District Pipeline	186,000	250,000	250,000	250,000	250,000	250,000
Septage	5,000	5,000	5,000	6,000	6,000	9,000
Total to WWTP	**1,385,000**	**1,545,000**	**1,628,000**	**1,775,000**	**1,979,000**	**6,479,000**

(1) Based on 126.5 gpd/ERU.

TABLE 5-26

Projected Total Maximum Month Flows to the Wastewater Treatment Plant

Wastewater Source	Existing (2020) (gpd)	2025 (gpd)	2030 (gpd)	2035 (gpd)	2040 (gpd)	Buildout (gpd)
Burlington UGA						
ERUs[(1)]	6,090	6,730	7,250	8,120	9,250	31,910
Average Sanitary Flow	771,000	851,000	918,000	1,027,000	1,170,000	4,037,000
I/I (300 gpad for future area)	615,000	615,000	615,000	653,000	732,000	852,000
Total	1,386,000	1,466,000	1,533,000	1,680,000	1,902,000	4,889,000
Western Service Area						
ERUs[(1)]	1,450	1,570	1,700	1,850	2,020	10,990
Average Sanitary Flow	183,000	198,000	215,000	234,000	255,000	1,390,000
I/I (300 gpad for future area)	299,000	299,000	299,000	299,000	299,000	733,000
Total	483,000	498,000	514,000	533,000	555,000	2,123,000
Samish Water District Pipeline[(2)]	249,000	320,000	320,000	320,000	320,000	320,000
Septage	4,000	6,000	6,000	7,000	7,000	12,000
Total to WWTP	**2,121,000**	**2,290,000**	**2,373,000**	**2,540,000**	**2,783,000**	**7,343,000**

(1) Based on 126.5 gpd/ERU.
(2) Based on flow records, maximum month flow is 1.28 x annual average flow, including I/I.

TABLE 5-27

Projected Total Peak Day Flows to the Wastewater Treatment Plant

Wastewater Source	Existing (2020) (gpd)	2025 (gpd)	2030 (gpd)	2035 (gpd)	2040 (gpd)	Buildout (gpd)
Burlington UGA						
ERUs[(1)]	6,090	6,730	7,250	8,120	9,250	31,910
Average Sanitary Flow	771,000	851,000	918,000	1,027,000	1,170,000	4,037,000
I/I (500 gpad for future area)	836,000	836,000	836,000	900,000	1,031,000	1,420,000
Total	1,607,000	1,687,000	1,754,000	1,926,000	2,200,000	5,456,000
Western Service Area						
ERUs[(1)]	1,450	1,570	1,700	1,850	2,020	10,990
Average Sanitary Flow	183,000	198,000	215,000	234,000	255,000	1,390,000
I/I (500 gpad for future area)	486,000	486,000	486,000	486,000	486,000	1,221,000
Total	669,000	684,000	701,000	720,000	741,000	2,612,000
Samish Water District Pipeline[(2)]	333,000	432,000	432,000	432,000	432,000	432,000
Septage	11,000	11,000	12,000	12,000	13,000	21,000
Total to WWTP	**2,620,000**	**2,814,000**	**2,898,000**	**3,090,000**	**3,386,000**	**8,521,000**

(1) Based on 126.5 gpd/ERU.
(2) Based on flow records, peak day flow is 1.73 x annual average flow, including I/I.

TABLE 5-28

Projected Total Peak Hour Flows to the Wastewater Treatment Plant

Wastewater Source	Existing (2020) (gpd)	2025 (gpd)	2030 (gpd)	2035 (gpd)	2040 (gpd)	Buildout (gpd)
Annual Average Sanitary Wastewater Flow[(1)]	1,026,000	1,174,000	1,258,000	1,386,000	1,551,000	5,556,000
ERUs[(1)]	8,110	9,280	9,940	10,960	12,260	43,920
Population Equivalent	25,000	28,000	30,000	34,000	38,000	135,000
Peaking Factor	2.60	2.50	2.50	2.40	2.40	1.90
Peak Hour Sanitary Wastewater Flow	2,667,000	2,936,000	3,145,000	3,327,000	3,722,000	10,557,000
I/I (1,100 gpad)	1,793,000	1,793,000	1,793,000	1,933,000	2,221,000	5,792,000
Total to WWTP	**4,460,000**	**4,728,000**	**4,937,000**	**5,259,000**	**5,943,000**	**16,349,000**

(1) Based on 126.5 gpd/ERU.
(2) Excludes 130,000 gpd from the Samish Water District treatment lagoons, which is discharged at night and will not contribute to peak hour flow.

PROJECTED LOADING RATES FOR THE PLANNING PERIOD

Future BOD_5 and TSS loading rates are estimated by assuming the same characteristics as the existing average sanitary flow including residential, commercial, industrial, and institutional loads. An annual average BOD_5 of 0.22 pounds per capita per day (lb/cap/d) and an annual average TSS of 0.21 lb/cap/d derived from the 2020 loading rates will be used for the City of Burlington UGA. Tables 5-29 and 5-30 show the estimated annual average and maximum BOD_5 loads, respectively, throughout the planning period and for buildout conditions from the various wastewater contributors.

TABLE 5-29

Projected Total Annual Average Influent BOD_5 Loads to the Wastewater Treatment Plant

Wastewater Source	Existing 2020 (lb/d)	2025 (lb/d)	2030 (lb/d)	2035 (lb/d)	2040 (lb/d)	Buildout (lb/d)
Burlington UGA	2,060	2,280	2,460	2,750	3,130	10,810
Western Service Area	690	740	810	880	960	5,210
Samish Water District Pipeline	200	270	270	270	270	270
Septage	130	140	150	150	160	260
Total to WWTP	**3,080**	**3,430**	**3,680**	**4,050**	**4,520**	**16,550**

TABLE 5-30

Projected Total Maximum Month Influent BOD_5 Loads to the Wastewater Treatment Plant

Wastewater Source	Existing 2020 (lb/d)	2025 (lb/d)	2030 (lb/d)	2035 (lb/d)	2040 (lb/d)	Buildout (lb/d)
Burlington UGA[(1)]	2,850	3,150	3,390	3,790	4,320	14,920
Western Service Area[(2)]	820	880	960	1,040	1,130	6,180
Samish Water District Pipeline[(3)]	350	480	480	480	480	480
Septage[(4)]	160	170	180	190	200	320
Total to WWTP	**3,870**	**4,670**	**5,000**	**5,500**	**6,130**	**21,890**

(1) Based on historical data, maximum month/annual average BOD_5 is 1.38.
(2) Based on historical data, maximum month/annual average BOD_5 is 1.19.
(3) Based on historical data, maximum month/annual average BOD_5 is 1.75.
(4) Based on historical data, maximum month/annual average BOD_5 is 1.23.

Tables 5-31 and 5-32 show the estimated annual average and maximum TSS loads, respectively, throughout the planning period and for buildout conditions from the various wastewater contributors.

TABLE 5-31

Projected Total Annual Average Influent TSS Loads to the Wastewater Treatment Plant

Wastewater Source	Existing 2020 (lb/d)	2025 (lb/d)	2030 (lb/d)	2035 (lb/d)	2040 (lb/d)	Buildout (lb/d)
Burlington UGA	1,950	2,160	2,320	2,600	2,960	10,220
Western Service Area	510	560	600	660	720	3,900
Samish Water District Pipeline	170	230	230	230	230	230
Septage	1,120	1,180	1,250	1,320	1,390	2,230
Total to WWTP	**3,760**	**4,120**	**4,410**	**4,800**	**5,300**	**16,590**

TABLE 5-32

Projected Total Maximum Month TSS Loads to the Wastewater Treatment Plant

Wastewater Source	Existing 2020 (lb/d)	2025 (lb/d)	2030 (lb/d)	2035 (lb/d)	2040 (lb/d)	Buildout (lb/d)
Burlington UGA[(1)]	2,410	2,660	2,870	3,210	3,660	12,630
Western Service Area[(2)]	660	710	770	840	920	5,000
Samish Water District Pipeline[(3)]	270	360	360	360	360	360
Septage[(4)]	1,380	1,460	1,540	1,620	1,720	2,760
Total to WWTP[(5)]	**4,220**	**5,190**	**5,540**	**6,040**	**6,650**	**20,750**

(1) Based on historical data, maximum month/annual average TSS is 1.25.
(2) Based on historical data, maximum month/annual average TSS is 1.28.
(3) Based on historical data, maximum month/annual average TSS is 1.53.
(4) Based on historical data, maximum month/annual average TSS is 1.23.
(5) 2020 maximum month loading to WWTP is less than the sum of maximum month loading from contributors, since the contributor might not have the maximum month loading the same month as the WWTP.

Table 5-33 shows a summary of the estimated hydraulic, BOD_5, and TSS loads to the wastewater treatment plant.

TABLE 5-33

Summary of Projected Totals to the Wastewater Treatment Plant[(1)]

Parameter	NPDES Permit Limit	Existing (2020)	2025	2030	2035	2040	Buildout
ERUs		8,110	9,280	9,940	10,960	12,260	43,920
Annual Average Flow (mgd)		1.39	1.54	1.63	1.78	1.98	6.48
Maximum Month Flow (mgd)	3.79	2.12	2.29	2.37	2.54	2.78	**7.34**
Peak Day Flow (mgd)		2.62	2.81	2.90	3.09	3.39	8.52
Peak Hour Flow (mgd)		4.46	4.73	4.94	5.26	5.94	16.35
Annual Average BOD_5 (lb/d)		3,080	3,430	3,680	4,050	4,520	16,550
Maximum Month BOD_5 (lb/d)	7,356	3,870	4,670	5,000	5,500	6,130	**21,890**
Annual Average TSS (lb/d)		3,760	4,120	4,410	4,800	5,300	16,590
Maximum Month TSS (lb/d)	7,660	4,220	5,190	5,540	6,040	6,650	**20,750**

(1) Values that exceed NPDES Permit limits are shaded.

CHAPTER 6

COLLECTION SYSTEM ANALYSIS

INTRODUCTION

The City's wastewater collection system has been analyzed for its ability to serve the future population and land use presented in Chapter 3, and the projected total wastewater flow rates to the wastewater treatment plant are described in Chapter 5. The City's sewer system was organized into three categories for analysis:

- Pump Stations
- Force Mains
- Major Gravity Lines

The physical condition of the existing wastewater collection system was analyzed through review of previous reports, existing City sewer base maps and data, interviews with City staff, and drawdown testing of pump stations. A hydraulic model was developed to analyze the capacity of major gravity lines at year 2040 and buildout conditions at peak hour wet weather flow rates. The pump station and force main capacities were analyzed using the projected flow rates developed in Chapter 5 and in this chapter. The results of the capacity analysis and physical condition assessment were used to identify collection system components in need of rehabilitation or replacement.

DRAINAGE BASINS

A schematic of the City's existing drainage basins is provided in Figure 6-1. As development continues in areas within the City's sewer service area that are currently unsewered, additional drainage basins will be formed. Figure 6-2 shows the existing sewer service area including the City's existing wastewater drainage basins and the proposed drainage basins within the City's sewer service area. Existing drainage basins can be seen in blue and proposed drainage basins are seen in pink. Figure 6-2 also shows proposed pump stations that will be necessary to serve proposed drainage basins. Each drainage basin was provided a number which corresponds to the numbers seen on the figures. The existing and proposed drainage basins can be seen in Table 6-1. For those basins that receive flow from more than one basin, flows were calculated by subtraction of upstream basin flows where applicable.

TABLE 6-1

Existing and Proposed Drainage Basin Base Flows without Contributions from Upstream Basins

Basin No.	Basin Name	Existing/ Proposed	Basin Area[(1)] (acres)	Buildout Average Base Flow[(2)] (gpd)
1	Pump Station 1	Existing	76	115,100[(3)]
2	Pump Station 2	Existing	137	158,100[(3)]
3	Pump Station 3	Existing	137	284,400
4	Pump Station 4	Existing	154	89,100
5	Pump Station 5	Existing	370	331,300
6	Pump Station 6	Existing	5	8,100[(4)]
7	Pump Station 7	Existing	68	61,000
8	Pump Station 8	Existing	265	201,200
9	Pump Station 9	Existing	124	92,700
10	Pump Station 10	Existing	836	370,300[(5)(6)]
11	Pump Station 11	Existing	709	1,785,500
12	Pump Station 12	Existing	26	40,500
13	Pump Station 13	Existing	206	255,900
14	Pump Station 14	Existing	48	89,800
15	Pump Station 15	Existing	150	81,500
16	Pump Station 16	Existing	334	167,200
17	Pump Station 17	Existing	10	5,100 [(6)]
18	Pump Station 18	Existing	33	21,800
19	Pump Station 19	Existing	82	41,200[(5)(6)]
20	Pump Station 20	Existing	64	32,000
21	Pump Station 21	Existing	37	107,200
22	WWTP Gravity	Existing	258	207,100[(3)]
23	PACCAR	Existing	242	121,000[(3)]
24	Skagit County Recovery Facility	Existing	11	5,500
25	Puget Sound Energy	Existing	21	10,500
26	Ovenell Road	Proposed	67	32.800 [(5)]
27	Dahlstead	Existing	52	26,000
28	Farm to Market Road	Proposed	206	-
29	Bayview Ridge Aviation	Proposed	90	- [(6)]
30	Bradshaw Road Pump Station	Proposed	136	68,000[(5)]
31	Airport 1	Existing	579	- [(6)]
32	Airport 2	Existing	58	- [(6)]
33	Bayview Ridge Residential	Proposed	231	122,500
34	Chinook Drive	Proposed	68	49,000
35	Markwood Lane	Proposed	60	43,300

SAMISH WATER DISTRICT (PRIVATE)

AIRPORT RUNWAY 1 (31)

AIRPORT RUNWAY 2 (32)

PACCAR (23)

P.S. NO. 17 (17)

P.S. NO. 19 (19)

P.S. NO. 10 (10)

P.S. NO. 20 (20)

PSE (25)

P.S. NO. 8 (8)

SKAGIT CO. RECOVERY (24)

P.S. NO. 9 (9)

DAHLSTEAD (27)

P.S. NO. 16 (16)

P.S. NO. 18 (18)

P.S. NO. 7 (7)

P.S. NO. 6 (6)

P.S. NO. 12 (12)

P.S. NO. 13 (13)

P.S. NO. 15 (15)

P.S. NO. 14 (14)

P.S. NO. 21 (21)

P.S. NO. 1 (1)

P.S. NO. 2 (2)

P.S. NO. 11 (11)

P.S. NO. 3 (3)

P.S. NO. 5 (5)

RASPBERRY RIDGE UNITS I, II, AND III

P.S. NO. 4 (4)

GRAVITY TO WWTP (22)

WWTP

LEGEND:

= PUMPED FLOW

= GRAVITY FLOW

CITY OF BURLINGTON

WASTEWATER COMPREHENSIVE PLAN
FIGURE 6-1
EXISTING WASTEWATER SYSTEM DRAINAGE BASINS SCHEMATIC

Gray & Osborne, Inc.
CONSULTING ENGINEERS

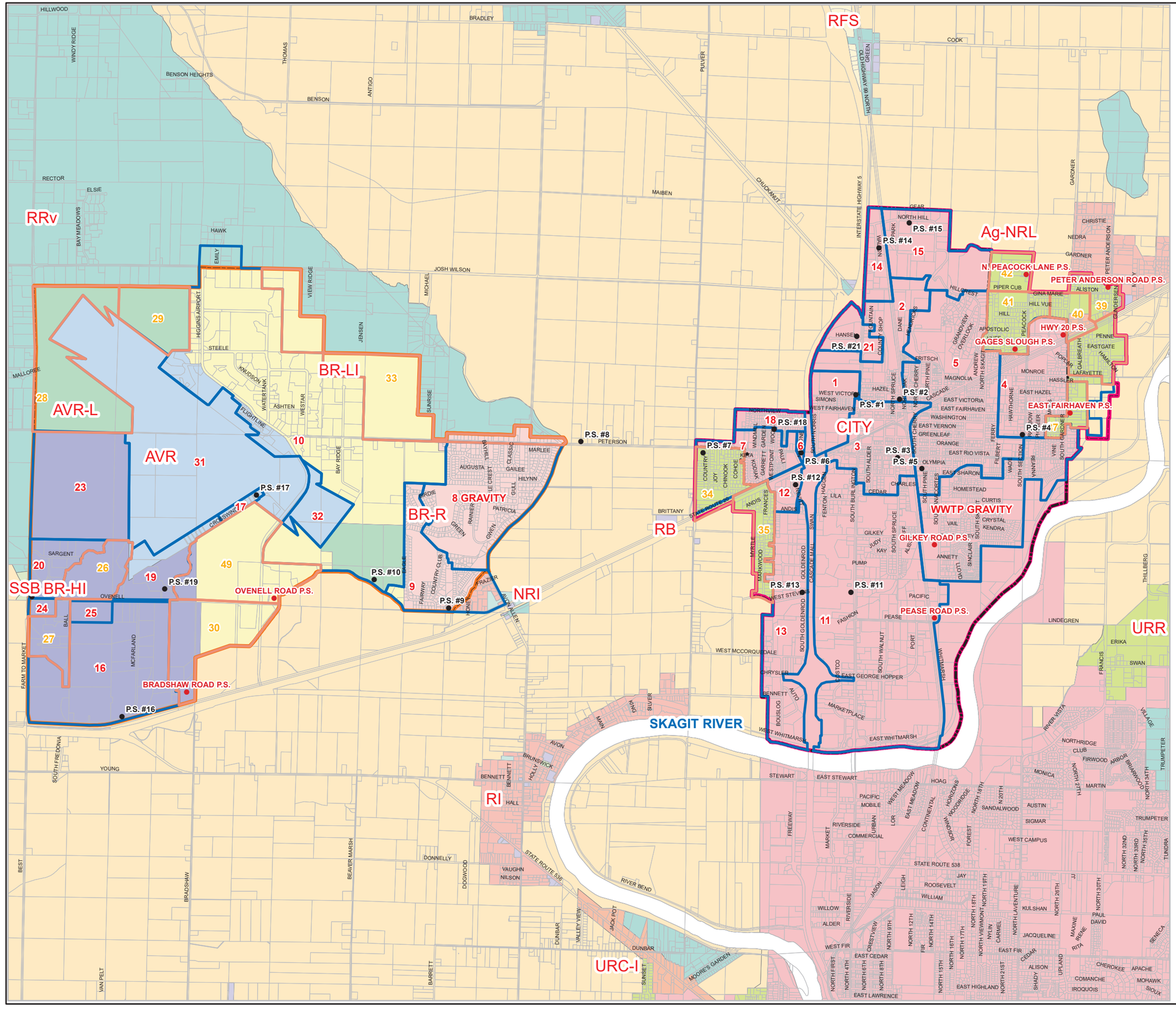

RFS
Ag-NRL
CITY
WWTP GRAVITY
RRv
AVR-L
AVR
BR-LI
BR-R
8 GRAVITY
SSB BR-HI
NRI
RB
RI
URC-I
URR
SKAGIT RIVER
N. PEACOCK LANE P.S.
PETER ANDERSON ROAD P.S.
HWY 20 P.S.
GAGES SLOUGH P.S.
EAST FAIRHAVEN P.S.
GILKEY ROAD P.S.
PEASE ROAD P.S.
OVENELL ROAD P.S.
BRADSHAW ROAD P.S.
P.S. #1
P.S. #2
P.S. #3
P.S. #4
P.S. #5
P.S. #6
P.S. #7
P.S. #8
P.S. #9
P.S. #10
P.S. #11
P.S. #12
P.S. #13
P.S. #14
P.S. #15
P.S. #16
P.S. #17
P.S. #18
P.S. #19
P.S. #21
HILLWOOD
BRADLEY
COOK
BENSON HEIGHTS
BENSON
RECTOR
ELSIE
HAWK
MAIBEN
JOSH WILSON
CHUCKANUT
INTERSTATE HIGHWAY 5
OLD HIGHWAY 99 NORTH
GEAR
NORTH HILL
CHRISTIE
NEDRA
GARDNER
PIPER CUB
GINA MARIE
ALISTON
HILL VUE
HILL
APOSTOLIC
PEACOCK
HILLCREST
GIBRANDVIEW OVERLOOK
HANSE
ERITSCH
MAGNOLIA
MONROE
HASSLER
LAFAYETTE
EAST HAZEL
WEST VICTORIA
SIMONS
WEST FAIRHAVEN
EAST VICTORIA
EAST FAIRHAVEN
WASHINGTON
EAST VERNON
GREENLEAF
ORANGE
EAST RIO VISTA
OLYMPIA
EAST SHARON
HOMESTEAD
CURTIS
CRYSTAL
KENDRA
VAIL
GILKEY
JUDY
KAY
PUMP
ANNETT
SOUTH SPRUCE
SOUTH ALDER
CEDAR
LILA
FENTON
ANDIS
SWAN
GOLDENROD
CASCADE MALL
MYRTLE
MARKWOOD
WEST STEWART
PACIFIC
PEASE
FASHION
WEST MCCORQUODALE
CHRYSLER
EAST GEORGE HOPPER
BENNETT
BOUSLOG
AUTO
MARKETPLACE
WEST WHITMARSH
EAST WHITMARSH
LINDEGREN
ERIKA
FRANCIS
THILLBERG
RIVER VISTA
NORTHRIDGE
CLUB
FIRWOOD
ARBOR
BRIARWOOD
VILLAGE
TRUMPETER
NORTH 34TH
NORTH 27TH
MONICA
MARTIN
HOAG
STEWART
EAST STEWART
PACIFIC
MOBILE
WEST MEADOW
EAST MEADOW
HORIZONS
WOODRIDGE
NORTH 18TH
N 20TH
SANDALWOOD
AUSTIN
SIGMAR
WEST CAMPUS
TRUMPETER
NORTH 32ND
NORTH 33RD
NORTH 35TH
TUNDRA
RIVERSIDE
URBAN
LOR
CONTINENTAL
HUNSAKER
FOREST
MARKET
FREEWAY
COMMERCIAL
STATE ROUTE 538
JAY
ROOSEVELT
WILLIAM
JASON
LEIGH
WILLOW
ALDER
WEST FIR
EAST CEDAR
EAST HIGHLAND
EAST LAWRENCE
NORTH 1ST
NORTH 4TH
NORTH 6TH
NORTH 8TH
NORTH 9TH
NORTH 12TH
NORTH 14TH
NORTH 15TH
NORTH 16TH
NORTH 17TH
NORTH 18TH
NORTH VIEWMONT
NYLIN
CARMEL
NORTH LAVENTURE
KULSHAN
JACQUELINE
NORTH 26TH
NORTH 30TH
MAINE
IRENE
RITA
PAUL
DAVID
SENECA
CRESTVIEW
CEDAR
ALISON
SHADY
UPLAND
CHEROKEE
APACHE
COMANCHE
MOHAWK
IROQUOIS
SIOUX
EAST FIR
NORTH 21ST
JACK POT
VALLEY VIEW
DUNBAR
MOORE'S GARDEN
SUNSET
RIVER BEND
DONNELLY
VAUGHN
NILSON
STATE ROUTE 536
BEAVER MARSH
BRADSHAW
BEST
VAN PELT
BARRETT
DOGWOOD
YOUNG
SOUTH FREDONIA
FARM TO MARKET
MCFARLAND
BALL
OVENELL
SARGENT
BRITTANY
AVON
BRUNSWICK
HOLLY
MAIN
RING
SILVER
HONEL
FRAZIER
AUGUSTA
GAILEE
HILYNN
MARLEE
GULL
CLASSIC
BYRON
GARDEN
WESTPOINT
WORK
PHILL
WINDMILL
COUNTRY
JOY
CHINOOK
COHOE
KOOPMAN
GARRETT
SOUTH CHERRY
NORTH CHERRY
NORTH SPRUCE
NORTH PINE
SOUTH PINE
SOUTH BURLINGTON
SOUTH GARDNER
SOUTH SECTION
VINE
ELBERT
FERRY
HAWTHORNE
ANDREW
NORTH SKAGIT
CASCADE
DANE
COUNTY SHOP
FOUNTAIN
WALNUT
PARK
GLENDALE
PETER ANDERSON
GALBREATH
POPLAR
PENNE
EASTGATE
HAMILTON
LAFAYETTE
GLENDALE
PEACOCK
HILLCREST
GIBRANDVIEW OVERLOOK
APOSTOLIC
GINA MARIE
PIPER CUB
ALISTON
HILL VUE
HILL
NORTH HILL
PARK
WALNUT
GEAR
CHRISTIE
NEDRA
GARDNER
PETER ANDERSON
GLENDALE
OLD HIGHWAY 99 NORTH
GREEN
PULVER
COOK
THOMAS
ANTIGO
BENSON
BENSON HEIGHTS
WINDY RIDGE
BAY MEADOWS
RECTOR
ELSIE
HAWK
EMILY
VIEW RIDGE
JENSEN
MICHAEL
JOSH WILSON
HIGGINS AIRPORT
STEELE
KNUDSON
WHITETAIL
ASHTEN
WESTAR
SUNRISE
FLIGHTLINE
BAY RIDGE
MALLOREE
CROSSWIND
BRADSHAW
BALL
MCFARLAND
FARM TO MARKET
OVENELL
SARGENT
FAIRWAY
COUNTRY CLUB
RAINIER
GREEN
GWEN
PATRICIA
BYRDIE
CREST
LEE
BRITTANY
ANDIS
FRANCES
SWAN
FENTON
HAGEN
SOUTH BURLINGTON
CEDAR
LILA
GILKEY
JUDY
KAY
PUMP
ANNETT
SOUTH SPRUCE
ALDER
SOUTH PINE
NORTH CHERRY
NORTH SPRUCE
NORTH PINE
SOUTH GARDNER
SOUTH SECTION
VINE
ELBERT
FERRY
HAWTHORNE
ANDREW
NORTH SKAGIT
CASCADE
DANE
COUNTY SHOP
FOUNTAIN
WALNUT
PARK
GLENDALE
PETER ANDERSON
GALBREATH
POPLAR
PENNE
EASTGATE
HAMILTON
LAFAYETTE
MONROE
HASSLER
EAST HAZEL
WEST VICTORIA
SIMONS
WEST FAIRHAVEN
EAST VICTORIA
EAST FAIRHAVEN
WASHINGTON
EAST VERNON
GREENLEAF
ORANGE
EAST RIO VISTA
OLYMPIA
EAST SHARON
HOMESTEAD
CURTIS
CRYSTAL
KENDRA
VAIL
GILKEY
JUDY
KAY
PUMP
ANNETT
SOUTH SPRUCE
SOUTH ALDER
CEDAR
LILA
FENTON
ANDIS
SWAN
GOLDENROD
CASCADE MALL
MYRTLE
MARKWOOD
WEST STEWART
PACIFIC
PEASE
FASHION
WEST MCCORQUODALE
CHRYSLER
EAST GEORGE HOPPER
BENNETT
BOUSLOG
AUTO
MARKETPLACE
WEST WHITMARSH
EAST WHITMARSH
LINDEGREN
ERIKA
FRANCIS
THILLBERG
RIVER VISTA
NORTHRIDGE
CLUB
FIRWOOD
ARBOR
BRIARWOOD
VILLAGE
TRUMPETER
NORTH 34TH
NORTH 27TH
MONICA
MARTIN
HOAG
STEWART
EAST STEWART
PACIFIC
MOBILE
WEST MEADOW
EAST MEADOW
HORIZONS
WOODRIDGE
NORTH 18TH
N 20TH
SANDALWOOD
AUSTIN
SIGMAR
WEST CAMPUS
TRUMPETER
NORTH 32ND
NORTH 33RD
NORTH 35TH
TUNDRA
RIVERSIDE
URBAN
LOR
CONTINENTAL
HUNSAKER
FOREST
MARKET
FREEWAY
COMMERCIAL
STATE ROUTE 538
JAY
ROOSEVELT
WILLIAM
JASON
LEIGH
WILLOW
ALDER
WEST FIR
EAST CEDAR
EAST HIGHLAND
EAST LAWRENCE
NORTH 1ST
NORTH 4TH
NORTH 6TH
NORTH 8TH
NORTH 9TH
NORTH 12TH
NORTH 14TH
NORTH 15TH
NORTH 16TH
NORTH 17TH
NORTH 18TH
NORTH VIEWMONT
NYLIN
CARMEL
NORTH LAVENTURE
KULSHAN
JACQUELINE
NORTH 26TH
NORTH 30TH
MAINE
IRENE
RITA
PAUL
DAVID
SENECA
CRESTVIEW
CEDAR
ALISON
SHADY
UPLAND
CHEROKEE
APACHE
COMANCHE
MOHAWK
IROQUOIS
SIOUX
EAST FIR
NORTH 21ST
JACK POT
VALLEY VIEW
DUNBAR
MOORE'S GARDEN
SUNSET
RIVER BEND
DONNELLY
VAUGHN
NILSON
STATE ROUTE 536
BEAVER MARSH
BRADSHAW
BEST
VAN PELT
BARRETT
DOGWOOD
YOUNG
SOUTH FREDONIA
FARM TO MARKET
MCFARLAND
BALL

TABLE 6-1 – (continued)

Existing and Proposed Drainage Basin Base Flows without Contributions from Upstream Basins

Basin No.	Basin Name	Existing/ Proposed	Basin Area[(1)] (acres)	Buildout Average Base Flow[(2)] (gpd)
37	Cascade Vista Road	Proposed	31	22,400
38	East Fairhaven Pump Station	Proposed	61	44,100
39	Peter Anderson Road Pump Station	Proposed	33	24,100
40	Highway 20 Pump Station	Proposed	25	18,100
41	Gages Slough Pump Station	Proposed	74	53,700
42	North Peacock Lane Pump Station	Proposed	38	27,300
47	Pease Road Pump Station	Proposed	18	60,800
48	Gilkey Road Pump Station	Proposed	17	57,400
49	Bayview Ridge Light Industrial	Proposed	189	94,200
SWD	Samish Water District	Existing	n.a.	120,000

(1) Drainage basin area does not include the area of any upstream drainage basins that pump or flow by gravity into the drainage basin.

(2) Drainage basin flow does not include the flows of any upstream drainage basins that pump or flow by gravity into the drainage basin.

(3) These flows include estimated flows from schools. It is assumed that existing schools within this drainage basin will remain schools and not be redeveloped.

(4) The Pump Station 6 drainage basin in this table (and any drainage basins which receive flows from Pump Station 6) does not include dry weather flow of 120,000 gpd from the Samish Water District.

(5) Wetland and wetland buffer areas were identified within this drainage basin. From discussions with the Port of Skagit County, flows assume these wetland and buffer areas will not be developed and will be excluded from the acreage.

(6) Flows assume that areas within this drainage basin zoned Aviation Related that are currently business related will be redeveloped to maximum capacity, and areas that are currently airport runways and open space will remain undeveloped.

A schematic drawing of the all the proposed drainage basins and how they will be served can be seen in Figure 6-3.

PROJECTED INFILTRATION AND INFLOW RATES

As discussed in Chapter 5, the projected wastewater flow rates for the City of Burlington sewer system include a sanitary component and an I/I component. The existing I/I in Burlington WWTP influent is primarily due to stormwater connections and defects in the older portions of the sewer system, which includes some areas of the Western Service Area. Although I/I tends to increase as sewers age, it is assumed that overall I/I will stay constant in the existing sewered parts of the City due to the ongoing sewer replacement and I/I control program presently a part of the City of Burlington Capital Improvement Program and as recommended previously in this chapter.

Table 6-2 provides the criteria that will be used to project I/I flow rates from newly sewered, based on benchmark values used in other communities.

TABLE 6-2

Projected Infiltration/Inflow Rates

Parameter	I/I Flow Rate (gpad)[(1)]
Dry Weather Infiltration	60
Annual Average	150
Maximum Month	300
Maximum Day	500
Peak Hour	1,100

(1) Projected I/I flow rates for newly sewered areas are based on benchmarks used by other communities.

As noted above, for this plan, infiltration and inflow for the *existing* service area is assumed to be constant throughout the 20-year planning period. (In other words, ongoing I/I rehabilitation efforts are assumed to compensate for the increase in new I/I due to deterioration of infrastructure). The I/I flow rates in Table 6-2 were used for all *new* basins under the AAF, MMF, PDF, and PHF condition during planning period, as well as all basins under buildout condition.

PROJECTED TOTAL WASTEWATER FLOW RATES

In order to establish the required capacity of facilities, such as gravity sewer lines and pump stations, peak hour rather than average flow has to be considered. A ratio of peak hour flow to dry weather flow is given in *Criteria for Sewage Works Design* (Ecology, 1998). This ratio, termed the "Peaking Factor" (*PF*), is given to be:

$$PF = \frac{18 + \sqrt{P}}{4 + \sqrt{P}}$$

where *P* is the population equivalent in thousands. Since much of the City and Western Service Area include non-residential flow, the commercial and industrial flows need to be converted into an equivalent population. The population equivalent is the total annual average flow divided by the flow per capita per day of 41.3 gallons per capita per day (gpcd).

BAYVIEW RIDGE AVIATION (29)

AIRPORT RUNWAY 1 (31)

AIRPORT RUNWAY 2 (32)

BAYVIEW RIDGE RESIDENTIAL (33)

SAMISH WATER DISTRICT (PRIVATE)

FARM TO MARKET ROAD (28)

PACCAR (23)

P.S. NO. 15 (15)

RASPBERRY RIDGE UNITS I, II, AND III

N. PEACOCK LANE P.S. (42)

PETER ANDERSON ROAD P.S. (39)

EAST FAIRHAVEN P.S. (38)

P.S. NO. 17 (17)

P.S. NO. 14 (14)

P.S. NO. 19 (19)

OVENELL ROAD WETLAND (26)

CHINOOK DRIVE (34)

GAGES SLOUGH P.S. (41)

HWY 20 P.S. (40)

P.S. NO. 10 (10)

P.S. NO. 21 (21)

P.S. NO. 18 (18)

P.S. NO. 20 (20)

OVENELL ROAD P.S. (49)

P.S. NO. 1 (1)

P.S. NO. 2 (2)

P.S. NO. 4 (4)

CASCADE VISTA ROAD (37)

PSE (25)

P.S. NO. 8 (8)

P.S. NO. 7 (7)

P.S. NO. 6 (6)

GRAVITY TO WWTP (22)

WWTP

SKAGIT CO. RECOVERY (24)

P.S. NO. 9 (9)

MARKWOOD LANE (35)

P.S. NO. 12 (12)

P.S. NO. 3 (3)

P.S. NO. 5 (5)

P.S. NO. 11 (11)

DAHLSTEAD (27)

BRADSHAW ROAD P.S. (30)

P.S. NO. 13 (13)

PEASE ROAD P.S. (48)

GILKEY ROAD P.S. (47)

P.S. NO. 16 (16)

BAYVIEW RIDGE LIGHT INDUSTRIAL (49)

LEGEND:

= PUMPED FLOW

= GRAVITY FLOW

= FUTURE DRAINAGE BASIN

CITY OF BURLINGTON

WASTEWATER COMPREHENSIVE PLAN

FIGURE 6-3

PROPOSED WASTEWATER SYSTEM DRAINAGE BASINS SCHEMATIC

Gray & Osborne, Inc.
CONSULTING ENGINEERS

Using the projected sanitary wastewater flow rates and the I/I flow rates, the total wastewater flow rates are then estimated as follows for each of the drainage basins:

> *Total Wastewater Peak Hour Flow Rate =*
> *Average Dry Weather Flow (or Sanitary Base Flow) * Peak Factor + Peak Hour I/I Flow Rate*

Table 6-3 provides the projected wastewater flow rates including I/I flow without contribution from upstream basins.

TABLE 6-3

Projected Wastewater Flows for Existing and Proposed Drainage Basins without Contribution from Upstream Basins

Basin No.	Basin Name	Area[1] (acres)	Buildout Equivalent Population[2]	Buildout Peak Hour Base Flow (gpd)	Buildout Peak Hour I/I[3] (gpd)	Buildout Peak Hour Flow with I/I[4] (gpd)
1	Pump Station 1	76	2,790	399,300	108,300	507,500
2	Pump Station 2	137	3,830	529,600	121,400	650,900[5]
3	Pump Station 3	137	6,890	885,300	133,200	1,018,500[5]
4	Pump Station 4	154	2,160	317,000	161,900	479,000
5	Pump Station 5	370	8,030	1,010,100	382,800	1,392,900
6	Pump Station 6	5	200	33,500	5,300	38,800[6]
7	Pump Station 7	68	1,480	224,600	75,100	299,800
8	Pump Station 8	265	4,870	655,000	291,600	946,500
9	Pump Station 9	124	2,250	328,600	136,400	465,000
10	Pump Station 10	836	8,970	1,111,300	813,600	1,924,900[7][8]
11	Pump Station 11	709	43,260	4,148,900	750,200	4,899,100
12	Pump Station 12	26	980	154,000	15,400	169,300
13	Pump Station 13	206	6,200	807,900	219,300	1,027,200
14	Pump Station 14	48	2,180	319,500	45,300	364,900
15	Pump Station 15	150	1,980	292,700	164,700	457,400
16	Pump Station 16	334	4,050	556,500	367,900	924,400
17	Pump Station 17	10	123	21,400	11,200	32,600[8]
18	Pump Station 18	33	530	86,400	36,600	123,100
19	Pump Station 19	82	1,000	156,600	90,700	247,300[7] [8]
20	Pump Station 20	64	780	124,000	70,500	194,500[7]
21	Pump Station 21	37	2,600	374,700	41,000	415,700
22	WWTP Gravity	258	5,020	671,700	279,500	951,300[5]
23	PACCAR	242	2,930	417,600	266,200	683,800[5]
24	Skagit Co. Recovery Facility	11	130	23,200	12,200	35,400
25	Puget Sound Energy	21	250	43,100	23,100	66,200
26	Ovenell Road	67	790	126,500	72,100	198,600[7]
27	Dahlstead	52	630	101,800	57,100	159,000

TABLE 6-3 – (continued)

Projected Wastewater Flows for Existing and Proposed Drainage Basins without Contribution from Upstream Basins

Basin No.	Basin Name	Area[1] (acres)	Buildout Equivalent Population[2]	Buildout Peak Hour Base Flow (gpd)	Buildout Peak Hour I/I[3] (gpd)	Buildout Peak Hour Flow with I/I[4] (gpd)
28	Farm to Market Road	206	-	-	-	-
29	Bayview Ridge Aviation	90	-	-	-	-
30	Bradshaw Road Pump Station	136	1,650	248,200	149,600	397,800[7]
31	Airport 1	579	-	-	-	-[8]
32	Airport 2	58	-	-	-	-[8]
33	Bayview Ridge Residential	231	2,970	422,200	254,400	676,600
34	Chinook Drive	68	1,190	183,900	74,400	258,400
35	Markwood Lane	60	1,050	163,900	65,700	229,600
37	Cascade Vista Road	31	540	88,500	34,000	122,500
38	East Fairhaven Pump Station	61	1,070	166,900	67,000	233,900
39	Peter Anderson Road Pump Station	33	590	95,100	36,600	131,700
40	Highway 20 Pump Station	25	440	72,300	27,400	99,700
41	Gages Slough Pump Station	74	1,300	199,900	81,500	281,400
42	North Peacock Lane Pump Station	38	660	106,800	41,500	148,300
47	Pease Road Pump Station	18	1,470	224,200	19,700	243,900
48	Gilkey Road Pump Station	17	1,390	212,500	18,600	231,100
49	Bayview Ridge Light Industrial	189	2,280	333,500	207,200	540,700
SWD	Samish Water District	n.a.	2,910	398,300[9]	-	398,300

(1) Drainage basin area does not include the area of any upstream drainage basins that pump or flow by gravity into the drainage basin.

(2) Equivalent population was calculated by converting commercial flows into populations using a flow rate of 41.3 gpcd as shown in Table 5-14.

(3) Infiltration and inflow was calculated by multiplying the developable area within the drainage basin by 1,100 gpad.

(4) Peak hour flows include the flows from any drainage basins upstream that pump or flow by gravity into the drainage basin.

(5) These flows include records for flows from schools. It is assumed that existing schools within this drainage basin will remain schools and not be redeveloped.

(6) The Pump Station 6 drainage basin and any drainage basins which receive flows from Pump Station 6 does not include dry weather flow of 120,000 gpd from the Samish Water District.

(7) Wetland and wetland buffer areas were identified within this drainage basin. From discussions with the Port of Skagit County, flows assume these wetland and buffer areas will not be developed and are excluded from the acreage.

(8) Flows assume that areas within this drainage basin zoned Aviation Related that are currently business related will be redeveloped to maximum capacity and areas that are currently airport runways and open space will remain undeveloped.

(9) Include I/I from Samish pipeline.

PROJECTED FLOWS FOR THE PLANNING PERIOD

The flow projections up to this point have been made for buildout conditions, which represent the maximum flows to be expected based on the current planning area and land use classifications within the planning area. Since it is not projected that the City will reach buildout within the 20-year planning period, flow and loading projections have been made for the 5-, 10-, 15- and 20-year planning periods. The City of Burlington wastewater service area is divided into three components for these projections:

1. City of Burlington UGA.
2. Western Service Area.
3. Samish Water District Pipeline.

CITY OF BURLINGTON UGA

As discussed in Chapter 5, during the first five years (2021-2025), an average City-wide growth of 2 percent per year is expected, with 90 percent of that growth occurring in Basin 11 and the remainder of the growth (10 percent of the total) distributed over the remainder of the City. Thus, 7 percent annual growth is estimated in Basin 11 area and 0.2 percent in the rest of the City area for those 5 years.

During the remainder of the planning period (2026-2040), the overall 1.49 percent growth rate is assumed. The 2021 draft *City Comprehensive Plan* indicates that most of the new residential units will be constructed in the commercial core, northern gateway and the downtown growth area, while most of the non-residential growth will occur in the commercial core, northern gateway, and west side freeway sales growth areas. Thus, a higher growth rate of 1.8 percent per year is estimated for the following drainage basins that include high growth areas:

1. Pump Station 1 Basin.
2. Pump Station 2 Basin.
3. Pump Station 3 Basin.
4. Pump Station 5 Basin.
5. Pump Station 11 Basin.
6. Pump Station 13 Basin.
7. Pump Station 21 Basin.

The remaining drainage basins in the City limits are assigned a 0.7 percent growth rate for an overall City growth rate of 1.49 percent. Table 6-4 shows the projected average dry weather flows for the various drainage areas within the existing City limits. The existing flows were estimated using pump station records and flow meter data. For those basins that receive flow from more than one basin, flows were calculated by subtraction of upstream basin flows where applicable.

TABLE 6-4

Projected Average Dry Weather Flows (ADWF) from Drainage Areas within Existing City Limits without Contributions from Upstream Basins

Drainage Basin	Existing (2020) ADWF (gpd)	2025 ADWF (gpd)	2030 ADWF (gpd)	2035 ADWF (gpd)	2040 ADWF (gpd)
Pump Station 1 Basin	64,700	65,600	71,700	78,400	85,700
Pump Station 2 Basin	17,700	17,900	19,600	21,400	23,400
Pump Station 3 Basin	39,500	40,100	43,800	47,900	52,300
Pump Station 4 Basin	67,500	68,400	71,800	75,400	79,100
Pump Station 5 Basin	151,200	153,200	167,500	183,200	200,300
Pump Station 6 Basin	2,900	3,000	3,100	3,300	3,400
Pump Station 7 Basin	35,400	35,900	37,700	39,600	41,500
Pump Station 11 Basin	180,400	252,600	276,200	302,000	330,200
Pump Station 12 Basin	3,300	3,300	3,500	3,700	3,900
Pump Station 13 Basin	25,200	25,500	27,900	30,500	33,400
Pump Station 14 Basin	670	680	710	750	790
Pump Station 15 Basin	10,600	10,800	11,300	11,800	12,400
Pump Station 18 Basin	22,400	22,700	23,900	25,000	26,300
Pump Station 21 Basin	1,200	1,200	1,300	1,400	1,500
Gravity to WWTP 22 Basin	148,200	150,200	157,600	165,400	173,600

The population of the City's unincorporated UGA increased from 1,645 to 2,132 over the last 20 years, representing a growth rate of 1.3 percent per year. The same population growth rate was used for the next 20 years for the unsewered urban reserve residential area (URR) in the UGA immediately outside the northeast corner of the City and west of the western part of the City, which include the following unsewered drainage basins:

Basin 34 – Chinook Drive
Basin 35 – Markwood Lane
Basin 37 – Cascade Vista Road
Basin 38 – East Fairhaven Pump Station
Basin 39 – Peter Anderson Road Pump Station
Basin 40 – Highway 20 Pump Station
Basin 41 – Gages Slough Pump Station

Basin 42 – North Peacock Lane Pump Station
Basin 47 – Pease Road Pump Station
Basin 48 – Gilkey Road Pump Station

Table 6-5 shows the projected average dry weather wastewater flows for those unsewered URR basins. The existing flows were estimated using the water billing data. It is assumed that these drainage areas will be sewered and connected to the existing wastewater collection system according to the following schedule:

Sewer Connections Made Between the Years 2030 to 2035:

Basin 34 – Chinook Drive
Basin 35 – Markwood Lane

Sewer Connections Made Between the Years 2035 to 2040:

Basin 37 – Cascade Vista Road
Basin 38 – East Fairhaven Pump Station
Basin 39 – Peter Anderson Road Pump Station
Basin 40 – Highway 20 Pump Station
Basin 41 – Gages Slough Pump Station
Basin 42 – North Peacock Lane Pump Station

Sewer Connections Made After 2040:

Basin 47 – Pease Road Pump Station
Basin 48 – Gilkey Road Pump Station

TABLE 6-5

Projected Average Dry Weather Flows (ADWF) from Drainage Areas within Existing UGA Expected to be Sewered in the Near Future without Contributions from Upstream Basins

Drainage Basin	Existing (2020) ADWF (gpd)	2025 ADWF (gpd)	2030 ADWF (gpd)	2035 ADWF (gpd)	2040 ADWF (gpd)	Buildout ADWF (gpd)
Basin 34 Chinook Drive	—	—	—	22,100	23,600	49,000
Basin 35 Markwood Lane	—	—	—	14,900	12,300	43,300
Basin 37 Cascade Vista Road	—	—	—	—	7,400	22,400
Basin 38 E. Fairhaven Pump Station	—	—	—	—	20,000	44,100
Basin 39 P. Anderson Road Pump Station	—	—	—	—	12,100	24,100
Basin 40 Highway 20 Pump Station	—	—	—	—	4,900	18,100
Basin 41Gages Slough Pump Station	—	—	—	—	21,000	53,700
Basin 42 North Peacock Lane Pump Station	—	—	—	—	820	27,300
Basin 47 Pease Road Pump Station	—	—	—	—	—	60,800
Basin 48 Gilkey Road Pump Station	—	—	—	—	—	57,400

The flows from all the drainage areas outside the City limits, but within the UGA, will have to pass through one of the drainage areas shown in Table 6-3 to reach the wastewater treatment plant, as follows:

- Basin 34, Chinook Drive flows will pass through Basin 7, Pump Station 7 and Basin 6, Pump Station 6.
- Basin 35, Markwood Lane flows will pass through Basin 13, Pump Station 13.
- Basin 37, Cascade Vista Road will pass though Basin 22, Gravity Flows to the Wastewater Treatment Plant.
- Basin 38, East Fairhaven Pump Station flows will pass through Basin 4, Pump Station 4.
- Basin 40, Highway 20 Pump Station receives flows from Basin 39, Peter Anderson Road Pump Station and the combined flow will pass through Basin 4, Pump Station 4.
- Basin 41, Gages Slough Pump Station receives flows from Basin 42, North Peacock Lane Pump Station and the combined flow will pass through Basin 4, Pump Station 4.

- Basin 47, Gilkey Road Pump Station receives flows from Basin 48, Pease Road Pump Station and the combined flow will pass through Basin 22, Gravity Flows to the Wastewater Treatment Plant.

Table 6-6 combines the information presented in Tables 6-2 and 6-3 and show the total average dry weather flow in the City drainage basins that receive flow from upstream drainage basins including flows generated within the Burlington UGA.

TABLE 6-6

Projected Average Dry Weather Flows (ADWF) from Drainage Areas within the Burlington UGA(1) Including Contributions from Upstream Basins

Drainage Basin	Existing (2020) ADWF (gpd)	2025 ADWF (gpd)	2030 ADWF (gpd)	2035 ADWF (gpd)	2040 ADWF (gpd)	Buildout ADWF (gpd)
Pump Station 1 Basin	64,700	65,600	71,700	78,400	85,700	115,100
Pump Station 2 Basin	30,100	30,500	32,900	35,400	38,200	436,700
Pump Station 3 Basin	134,400	136,200	148,400	161,700	176,300	836,100
Pump Station 4 Basin	67,500	68,400	71,800	75,400	137,900	256,400
Pump Station 5 Basin	151,200	153,200	167,500	183,200	200,300	331,300
Pump Station 6 Basin	179,800	311,600	314,700	362,100	368,400	439,000
Pump Station 7 Basin	57,900	58,600	61,500	86,700	91,400	131,800
Pump Station 11 Basin	180,400	252,600	276,200	302,000	330,200	1,785,500
Pump Station 12 Basin	3,300	3,300	3,500	3,700	3,900	40,500
Pump Station 13 Basin	28,500	28,900	31,400	49,100	49,500	339,700
Pump Station 14 Basin	11,300	11,400	12,000	12,600	13,200	171,400
Pump Station 15 Basin	10,600	10,800	11,300	11,800	12,400	81,500
Pump Station 18 Basin	22,400	22,700	23,900	25,000	26,300	21,800
Pump Station 21 Basin	1,200	1,200	1,300	1,400	1,500	107,200
Gravity to WWTP	148,200	150,200	157,600	165,400	181,000	229,500

(1) Drainage basin flow includes the flows of any upstream drainage basins that pump or flow by gravity into the drainage basin.

The information presented in Table 6-6 can be utilized to establish the peak hour flow to each of the pump stations in the UGA based on the methodology stated in earlier sections. The peak hour flow is the required capacity of each of the pump stations and sewer lines carrying the flows from each basin. Table 6-7 shows the peak hour flow for the 5-year increments during the planning period as well as buildout conditions for each of the existing and planned major pump stations that receives flow from upstream drainage basins within the Burlington UGA. The capacity of the existing pump stations are also shown to establish which pump stations are in need of additional capacity. Pump Station 6 also will receive flow from outside the UGA and is not included in Table 6-7. The required capacity of Pump Station 6 will be discussed later in this chapter.

TABLE 6-7

Projected Peak Hour Flow to Each Pump Station within the Burlington UGA
<u>Including</u> Contribution from Upstream Basins

Pump Station	Existing (2020) Peak Hour Flow with I/I (gpm)	2025 Peak Hour Flow with I/I (gpm)	2030 Peak Hour Flow with I/I (gpm)	2035 Peak Hour Flow with I/I (gpm)	2040 Peak Hour Flow with I/I (gpm)	Buildout Peak Hour Flow with I/I (gpm)	Existing Capacity (gpm)(1)
Pump Station 1	240	242	256	271	288	352	436
Pump Station 2	344	345	351	358	365	1,312	453
Pump Station 3	781	785	815	847	881	2,372	1,695
Pump Station 4	284	286	294	302	651	954	566
Pump Station 5	619	624	653	685	719	967	1,056
Pump Station 7	234	236	243	363	375	473	1,069
Pump Station 11	947	1,089	1,133	1,181	1,233	3,415	1,462
Pump Station 12	20	21	21	22	22	118	250
Pump Station 13	241	242	249	344	344	990	369
Pump Station 14	178	179	180	182	183	571	136
Pump Station 15	145	145	146	148	150	318	228
Pump Station 18	87	88	91	94	97	97	486
Pump Station 21	32	32	32	33	33	289	63
East Fairhaven Pump Station	0	0	0	0	102	162	—
P. Anderson Road Pump Station	0	0	0	0	60	91	—
Highway 20 Pump Station	0	0	0	0	93	161	—
Gages Slough Pump Station	0	0	0	0	146	298	—
North Peacock Lane Pump Station	0	0	0	0	31	103	—
Pease Road Pump Station	—	—	—	—	—	169	—
Gilkey Road Pump Station	—	—	—	—	—	329	—

(1) Based on drawdown test performed by City of Burlington.

WESTERN SERVICE AREA

The entire Western Service Area drains to Pump Station 8, which in turn conveys the flow directly to the large-diameter gravity sewers by the WWTP. According to the *2014 Bayview Ridge Subarea Plan*, only 72 people are expected to infill the residential area between 2015 and 2036, which is equivalent to the annual growth rate of 0.3 percent. Meanwhile, a substantial annual employee growth of 2.6 percent is projected. For the purposes of this plan, it is assumed that the Western Service Area population generally will grow at 0.3 percent in residential area and 2.6 percent in non-residential area. It is further assumed that this growth will only take place in the existing Western Service Area drainage basins and no new drainage area will be connected during the 20-year planning horizon. The wastewater from the Western Service Area would be conveyed directly to the existing sewer systems in the area.

Table 6-8 shows the projected average dry weather flows for the various drainage areas within the Western Service Area, based on the assumptions stated above. Existing flows were estimated utilizing pump station records combined with the water use data. For those basins that receive flow from more than one basin, flows were calculated by subtraction of upstream basin flows where applicable.

TABLE 6-8

Projected Average Dry Weather Flows (ADWF) from Drainage Areas within the Western Service Area without Contributions from Upstream Basins

Drainage Basin	Existing (2020) ADWF (gpd)	2025 ADWF (gpd)	2030 ADWF (gpd)	2035 ADWF (gpd)	2040 ADWF (gpd)
Pump Station 8 Basin(1)	26,700	27,100	27,500	27,900	28,300
Pump Station 9 Basin(1)	57,100	58,000	58,900	59,800	60,700
Pump Station 10 Basin	85,000	96,700	109,900	125,000	142,100
Pump Station 16 Basin	11,000	12,500	14,200	16,200	18,400
Pump Station 17 Basin	1,900	2,100	2,400	2,800	3,100
Pump Station 19 Basin	110	120	140	160	180
Pump Station 20 Basin	1,400	1,600	1,800	2,100	2,300

(1) Includes Bayview Ridge Residential Area.

The information presented in Table 6-8 can be utilized to establish the peak hour flow to each of the existing pump stations that receives flow from upstream drainage basins in the Western Service Area, based on the methodology stated in earlier sections. The peak hour flow is the required capacity of each of the pump stations. Table 6-9 shows the peak hour flow for the 5-year increments during the planning period as well as buildout conditions for each of the major existing pump stations in the Western Service Area. The capacities of the existing pump stations are also shown to establish which pump stations are in need of additional capacity.

The conclusions that can be drawn from the information presented in Table 6-9 will be discussed later in this chapter.

TABLE 6-9

Projected Peak Hour Flows from Pump Station within the Western Service Area Including Contribution from Upstream Basins

Pump Station	Existing (2020) Peak Hour Flow with I/I (gpm)	2025 Peak Hour Flow with I/I (gpm)	2030 Peak Hour Flow with I/I (gpm)	2035 Peak Hour Flow with I/I (gpm)	2040 Peak Hour Flow with I/I (gpm)	Buildout Peak Hour Flow with I/I (gpm)	Existing Capacity (gpm)[2]
Pump Station 8[1]	1,100	1,135	1,173	1,216	1,263	2,679	2,950
Pump Station 9[1]	242	244	246	248	250	323	511
Pump Station 10	584	615	650	689	733	1,699	1,142
Pump Station 16	114	119	124	131	138	587	566
Pump Station 17	13	14	15	16	17	23	10
Pump Station 19	24	24	24	24	24	132	161
Pump Station 20	29	29	30	31	31	111	289

(1) Includes Bayview Ridge Residential Area.
(2) Based on drawdown tests performed by the City of Burlington.

SAMISH WATER DISTRICT PIPELINE

The future flow projections from the Samish Water District pipeline are based on agreements with the users of this pipeline. The Samish Water District has a contract for discharging an annual average flow of 250,000 gpd to Pump Station 6. This flow includes all dischargers to the pipeline, except the Skagit Valley Resort and Casino (Casino). This agreement is not expected to change over the next 20 years.

The Casino has a separate agreement with the City of Burlington to maintain a reserve capacity for the Casino, in the case of temporary upsets of their treatment facility, or if they generate wastewater in excess of the capacity of their new treatment facility. Based on these considerations, it is assumed the annual average flow from the Samish Water District pipeline will be 250,000 gpd within the planning period.

Historically, the maximum month flow from the Samish Water District pipeline has been 1.28 times the annual average flow. Thus, the projected maximum month flow from the Samish Water District pipeline is assumed to be 1.28 x 250,000 gpd = 320,000 gpd.

The Samish Water District has a waste stabilization pond to pretreat wastewater prior to it being pumped to the Samish Water District pipeline for conveyance to the City of Burlington sewer system. The effluent flows from this treatment system are conveyed to the City of Burlington during night when the wastewater flows are generally low. Peak

hour flows for the rest of Burlington, on which the capacities of wastewater pump stations and pipelines are based, normally occur during the daytime hours. Therefore, the flows from the Samish Water District pretreatment system will be subtracted from the total contracted flow in order to estimate peak hour flows to Pump Station 6.

The annual average flow from the Samish Water District pretreatment system for the period of January 2016 through 2020 was 130,000 gpd. This leaves an annual average flow of 250,000 gpd – 130,000 gpd = 120,000 gpd discharged during daytime. Applying a peaking factor of 3.32 to this flow (based on the procedure discussed previously in this chapter), a peak hour flow of 398,300 gpd results for flow from the Samish Water District pipeline. It is assumed that the above flows include infiltration/inflow.

As discussed previously, the required capacity of Pump Station 6 depends on the flow from the Samish Water District pipeline, as well as the flows from Pump Station 7. The capacities of the two pumps in Pump Station 7 have been established to be 818 gpm each; thus, the firm pump station capacity (with one pump out of service) is 818 gpm. Although the expected peak hour flow from the Pump Station 7 drainage basin is 473 gpm at buildout, it is assumed that the existing pumps will remain throughout the planning horizon.

Table 6-10 shows the peak hour flow for the 5-year increments during the planning period as well as buildout conditions for Pump Station 6, including flows from Pump Station 7, the Samish Water District pipeline, and the local area around Pump Station 6 draining by gravity to this pump station. The capacity of existing Pump Station 6 is also shown.

TABLE 6-10

Projected Peak Hour Flows to Pump Station 6
<u>Including</u> Contribution from Upstream Basins

Pump Station	Existing (2020) Peak Hour Flow with I/I (gpm)	2025 Peak Hour Flow with I/I (gpm)	2030 Peak Hour Flow with I/I (gpm)	2035 Peak Hour Flow with I/I (gpm)	2040 Peak Hour Flow with I/I (gpm)	Buildout Peak Hour Flow with I/I (gpm)	Existing Capacity (gpm)[(1)]
Pump Station 6	1,118	1,118	1,119	1,232	1,236	1,312	1,413

(1) Based on drawdown tests performed by the City of Burlington.

EVALUATION OF PUMP STATIONS

The condition of the existing pump stations was evaluated through past inspections, previous reports, interviews with City staff, run time records, drawdown testing, and projected wastewater flows. The existing pump stations are all in serviceable condition.

SCADA AND TELEMETRY

All the pump stations are connected to SCADA or an auto-dialer. Most of the pump stations are connected by phone or fiber optic to an auto-dialer. The auto-dialer places a call if the pump station goes into an alarm mode. Twelve of the pump stations are connected into a supervisory control and data acquisition (SCADA) telemetry system located at the WWTP. The SCADA system offers the ability to monitor more information and to adjust functions and set points remotely. The City is planning to connect the remaining pump stations to the SCADA system.

The Burlington Sewer Department SCADA is operated separately from other City operations via an individual network system. Although the two networks are connected via a virtual local area network, they possess separate internet protocol addresses, which separate the two networks. Servers attached to the programmable logic controller (PLC), which relays information and controls regarding WWTP operations, are controlled via a secure network interface directly on the PLCs network. Security to this server is achieved through password protected individual login information for a list of users who have been granted appropriate network access.

FLOW METERS

Pump Stations 3, 6, 8, 10, and 16 are equipped with flow meters on the discharge force main. Pump Station 6 has a flow meter on the inlet discharge from the Samish Water District force main. The flows from the remainder of the pump stations can be calculated by pump run time meters. In general, City staff record the pump run time hours three times a week for the majority of the pump stations and once a week for a few of the smaller pump stations. It is recommended that the City install flow meters on the pump stations discharging to a common force main. This includes Pump Stations 5, 11, 13, 19, and 20. For pump stations discharging to a common force main, flows cannot be reliably estimated from pump run time meters because flows would vary depending on the head created by additional pump stations operating at the same time. Flows to Pump Stations 19 and 20 are presently very low and are not expected to increase significantly during the planning period. Flow meter installations at these pump stations should not be required until significant development is expected to occur in these pump stations' drainage basins. Flow meters at Pump Stations 5, 11, and 13 should be installed as soon as possible to obtain reliable flow records for these pump stations. The flow meters can be connected to the SCADA system when it has been installed. The flow meters will be able to save a considerable amount of staff time spent driving around and recording run time hours.

GENERATORS

Nine of the 21 pump stations have on-site standby generators. The remaining pump stations utilize portable generators for standby power. However, all the pump stations have bypass connections which include the ability to install temporary bypass pumps to

pump from the wet well into the force main. The pump stations and the types of generators can be seen in Table 6-11.

TABLE 6-11

Pump Station Generator Data

Pump Station	Pump Horsepower	Generator Type
1	7.5	Portable
2	3	Portable
3	40	On-Site
4	7.5	On-Site
5	15	On-Site
6	40	On-Site
7	25	Portable
8	75	On-Site
9	5	On-Site
10	45	On-Site
11	25	On-Site
12	5	Portable
13	7.5	On-Site
14	10	Portable
15	5	Portable
16	30	Portable
17	2	Portable
18	5	Portable
19	2	Portable
20	20	Portable
21	5	Portable

PUMP EFFICIENCY AND DRAWDOWN TESTING

Drawdown testing was performed by City staff for the majority of the pump stations. The City measured the time to pump down the wet well 1 foot with each pump. In addition, the time to fill the wet well 1 foot was measured. The drawdown capacity for each pump was calculated based on these measurements and the wet well size and volume for 1 foot of wet well height. Table 6-12 provides the pump station design capacities and the drawdown test capacities.

TABLE 6-12

Pump Station Drawdown Test Results

Pump Station	Pump Design Capacity (gpm)	Pump 1 Drawdown Capacity (gpm)	Pump 2 Drawdown Capacity (gpm)
1	495	584	532
2	390	357	367
3(1)	1,500 2,150	1,695	1,844
4	500	566	593
5(1)	713 1,217	1,056	1,094
6(1)	1,580 1,874	1,413	1,469
7	760	1,069	1,171
8(2)	2,950 3,700	N/A	N/A
9	550	511	559
10	1,425	1,142	1,142
11(2)	1,283 1,650	1,462	1,462
12	250	277	250
13(2)	290 740	405	369
14	136	145	136
15	228	228	266
16(3)	566	579	566
17(4)	N/A	10	12
18	200	486	510
19(3)	161	161	185
20(3)	289	289	289
21	120	N/A	110

(1) Pump Stations 3, 5, and 6 discharge to a common force main. The upper numbers in the capacity column indicate the conditions when all three pump stations discharge simultaneously to the force main. This number represents the rated capacity of the pump station. The lower numbers indicate the condition when each pump station is discharging by itself to the force main. The actual flow rate at any time would be somewhere between the two conditions.

(2) Pump Stations 8, 11, and 13 discharge to a common force main. The upper numbers in the capacity column indicate the conditions when all three pump stations discharge simultaneously to the force main. This number represents the rated capacity of the pump station. The lower numbers indicate the condition when each pump station is discharging by itself to the force main. The actual flow rate at any time would be somewhere between the two conditions.

(3) Pump Stations 16, 19, and 20 discharge to a common force main. The stated capacities for these pump stations have been obtained from drawdown tests and pump curves. No hydraulic analyses have been made on the force main system for these pump stations and it is unknown whether the pumps were operating alone or simultaneously with other pump stations when the drawdown tests were made.

(4) Design information for Pump Station 17 pumps is not available.

The drawdown test results show that the actual pump capacities are at or above the design capacities for the majority of the pump stations. The drawdown pump results show that the Pump Station 13 pumps do not appear to be operating efficiently. The pump curves show these pumps operating near 40 percent efficiency, when they should be operating closer to the 60 to 80 percent efficiency range. It is recommended that the existing pumps at Pump Station 13 be replaced with more efficient and possibly higher capacity pumps.

PUMP STATION CAPACITIES

The City owns and operates 21 pump stations. An additional five pump stations are anticipated to be constructed as drainage basins are connected to the sewer system. The capacity evaluation of the pump stations was conducted by comparing the existing capacities to the projected wastewater flows. The evaluation includes the existing, 2025, 2030, 2035, 2040, and buildout projected peak hour wastewater flows. The existing pump station capacities are summarized in Chapter 4 and the projected wastewater flows for each pump station are summarized in this chapter. The results of the pump station capacity evaluation can be seen in Table 6-13.

TABLE 6-13

Pump Station Capacity Evaluation

Pump Station	Existing (2020) Peak Hour Flow with I/I (gpm)	2025 Peak Hour Flow with I/I (gpm)	2030 Peak Hour Flow with I/I (gpm)	2035 Peak Hour Flow with I/I (gpm)	2040 Peak Hour Flow with I/I (gpm)	Buildout Peak Hour Flow with I/I (gpm)	Existing Capacity (gpm)
Pump Station 1	240	242	256	271	288	352	532
Pump Station 2	344	345	351	358	365	1312	357
Pump Station 3	781	785	815	847	881	2372	1,695
Pump Station 4	284	286	294	302	651	954	566
Pump Station 5	619	624	653	685	719	967	1,056
Pump Station 6	1,118	1,118	1,119	1,232	1,236	1,312	1,413
Pump Station 7	234	236	243	363	375	473	1,069
Pump Station 8	1,100	1,135	1,173	1,216	1,263	2,679	2,950
Pump Station 9	242	244	246	248	250	323	511
Pump Station 10	584	615	650	689	733	1,699	1,142
Pump Station 11	947	1,089	1,133	1,181	1,233	3,415	1,462
Pump Station 12	20	21	21	22	22	118	250
Pump Station 13	241	242	249	344	344	990	369
Pump Station 14	178	179	180	182	183	571	136
Pump Station 15	145	145	146	148	150	318	228
Pump Station 16	114	119	124	131	138	587	566
Pump Station 17	13	14	15	16	17	23	10
Pump Station 18	87	88	91	94	97	97	486
Pump Station 19	24	24	24	24	24	132	161
Pump Station 20	29	29	30	31	31	111	289
Pump Station 21	32	32	32	33	33	289	63
East Fairhaven Pump Station	—	—	—	—	102	162	—
Peter Anderson Road Pump Station	—	—	—	—	60	91	—
Highway 20 Pump Station	—	—	—	—	93	161	—
Gages Slough Pump Station	—	—	—	—	146	298	—
North Peacock Lane Pump Station	—	—	—	—	31	103	—
Gilkey Road Pump Station	—	—	—	—	—	329	—
Pease Road Pump Station	—	—	—	—	—	169	—

Note: Shaded areas indicate pump station capacities are exceeded.

The analysis shows that Pump Stations 14 and 17 are currently over their existing capacity. A sewer improvement project proposed by the Port will significantly decrease the length of the force main from Pump Station 17. This will most probably increase the capacity of the existing pumps at Pump Station 17 to accommodate 2040 projected flows. The capacity of these pumps should be reviewed upon the completion of the Port sewer improvement project. The capacity of Pump Station 2 will be exceeded by 2035. Pump Station 4 is projected to be at capacity by 2040 in its existing configuration with two pumps. The remaining pump stations have capacity to serve flows throughout the planning period.

It is recommended that Pump Station 5 be equipped with a flow meter and, as will be discussed in a subsequent section, the capacity its force main upstream of its connection to the common 14-inch force main, needs to be increased by 2040.

EVALUATION OF FORCE MAINS

The capacity of the City's force mains is tied directly to the pump station capacity evaluation. Table 6-14 compares the pumping capacity of each of the pump stations with the force main capacities. Force main capacity is typically based on a maximum design velocity of 8 feet per second (fps). This 8 fps criterion has been used to evaluate capacity in Table 6-14; however, the maximum velocity of 8 fps is not ideal and results in large head losses for longer force mains. The flow to each force main is assumed equal to the flow to the pump stations which pump to that force main.

TABLE 6-14

Force Main Capacity Evaluation

Force Main	Existing Force Main Size (inches)	Existing Capacity[1] (gpm)	Existing (2020) Peak Hour Flow with I/I (gpm)	2025 Peak Hour Flow with I/I (gpm)	2030 Peak Hour Flow with I/I (gpm)	2035 Peak Hour Flow with I/I (gpm)	2040 Peak Hour Flow with I/I (gpm)	Buildout Peak Hour Flow with I/I (gpm)
Pump Station 1[2]	6 8	705 1,253	240	242	256	271	288	352
Pump Station 2	8	1,253	344	345	351	358	365	1,312
Pump Station 3[3]	10 12 12 common 14	1,958 2,820 2,820 3,838	781 781 1,899 2,518	785 785 1,903 2,527	815 815 1,934 2,587	847 847 2,079 2,764	881 881 2,117 2,836	2,372 2,372 3,684 4,651
Pump Station 4	6 8 10	705 1,253 1,958	284 284 284	286 286 286	294 294 294	302 302 302	651 651 651	954 954 654
Pump Station 5[3]	6 14	705 3,838	619 2,518	624 2,527	653 2,587	685 2,764	719 2,836	967 4,651
Pump Station 6[3]	12 12 common 14	2,820 2,820 3,838	1,118 1,899 2,518	1,118 1,903 2,527	1,119 1,934 2,587	1,232 2,079 2,764	1,236 2,117 2,836	1,312 3,684 4,651
Pump Station 7	8 12	1,253 2,820	234	236	243	363	375	473
Pump Station 8[4]	16 18 20 20 common 24 14 20	5,013 6,345 7,832 7,832 11,279 3,838 7,832	1,100 1,100 1,100 1,341 2,288 1,144 1,144	1,135 1,135 1,135 1,377 2,466 1,233 1,233	1,173 1,173 1,173 1,422 2,555 1,278 1,278	1,216 1,216 1,216 1,560 2,741 1,371 1,371	1,263 1,263 1,263 1,607 2,840 1,420 1.420	2,679 2,679 2,679 3,669 7,084 3,707 3,707
Pump Station 9	8 10	1,253 1,958	242	244	246	248	250	323

TABLE 6-14 – (continued)

Force Main Capacity Evaluation

Force Main	Existing Force Main Size (inches)	Existing Capacity[(1)] (gpm)	Existing (2020) Peak Hour Flow with I/I (gpm)	2025 Peak Hour Flow with I/I (gpm)	2030 Peak Hour Flow with I/I (gpm)	2035 Peak Hour Flow with I/I (gpm)	2040 Peak Hour Flow with I/I (gpm)	Buildout Peak Hour Flow with I/I (gpm)
Pump Station 10	12	2,820	584	615	650	689	733	1,699
Pump Station 11[(4)]	10	1,958	947	1,089	1,133	1,181	1,233	3,415
	24	11,279	2,288	2,466	2,555	2,741	2,840	7,084
	14	3,838	1,144	1,233	1,278	1,371	1,420	3,707
	20	7,832	1,144	1,233	1,278	1,371	1.420	3,707
Pump Station 12[(5)]	4	313	20	21	21	22	22	118
Pump Station 13	6	705	241	242	249	344	344	990
	8	1,253	241	242	249	244	344	990
	20	7,832	1,341	1,377	1,422	1,560	1,607	3,669
	24	11,279	2,288	2,466	2,555	2,741	2,840	7,085
	14	3,838	1,144	1,233	1,278	1,371	1,420	3,707
	20	7,832	1,144	1,233	1,278	1,371	1,420	3,707
Pump Station 14	6	705	178	179	180	182	183	571
Pump Station 15	6	705	145	145	146	148	150	318
Pump Station 16	8	1,253	114	119	124	131	138	587
Pump Station 17	3	176	13	14	15	16	17	23
Pump Station 18	4	313	87	88	91	94	97	97
Pump Station 19	6	705	24	24	24	24	24	132
Pump Station 20	6	705	29	29	30	31	31	111
Pump Station 21	4	313	32	32	33	33	33	289

Note: Shaded areas indicate force main capacities are exceeded.

(1) Existing capacity is based on a maximum force main velocity of 8 fps.

(2) Pump Station 1 has a 6-inch force main which increases to an 8-inch force main.

(3) Pump Stations 6 and 3 discharge to a 12-inch common force main. The force main increases to 14 inches as Pump Station 5 discharges to the force main.

(4) Pump Stations 8 and 13 discharge to a 20-inch common force main. The force main increases to 24 inches as Pump Station 11 discharges to the force main. The flow from the 24-inch force main is split evenly between a 14-inch and 20-inch force main at South Anacortes Street. The future Gilkey Road Pump Station discharges into the 20-inch force main after the split.

The 12- and 14-inch force main from Pump Station 6 to Sharon Avenue was originally constructed using asbestos cement (AC) pipe. This pipe has been subject to failure recently and may approach the end of its useful life. The City should consider replacing this pipeline with ductile iron or HDPE pipe during the next 5 years. This pipe is not projected to have any capacity problem during the planning period, but will reach capacity before buildout conditions. Replacing this pipe with ductile iron or HDPE will offer an opportunity to increase the capacity and reduce the friction loss through this pipe, thus making the pump stations more energy efficient and providing sufficient capacity through buildout conditions. The 12-inch force main from Pump Station 6 to Pump Station 3 can remain a 12-inch pipe. The 12-inch pipe from Pump Station 3 to Pump Station 5 should be upsized to an 18-inch diameter force main. The 14-inch pipe from Pump Station 5 to the discharge point in Sharon Avenue should be upsized to a 20-inch force main. This will result in velocities in the 4-5 fps range.

The 6-inch force main from the pumps to connection to the 14-inch force main at Pump Station 5 should be upsized to 8-inch by 2040. This could be implemented in conjunction with the replacement of the 14-inch AC force main and/or the upgrade of this pump station, including the installation of a flow meter.

The remainder of the force mains have adequate capacities to accommodate the flows through the planning period.

HYDRAULIC MODEL

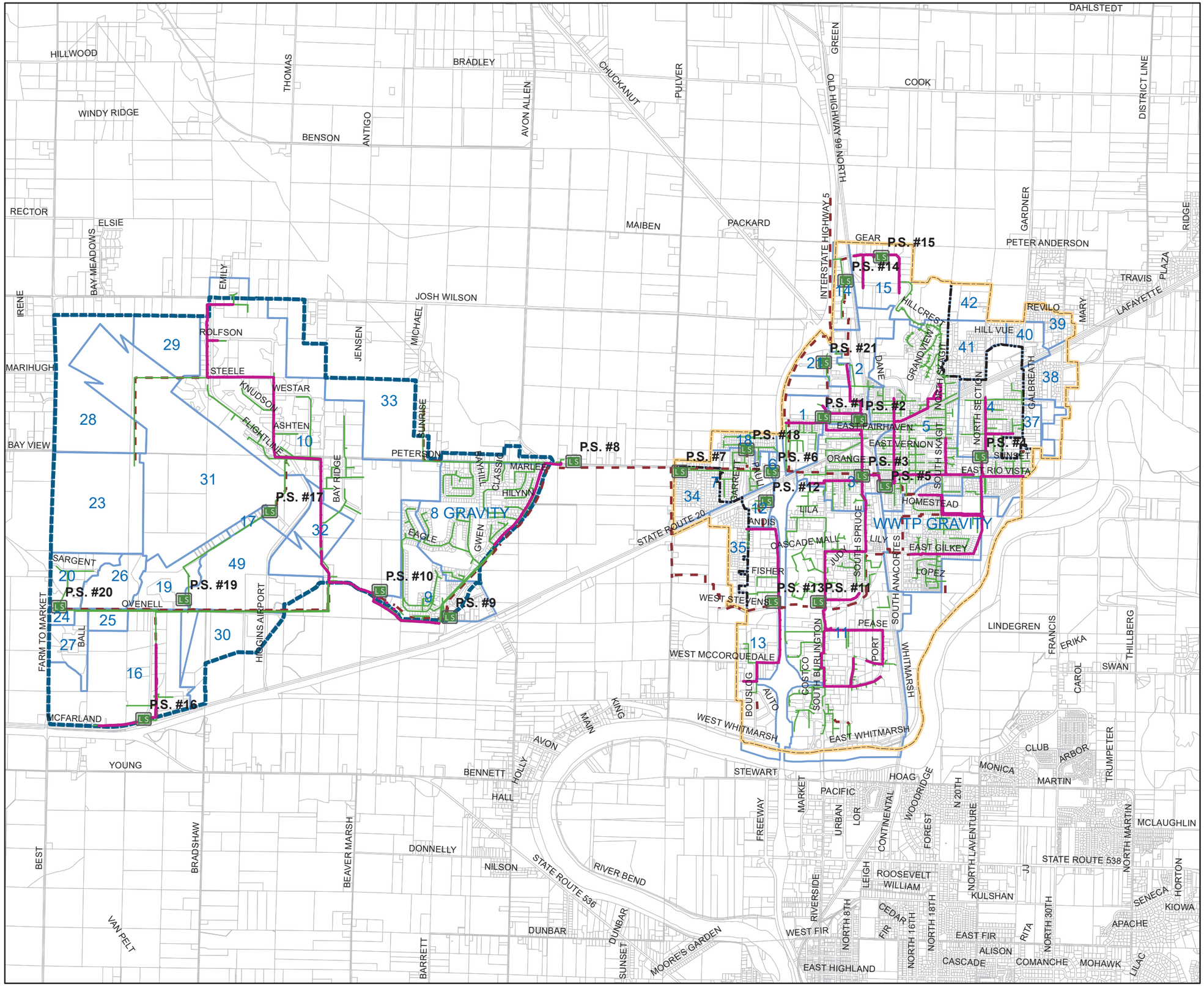
A hydraulic model of the City's wastewater collection system is presented in this section, including a description of model development and the assumptions used in the model. This model has two main functions: (1) to provide information to develop recommended improvements to convey the projected flow rates; and (2) to evaluate the system with the recommended capital improvements to verify capacity. The model can be updated and maintained for use as a tool to aid in future planning and design.

MODEL DEVELOPMENT

Physical Model

The major gravity sewer lines of the City's sewer system were modeled using an Excel-based spreadsheet. Figure 6-4 shows the sewer lines that were included in the hydraulic model.

The hydraulic model was developed from record drawing information provided by the City. The accuracy of the hydraulic model results depends on the accuracy of the data input to the model. In some cases, reliable invert elevations of manholes were not known, and invert elevations were linearly interpolated between known invert elevations upstream and downstream. Data used in the hydraulic model is shown in Table 6-15.



N

Legend

- LIFT STATION
- MODELED SEWER PIPES
- SEWER MAIN
- FORCEMAIN
- CITY LIMITS
- CITY UGA
- BAYVIEW RIDGE UGA
- BASINS

DATA SOURCES:
CITY OF BURLINGTON

CITY OF BURLINGTON

WASTEWATER COMPREHENSIVE PLAN
FIGURE 6-4
MODELED SEWER PIPES

Gray & Osborne, Inc.
CONSULTING ENGINEERS

TABLE 6-15

Sewer System Information from City Data

Category	Gravity Sewers	Manholes
Number	Pipe ID number based on upstream manhole number	Manhole number based on City's numbering convention
Dimension	Length from City records	Not applicable
Elevation	Upstream and downstream pipe invert elevations from City records	Ground elevations from City records
Size	Pipe diameters from City records	Assumed 48-inch manhole size
Flow Criteria	Assumed Manning's roughness coefficient of 0.013 which corresponds to average concrete pipe	Not applicable

Wastewater Flow Model

The hydraulic model was used to simulate peak hour flow rates for the projected 2040 and buildout flow conditions. Sanitary sewer flow projections determined previously in this chapter were applied for each of the sewer drainage basins.

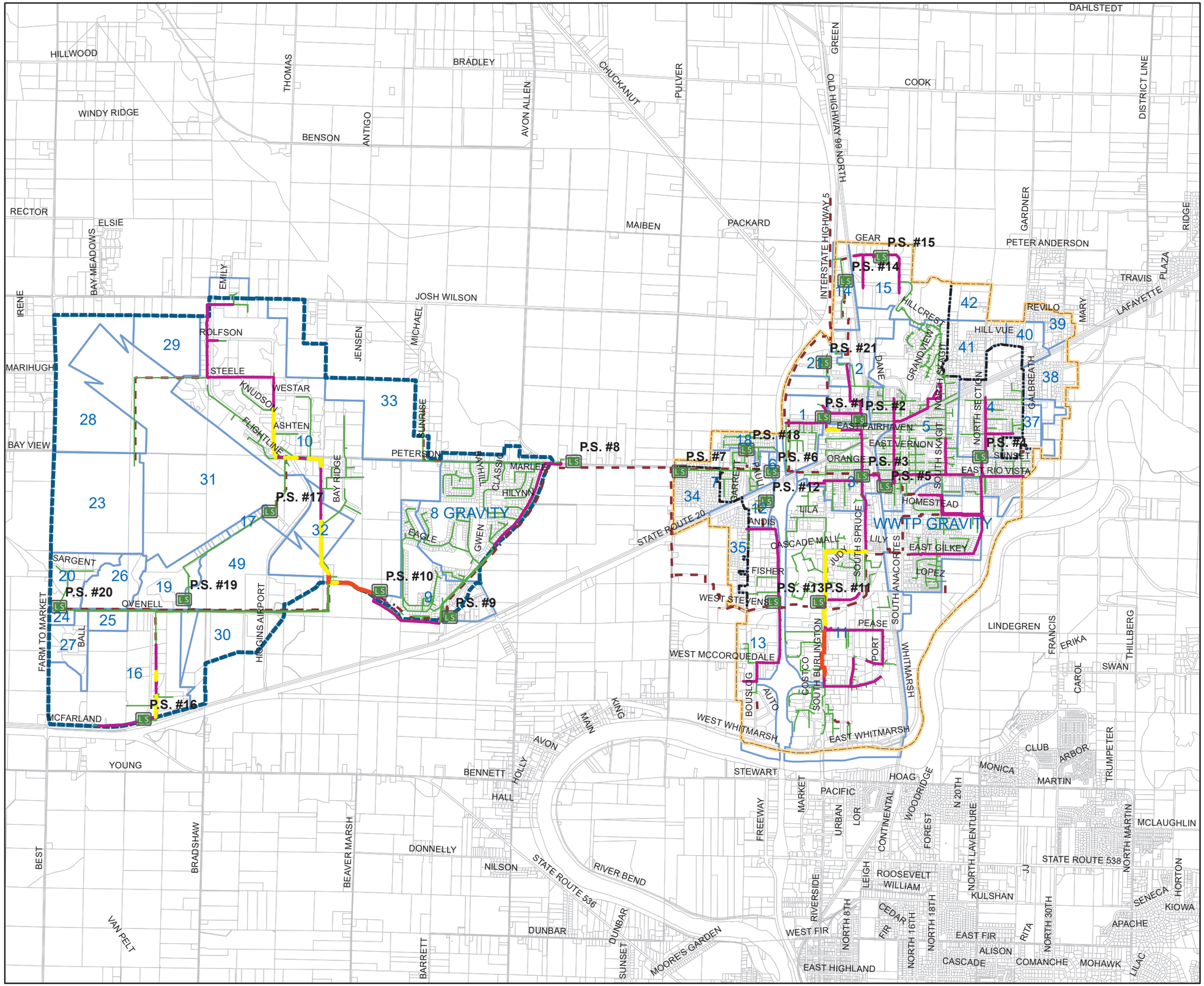
For the existing sewer drainage basins with 10-inch or larger sewer pipes, the projected 2040 and buildout flows were distributed within the drainage basins. Flows from pump stations were input at the force main discharge manholes. For proposed drainage basins, flows were input at the anticipated gravity drainage discharge or force main discharge manhole. Only the existing sewer system was modelled and it was assumed that when future drainage basins are connected to the system, new pipes will be sized to receive projected flows. Appendix E provides the distribution and flow rates input into the sewer model.

Model Evaluation Criteria

The 2040 and buildout model runs identify sewers that may be hydraulically deficient if a peak hour flow event including infiltration and inflow happened with the estimated 2040 or buildout flow conditions. The criteria for listing a gravity sewer pipe as "deficient" are that at peak hour flow, the flow exceeds the capacity of the pipe. The capacity of the pipe is calculated using Manning's equation assuming that the pipe is flowing full. The slope of the pipe is calculated using pipe length and the difference between the pipe invert elevations as recorded in the City's record drawing data. Pipes that marginally exceed their capacity may result in an acceptable surcharge, i.e., a surcharge level in the upstream manhole that does not flood.

RESULTS OF HYDRAULIC MODELING ANALYSIS

The model was run with the projected year 2040 and buildout sanitary and I/I flow rates, and the capacities of the existing sewer pipes were compared to the estimated peak hour flow rates. The projected flow rates are conservative, and can be used to size components for new projects. Table 6-16 provides information on all the existing system components that may have insufficient capacity under 2040 and buildout conditions, respectively and Figure 6-5 shows the locations of the deficient pipes. These include pipes that have acceptable surcharge levels. Full-size maps of the deficient pipes can be seen in Appendix F.



N

Legend

- LIFT STATION
- MODELED SEWER PIPES
- OVER CAPACITY AT 2040
- OVER CAPACITY AT BUILDOUT
- SEWER MAIN
- FORCEMAIN
- CITY LIMITS
- CITY UGA
- BAYVIEW RIDGE UGA
- BASINS

DATA SOURCES:
CITY OF BURLINGTON

CITY OF BURLINGTON

WASTEWATER COMPREHENSIVE PLAN
FIGURE 6-5
SEWER MODEL RESULTS

Gray & Osborne, Inc.
CONSULTING ENGINEERS

TABLE 6-16

Hydraulic Model Results – Deficiencies at Projected Year 2040 and Buildout Conditions

Pipe Label	Upstream Node	Downstream Node	Existing Pipe Size (inch)	Estimated Capacity (gpm)	Capacity Exceedance at 2040 (gpm)	Pipe Size Required to Accept 2040 Flow (inch)	Capacity Exceedance at Buildout (gpm)	Pipe Size Required to Accept Buildout Flow (inch)
P-1177	MH-1177	MH-P.S. #10	10	1,540,000			1,505,000	15
P-1178	MH-1178	MH-1177	10	707,000	289,000	12	2,337,000	18
P-1179	MH-1179	MH-1178	10	788,000	208,000	12	2,256,000	18
P-1180	MH-1180	MH-1179	10	642,000	355,000	12	2,403,000	18
P-1181	MH-1181	MH-1180	10	763,000	234,00	12	2,282,000	18
P-1182	MH-1182	MH-1181	10	701,000	296,000	12	2,344,000	18
P-1183	MH-1183	MH-1182	10	726,000	270,000	12	2,318,000	18
P-1184	MH-1184	MH-1183	10	1,461,000			1,583,000	15
P-1185	MH-1185	MH-1184	8	552,000	98,000	10	989,000	12
P-1186	MH-1186	MH-1185	8	877,000			664,000	10
P-1187	MH-1187	MH-1186	8	1,132,000			409,000	10
P-1188	MH-1188	MH-1187	8	1,298,000			242,000	10
P-1189	MH-1189	MH-1188	8	1,328,000			213,000	10
P-1190	MH-1190	MH-1189	8	1,298,000			242,000	10
P-1225	MH-1225	MH-1224	8	535,000			331,280	10
P-1226	MH-1226	MH-1225	8	477,000			4,482	10
P-1227	MH-1227	MH-1226	8	352,000			128,865	10
P-1238	MH-1238	MH-1236	8	377,000			103,666	10
P-1240	MH-1240	MH-1239	8	570,000			7,000	10
P-1225	MH-1225	MH-1224	8	535,000	34,000	10	813,000	12
P-1226	MH-1226	MH-1225	8	477,000			486,000	12
P-1227	MH-1227	MH-1226	8	352,000	54,000	10	610,000	12
P-1236	MH-1236	MH-1227	8	607,000			356,000	10
P-1238	MH-1238	MH-1236	8	377,000	29,000	10	585,000	12
P-1239	MH-1239	MH-1238	8	484,000			478,000	12
P-1240	MH-1240	MH-1239	8	570,000			7,000	10

TABLE 6-16 – (continued)

Hydraulic Model Results – Deficiencies at Projected Year 2040 and Buildout Conditions

Pipe Label	Upstream Node	Downstream Node	Existing Pipe Size (inch)	Estimated Capacity (gpm)	Capacity Exceedance at 2040 (gpm)	Pipe Size Required to Accept 2040 Flow (inch)	Capacity Exceedance at Buildout (gpm)	Pipe Size Required to Accept Buildout Flow (inch)
P-1241	MH-1241	MH-1240	8	574,000			4,000	10
P-1242	MH-1242	MH-1241	8	575,000			2,000	10
P-1245	MH-1245	MH-1242	8	567,000			10,000	10
P-1246	MH-1246	MH-1245	8	537,000			41,000	10
P-1321	MH-1321	MH-1321A	10	412,000			50,000	12
P-1323	MH-1323	MH-1324	10	449,000			411,000	15
P-1324	MH-1324	MH-1325	10	476,000			384,000	15
P-278	MH-278	MH-277	12	1,048,000			1,129,000	18
P-287	MH-287	MH-278	12	1,163,000			505,000	15
P-292	MH-292	MH-287	12	1,089,000			579,000	15
P-293	MH-293	MH-292	12	1,098,000			569,000	15
P-295	MH-295	MH-294	12	1,006,000			407,000	15
P-313	MH-313	MH-308	10	738,000			24,000	12
P-322	MH-322	MH-313	10	735,000			28,000	12
P-441	MH-441	MH-442	8	524,000			132,000	10
P-443	MH-443	MH-444	8	509,000			147,000	10
P-444	MH-444	MH-445	8	542,000			114,000	10
P-445	MH-445	MH-448	8	557,000			355,000	10
P-448	MH-448	MH-449	10	906,000			7,000	12
P-451	MH-451	MH-450	8	482,000			31,000	10
P-453	MH-453	MH-452	8	450,000			64,000	10
P-456	MH-456	MH-267	8	509,000			4,000	10
P-498	MH-498	MH-499	8	477,000	234,000	10	1,483,000	15
P-499	MH-499	MH-500	8	868,000			1,092,000	12
P-500	MH-500	MH-297	8	518,000	193,000	10	1,442,000	15
P-504	MH-504	MH-505	8	505,000	206,000	10	1,455,000	15

TABLE 6-16 – (continued)

Hydraulic Model Results – Deficiencies at Projected Year 2040 and Buildout Conditions

Pipe Label	Upstream Node	Downstream Node	Existing Pipe Size (inch)	Estimated Capacity (gpm)	Capacity Exceedance at 2040 (gpm)	Pipe Size Required to Accept 2040 Flow (inch)	Capacity Exceedance at Buildout (gpm)	Pipe Size Required to Accept Buildout Flow (inch)
P-505	MH-505	MH-506	8	901,000			1,059,000	12
P-506	MH-506	MH-515	10	698,000	12,000	12	1,262,000	15
P-515	MH-515	MH-523	10	663,000	48,000	12	1,297,000	18
P-523	MH-523	MH-522	10	971,000			1,479,000	15
P-538	MH-538	MH-498	12	1,398,000			562,000	15
P-555	MH-555	MH-556	12	1,178,000			1,271,000	18
P-556	MH-556	MH-557	12	1,287,000			1,163,000	18
P-557	MH-557	MH-558	12	1,788,000			661,000	15
P-568	MH-568	MH-560	10	1,001,000			959,000	15
P-572	MH-572	MH-568	10	782,000			1,178,000	15
P-588	MH-588	MH-572	10	913,000			1,047,000	15
P-591	MH-591	MH-588	10	776,000			1,183,000	15
P-594	MH-594	MH-595	8	963,000			17,000	10
P-595	MH-595	MH-591	10	1,102,000			858,000	15
P-641	MH-641	MH-642	8	540,000			440,000	12
P-651	MH-651	MH-594	8	561,000			419,000	10
P-652	MH-652	MH-651	8	500,000			479,000	12
P-670	MH-670	MH-652	8	514,000			466,000	12
P-671	MH-671	MH-670	8	507,000			473,000	12
P-728	MH-728	MH-730	18	3,112,000			684,000	21
P-729	MH-729	MH-329	18	3,090,000			706,000	21
P-735	MH-735	MH-736	18	2,877,000			920,000	21
P-736	MH-736	MH-332	18	2,856,000			940,000	21
P-739	MH-739	MH-764	18	3,714,000			320,000	21

The analysis shows that 15 sections of gravity sewer are undersized for projected 2040 peak hour wastewater flows, while 76 sections are undersized for buildout conditions. It is recommended that planning to increase the capacities of sewers that are undersized for 2040 be started within the next 5 years. The sewers undersized for 2040 conditions include portions of the trunk sewer along Burlington Boulevard from approximately Costco Drive to Pump Station 11 and portions of the trunk sewer serving the Port of Skagit County along Ovenell Road to Pump Station 10. The analysis shows that only portions of these trunk sewers need to be replaced; however, it is recommended that the entire trunk sewer be replaced. Replacing only the segments that require a larger sewer, based the analysis presented in this Plan, may result in a larger diameter pipe discharging into a smaller diameter pipe. This is not considered an acceptable practice.

Furthermore, when the sewers are replaced, the new sewer should have the capacity to accommodate buildout conditions (rather than 2040 conditions). Based on these considerations, the following sewer upgrade projects are recommended to be completed within the next 10 years, or previous to the implementation of any major developments in Basin 10 or Basin 11 south of Gages Slough:

1. Replace the existing 8- and 10-inch sewer in Burlington Boulevard from Manhole 498 to Manhole 515 with a 15-inch sewer. (Per discussion with the City, they will verify surcharging during major storm events in the future before implementing.)

2. Replace the existing 10- and 12-inch sewer in Burlington Boulevard from Manhole 515 to Pump Station 11 with an 18-inch sewer.

3. Replace the existing 8-inch sewer in the trunk sewer serving the Port of Skagit County from Manhole 1185 to Manhole 1184 with a 12-inch sewer.

4. Replace the existing 10-inch sewer in Ovenell Road from Manhole 1184 to Pump Station 10 with an 18-inch sewer. (Per discussion with the City, they will verify surcharging during major storm events in the future before implementing.)

As future development occurs and new drainage basins are added to the collection system, the projected wastewater flows should be updated and checked in the hydraulic model. As existing sewer pipes are repaired or replaced, the City should consider upsizing these pipes to accept the projected buildout flows. In general, the cost to upsize a gravity sewer pipe by one size is relatively minor.

The analysis also shows that the existing 18-inch and 21-inch gravity sewer pipes on Gilkey Road will not have the capacity accept projected buildout sanitary and I/I peak hour wastewater flows. However, if the plug valve on the Pump Station 8 force main is throttled, more of the flow can be sent to the 21-inch gravity sewer pipe off Skagit Street and the combination of both gravity pipes can accept the projected buildout flows.

INFILTRATION AND INFLOW

Table 6-17 shows a breakdown of wastewater base flow, infiltration, and inflow from the various existing drainage basins, for which flows can be reasonably estimated, in the City of Burlington service area. The various flow components are estimated using the same procedure as for the overall WWTP flow shown on Figure 5-3, by plotting the flows from the various drainage areas against the monthly precipitation. The flows from the Samish Water District pipeline; Pump Stations 3, 6, 8, and 10; Port 1 and Port 2; and WWTP influent are based on actual flow meter readings. The flows from the rest of the pump stations are based on pump drawdown tests and run time meter readings. The values are estimates based on the information available and should be used with caution. The information presented does, however, indicate areas within the City's service area that may experience high infiltration/inflow which should be targeted for further investigation.

TABLE 6-17

Peak Day Infiltration/Inflow Values from the Various Drainage Basins

Drainage Basin	Peak Day Flow (gpd)	Base Flow (gpd)	Infiltration (gpd)	Inflow (gpd)	Basin Area[(1)] (acres)	Infiltration (gpad)	Inflow (gpad)
Pump Station 1	264,000	56,000	47,000	161,000	52	904	3,096
Pump Station 2	257,000	21,000	61,000	175,000	370	165	473
Pump Station 3	660,000	72,000	142,000	446,000	560	254	796
Pump Station 4	363,000	44,000	127,000	192,000	153	830	1,422
Pump Station 5	1,191,000	162,000	397,000	632,000	937	424	974
Pump Station 6	482,000	141,000	117,000	224,000	N/A[(2)]	N/A[(2)]	N/A[(2)]
Samish Water District Pipeline	359,000	89,000	110,000	160,000	N/A[(2)]	N/A[(2)]	N/A[(2)]
Pump Station 7	131,000	53,000	45,000	33,000	101	446	327
Pump Station 8	1,041,000	138,000	231,000	672,000	1,630	142	412
Pump Station 9	347,000	34,000	51,000	262,000	137	372	1,912
Pump Station 10	477,000	93,000	120,000	264,000	359	287	735
Pump Station 11	366,000	142,000	125,000	99,000	775	161	127
Pump Station 12	8,000	2,700	2,100	3,200	26	81	123
Pump Station 13	62,000	24,000	32,000	6,000	240	133	25
Pump Station 14	40,000	5,800	7,400	26,800	199	37	135
Pump Station 15	39,000	4,300	10,300	24,400	150	69	163
Pump Station 16	56,000	2,900	33,800	19,300	100	338	193
Pump Station 17	6,000	70	2,100	3,800	10	210	380
Pump Station 18	28,000	12,000	11,000	5,000	33	333	152
Pump Station 19	3,000	40	980	1,980	26	38	76
Pump Station 20	6,000	330	1,810	3,860	101	18	28
Pump Station 21	5,000	300	2,100	2,600	47	45	55
Port 1	152,000	18,000	66,000	68,000	156	423	436
Port 2	16,000	3,700	9,500	2,800	30	317	93
Wastewater Treatment Plant	2,742,000	955,000	600,000	1,180,000	4,061[(3)]	121[(4)]	251[(4)]

(1) Drainage basin area includes only the existing developed areas.
(2) The drainage basin for the Samish Water District pipeline service area is unknown.
(3) Excludes area served by the Samish Water District pipeline.
(4) Excludes flows from the Samish Water District pipeline.

One area of interest is the Pump Station 1 drainage area, which appears to be subject to both high infiltration and inflow. Several projects designed to reduce infiltration have been undertaken in this area and several more projects have been designed and are scheduled for construction over the next few years. When compared with the infiltration in the Pump Station 1 drainage area presented in the 2011 Plan, an estimated 13 percent reduction in infiltration over the past 10 years is noted. Also, the base flow has been reduced by 36 percent. This may indicate that a significant amount if infiltration was included in this base flow in the 2011 Plan, even during dry weather; and this infiltration has been removed or significantly reduced. Inflow, however, has not been addressed for this drainage area. It is recommended that smoke testing be performed in the Pump Station 1 drainage area to identify sources of inflow and possible remediation. I/I should be reassessed when the infiltration reduction process has been completed with implementation of the Norris Street Schedule C Sewer Replacement project.

Another area of potentially high I/I is the old downtown area served by gravity by Pump Stations 4 and 5. Pump Station 4 also receives flows from the Raspberry Ridge development area. Again, several projects designed to reduce infiltration have been undertaken in this area and several more projects have been designed and are scheduled for construction over the next several years. It is recommended that the City consider smoke testing in the old downtown area in order to identify sources of inflow and possible remediation (although smoke testing in the downtown area may be challenging). I/I should be reassessed when the infiltration reduction process has been completed. The base flow in the Pump Station 5 drainage area has been reduced by 39 percent. This may indicate that a significant amount if infiltration was included in this base flow in the 2011 Plan, even during dry weather; and this infiltration has been removed. The base flow in the Pump Station 4 drainage area has increased slightly, probably due to the connection of the Raspberry Ridge development area. The I/I in the Pump Station 4 drainage area has increased, however. The I/I generated in the Raspberry Ridge development area is unknown, but the connection of this area to the Pump Station 4 sewer system appears to have increased the I/I to Pump Station 4. Most of the increase appears to be inflow.

A third area of interest is the Pump Station 9 drainage area, which appears to be subject to high inflow. Smoke testing of the drainage area is recommended.

The Pump Stations 3 and 10 and Port 1 drainage areas appear to be subject to moderate inflow and should be smoke tested.

In summary, the City of Burlington's infiltration reduction program appears to be working well. The City is currently spending about $150,000 per year on sewer cleaning and TV inspection and sewer line rehabilitation and replacement. In addition, the City is implementing several specific projects designed to upgrade sewer lines and reduce infiltration/inflow. It is recommended that this program continue throughout the planning period. In addition, it is recommended that an additional $30,000 per year be included in the Capital Improvement Plan for inflow control, including smoke testing, wet weather flow monitoring, and physical improvements, including enforcement of the Sewer Use

Ordinance. Continued removal of infiltration/inflow will result in additional capacity available in the existing lines and treatment plant for growth.

The following would be the recommended priorities for smoke testing and inflow reduction:

1. Pump Station 1 drainage area.
2. Old downtown area (Basin 3, 4 and 5).
3. Pump Station 9 drainage area.
4. Pump Station 10 drainage area including Port of Skagit County.
5. Remainder of the system.

RECOMMENDED PROJECTS

The following are a list of recommended projects that are recommended for implementation during the planning period as a result of the discussion in this chapter:

HIGH PRIORITY PROJECTS TO BE IMPLEMENTED AS SOON AS POSSIBLE (NOTE: AS OF LATE 2023, THE TWO FIRST PROJECTS HAVE ALREADY BEEN COMPLETED.)

- Rio Vista Avenue Pipe Bursting (this project has been designed and is scheduled for construction during the summer of 2022).
- Norris Street Schedule C Sewer Replacement (the design of this project will start soon and is scheduled for construction during the summer of 2022).
- Pump Station 14 capacity upgrade.

PROJECTS TO BE IMPLEMENTED OVER THE NEXT 5 YEARS

- Installation of flow meter at Pump Station 11.
- Installation of flow meter at Pump Station 13.
- Smoke testing of areas with high inflow and implementation of inflow reduction measures.
- Continue sewer replacement projects to reduce infiltration.

PROJECTS TO BE IMPLEMENTED OVER THE NEXT 10 YEARS

- Installation of a parallel line to the 12-inch and 14-inch Force Main from Pump Station 6 to Sharon Avenue, and upsize force main from Pump Station 5.
- Smoke testing of areas with high inflow and implementation of inflow reduction measures.
- Continue sewer replacement projects to reduce infiltration.

PROJECTS TO BE IMPLEMENTED OVER THE NEXT 15 YEARS

- Installation of flow meter at Pump Station 19.
- Installation of flow meter at Pump Station 20.
- Pump Station 2 capacity upgrade.
- Replace the existing 8- and 10-inch sewer in Burlington Boulevard from Manhole 498 to Manhole 515 with a 15-inch sewer.
- Replace the existing 10- and 12-inch sewer in Burlington Boulevard from Manhole 515 to Pump Station 11 with an 18-inch sewer. (Per discussion with the City, they will verify surcharging during major storm events in the future before implementing.)
- Replace the existing 8-inch sewer in the trunk sewer serving the Port of Skagit County from Manhole 1285 to Manhole 1184 with a 12-inch sewer.
- Replace the existing 10-inch sewer in Ovenell Road from Manhole 1184 to Pump Station 10 with an 18-inch sewer. (Per discussion with the City, they will verify surcharging during major storm events in the future before implementing.)

PROJECTS TO BE IMPLEMENTED OVER THE NEXT 20 YEARS

- Installation of the third pump in Pump Station 4.

Projects that would be implemented over the next 6 years are further described in Chapter 9 – Capital Improvement Plan, including budgetary costs for each item.

CHAPTER 7

WASTEWATER TREATMENT PLANT ANALYSIS

INTRODUCTION

The purpose of this chapter is to evaluate the City of Burlington Wastewater Treatment Plant (WWTP) for its ability to meet its treatment objectives at the projected future flow and loading rates, and to identify improvements necessary to meet treatment objectives. The projected flow and loading rates for the planning period (2020 to 2040) were determined in Chapter 5. The treatment plant effluent quality must meet the projected limits in the National Pollution Discharge Elimination System (NPDES) permit. Recommended modifications to increase the operational efficiency or performance of the WWTP and to replace aging infrastructure are also provided.

PROJECTED FLOW AND LOADING RATES

Table 7-1 presents a comparison of the NPDES-permitted capacity for influent flow and loading with the projected flow and loading rates that were developed in Chapter 5. Based on these projections, none of the permitted parameters will be exceeded during the planning period.

The City's NPDES permit (Appendix B) mandates that when the monthly average flow or loading reaches 85 percent of the capacity listed in the permit for 3 consecutive months or it is projected that the facility would reach design capacity within 5 years, the City must submit a plan to maintain adequate capacity (PMAC) to the Washington State Department of Ecology (Ecology). These requirements are typical in NPDES permits because sufficient time is needed to plan, design, and construct additional capacity. The maximum month influent flow, BOD_5, or TSS have never exceeded 85 percent of the NPDES-permitted design criteria during the past 5 years. Based on the projected growth in the community, the treatment plant will not exceed the 85 percent threshold for any of the permitted parameters during the planning period.

TABLE 7-1

Comparison of NPDES-Permitted Capacity to Current and Projected Flow and Loading Rates

	NPDES Permit Capacity(1)	Existing (2020)	Projections			
			2025	2030	2035	2040
Average Annual Flow (mgd)	--	1.39	1.54	1.63	1.78	1.98
Maximum Month Flow (mgd)	3.79	2.12	2.29	2.37	2.54	2.78
Peak Hour Flow (mgd)	--	4.46	4.73	4.94	5.26	5.94
Annual Average BOD_5 Loading (lb/d)	--	3,080	3,430	3,680	4,050	4,520
Maximum Month BOD_5 Loading (lb/d)	7,356	3,870	4,670	5,000	5,500	6,130
Annual Average TSS Loading (lb/d)	--	3,760	4,120	4,410	4,800	5,300
Maximum Month TSS Loading (lb/d)	7,660	4,220	5,190	5,540	6,040	6,650

(1) Condition S4.A of City's NPDES permit (see Appendix B).

EXISTING WWTP PERFORMANCE

The WWTP has remained in compliance with its effluent limits based on a review of Discharge Monitoring Reports (DMRs) from 2016 through 2020.

EFFLUENT BOD AND TSS

As shown in Figure 7-1 and Figure 7-2, effluent BOD and TSS concentrations have been compliant with permit limits, averaging 9.0 mg/L monthly for BOD and 10.8 mg/L for TSS, and 11.2 mg/L weekly for BOD and 14.3 mg/L for TSS, over the 5 years of record from 2016 through 2020.

Figures 7-3 and 7-4 shows daily BOD and TSS removal, respectively, as a percentage of influent values from 2016 through 2020. The removal rate is often lower during the wet season, especially during high flows. This provides further evidence of degree of the impact of inflow and infiltration in the City's WWTP. The lowest TSS removal happened after the reported highest daily flow of 2.63 mgd on February 16, 2016.

Figure 7-5 shows that the monthly average BOD and TSS removal has been in compliance with the limit of 85 percent.

Figures 7-6 and 7-7 shows that the plant has been in compliance with the monthly and weekly effluent loading permit limits throughout the period of record for both BOD and TSS.

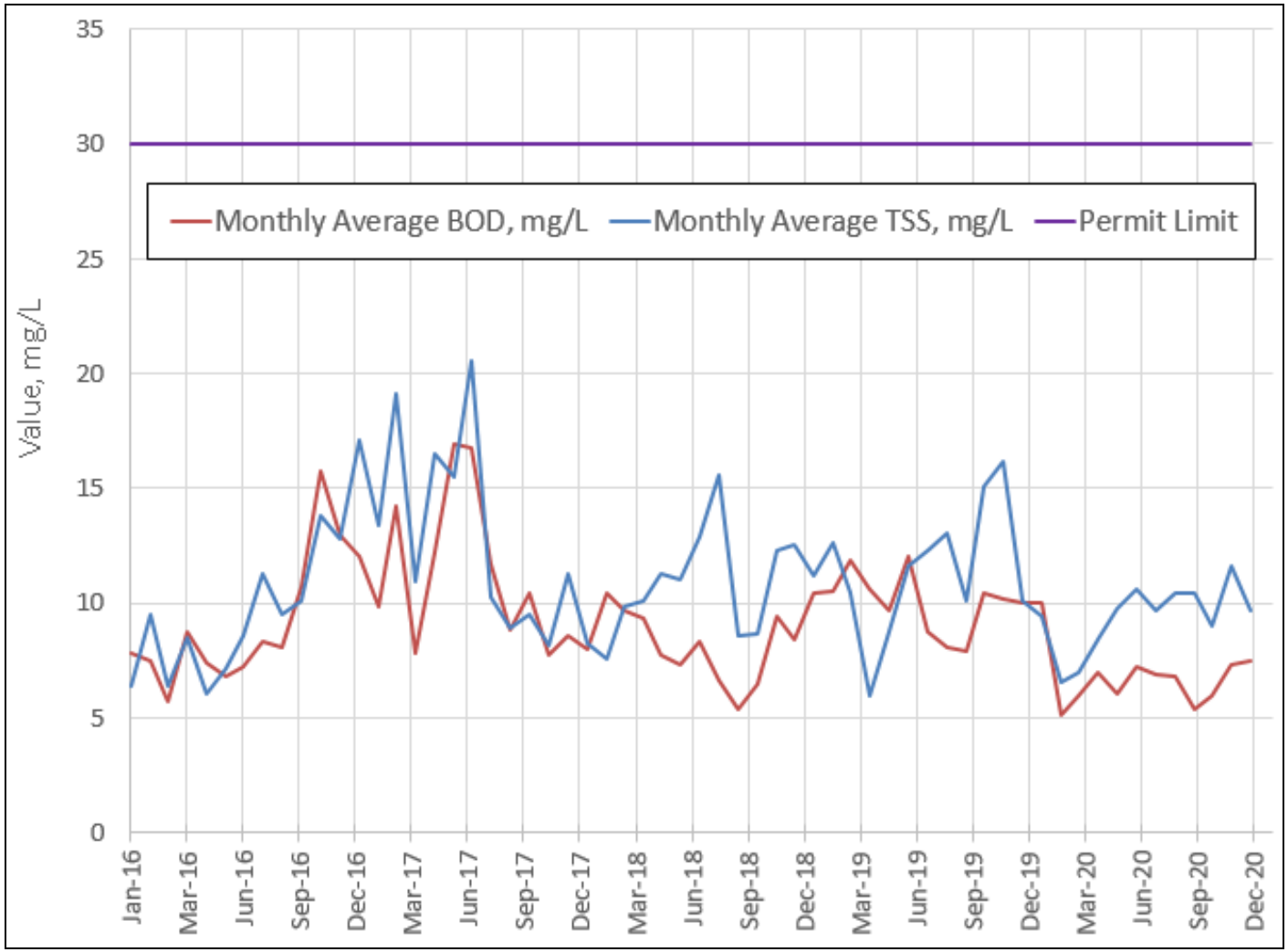


FIGURE 7-1

Monthly Average Effluent Concentrations

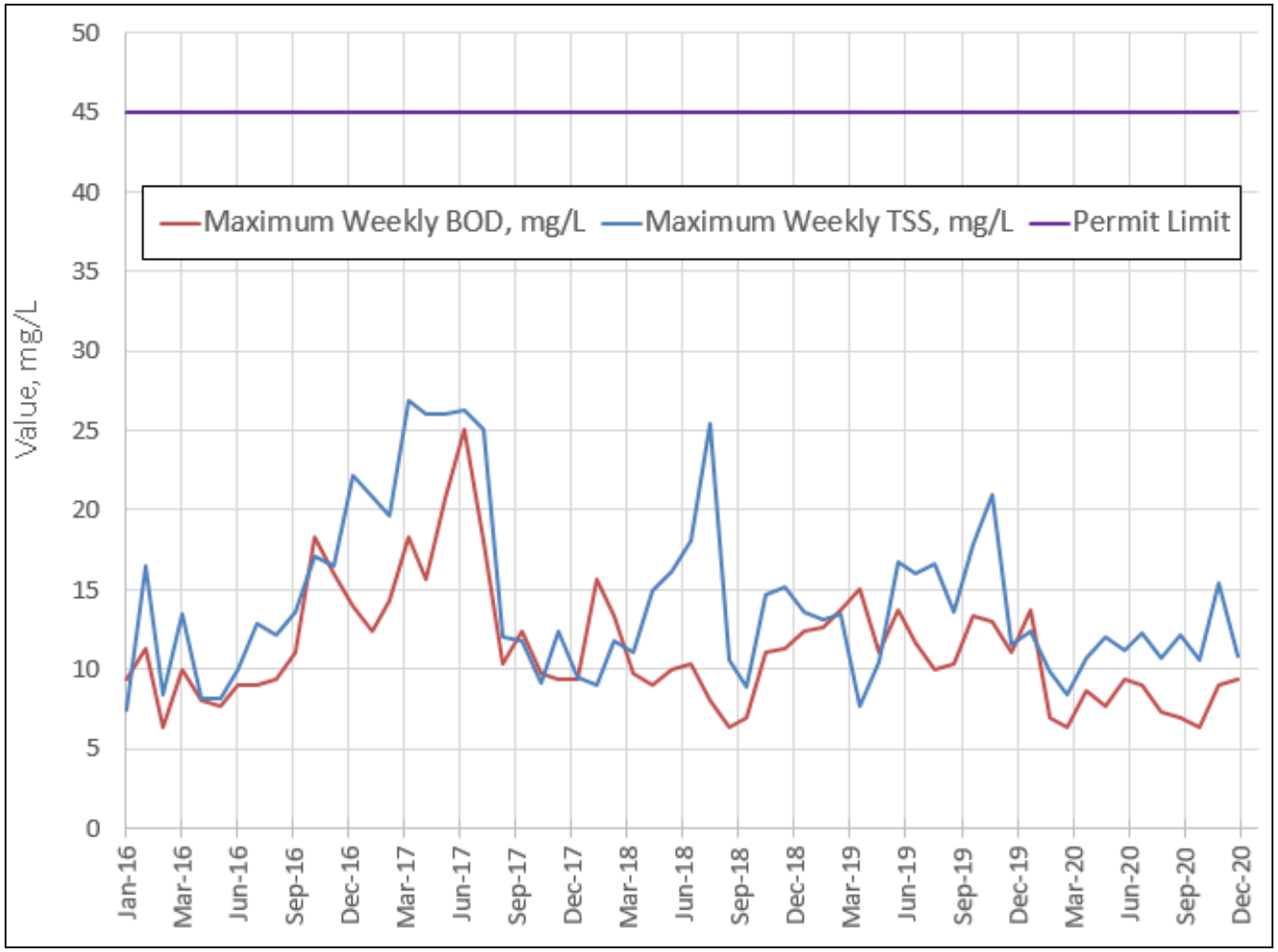


FIGURE 7-2

Weekly Average Effluent Concentrations

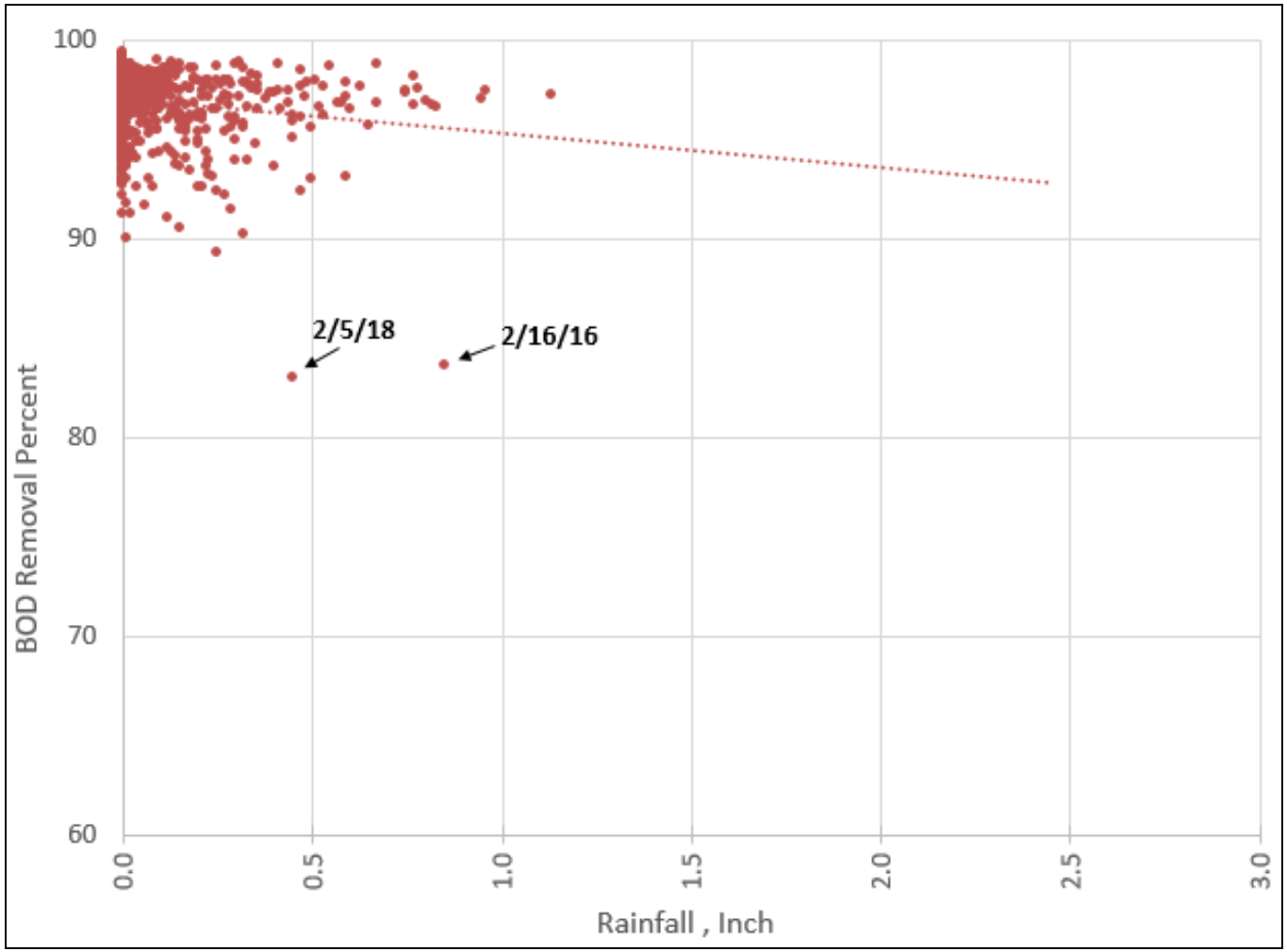


FIGURE 7-3

Daily BOD Removal Percentages

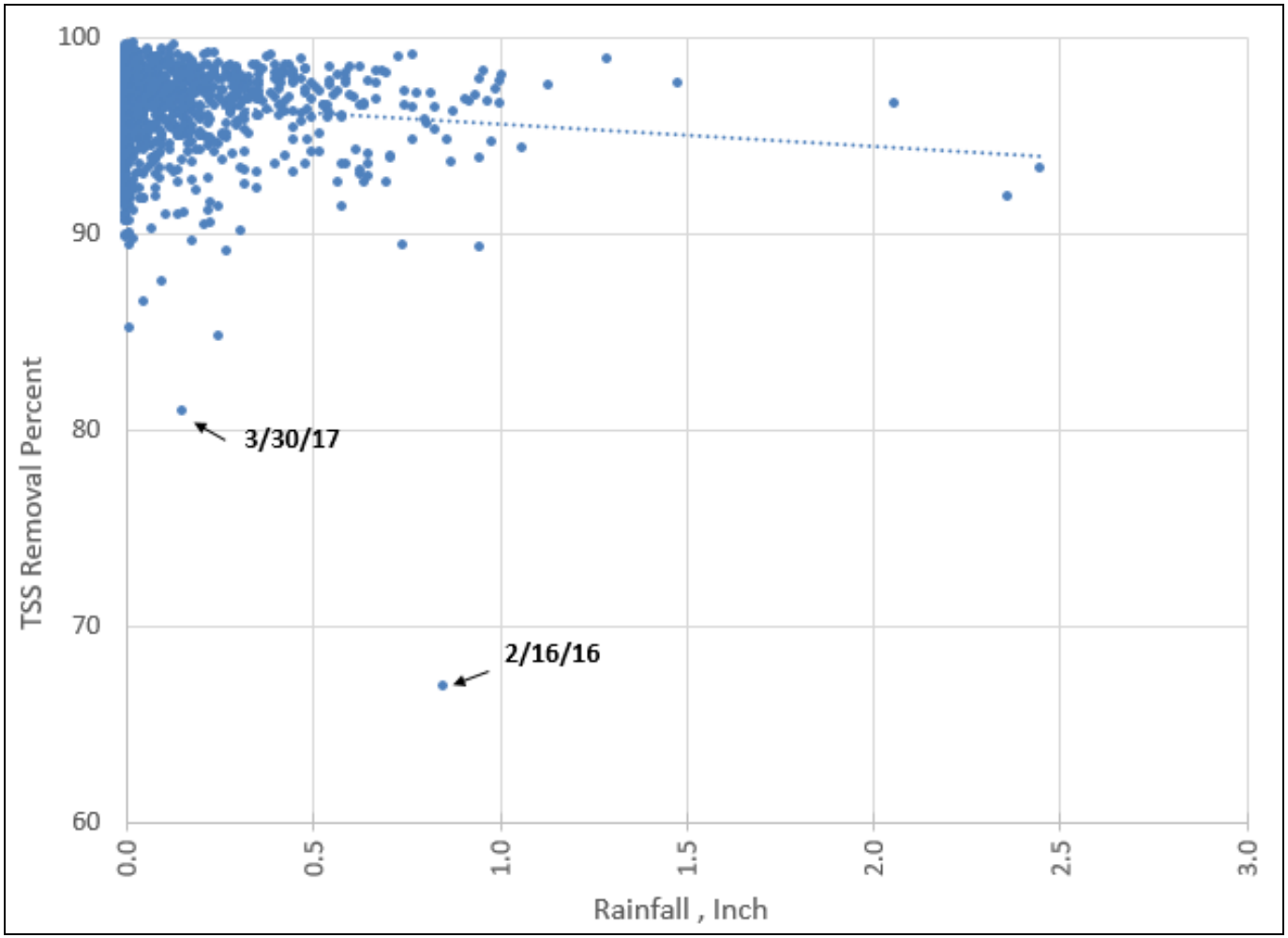


FIGURE 7-4

Daily TSS Removal Percentages

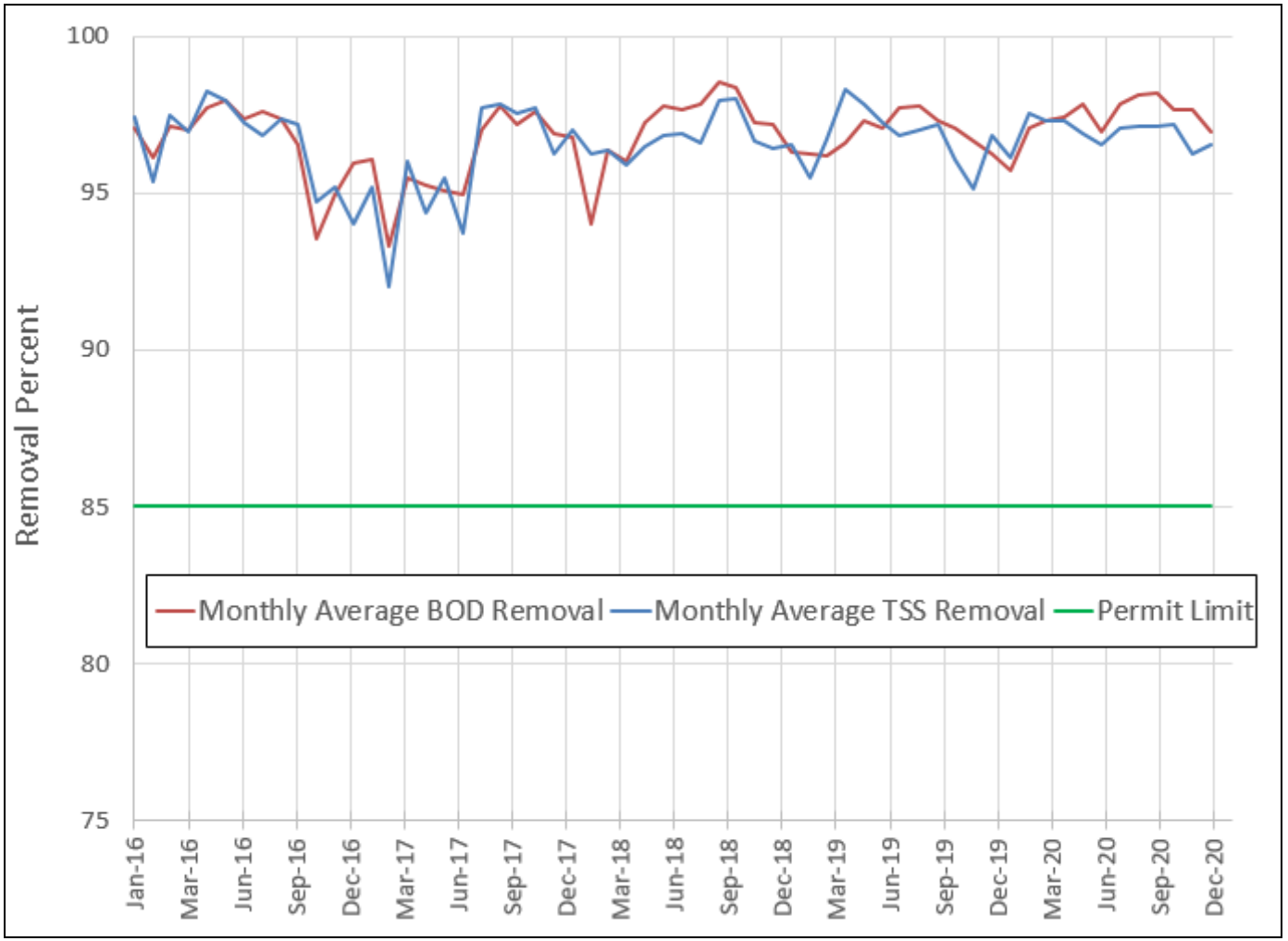


FIGURE 7-5

Monthly Average Removal Percentages

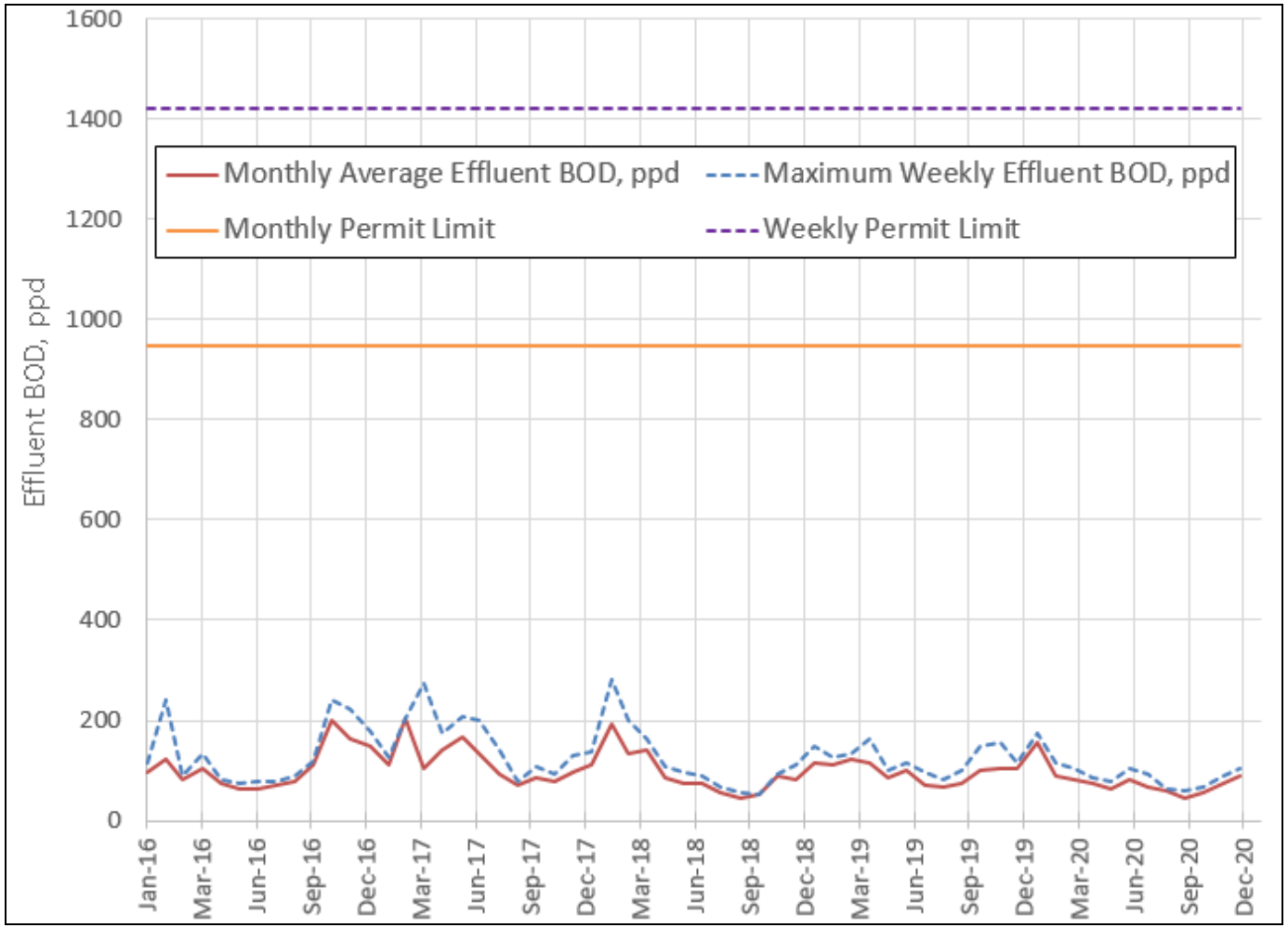


FIGURE 7-6

Effluent BOD Loading

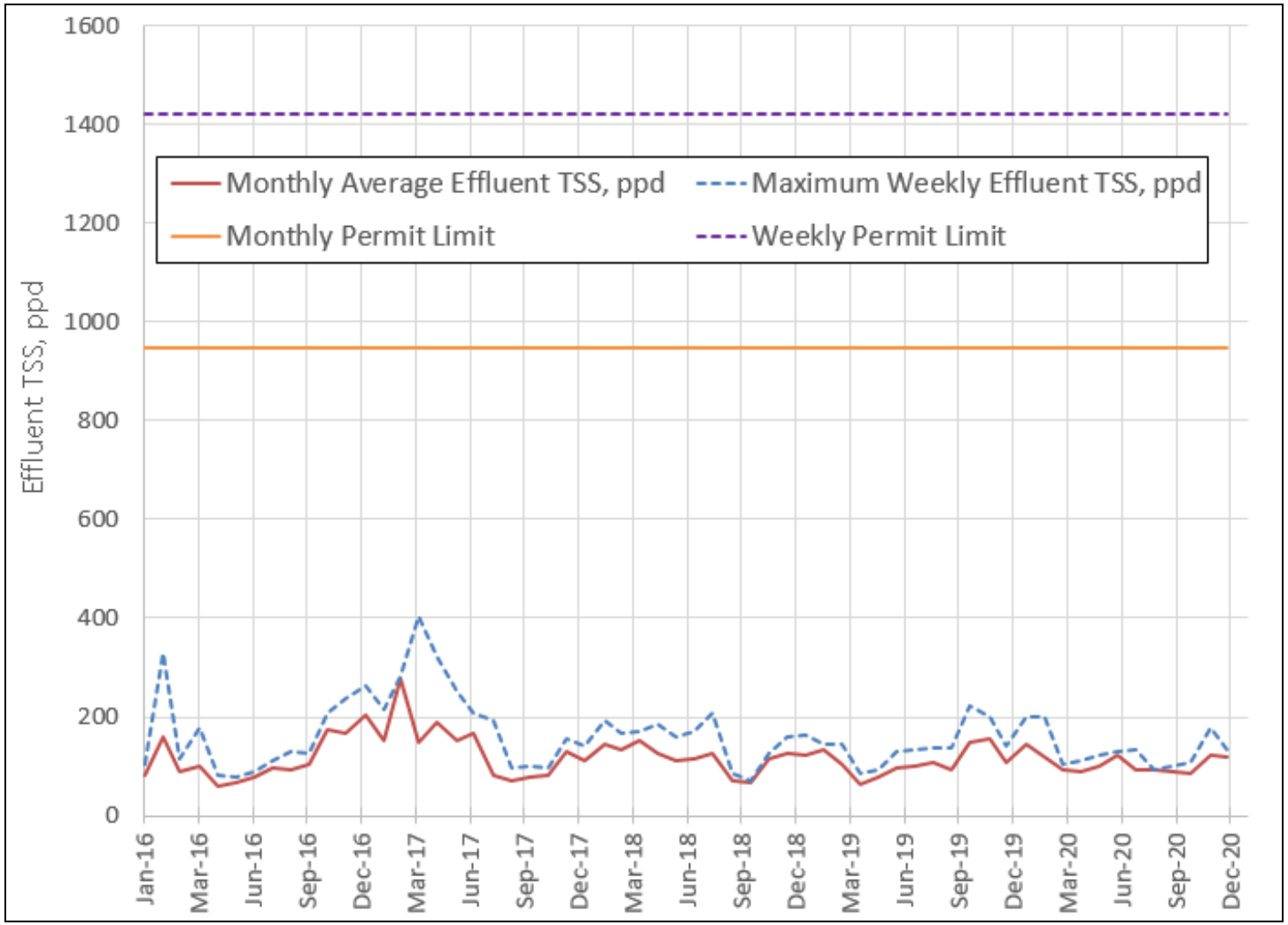


FIGURE 7-7

Effluent TSS Loading

AMMONIA AND TOTAL INORGANIC NITROGEN REMOVAL

Figures 7-8 and 7-9 present effluent ammonia and total inorganic nitrogen (TIN) concentrations for the period from 2016 to 2020. As noted above, TIN is the sum of ammonia, nitrate, and nitrite nitrogen. Ammonia removal is accomplished by the biologically mediated process of nitrification in the aeration basins, which yields nitrate. Nitrate could then be removed by the process of denitrification, which is typically accomplished in anoxic (low oxygen) basins after recycling the mixed liquor back from the aeration basins. The Burlington WWTP presently does not include a denitrification process. Denitrification may be required in the future, however, as will be discussed later in this chapter.

The effluent ammonia level has varied significantly, ranging between 0.2 mg/l and 54 mg/l. The effluent TIN has shown similar variation, ranging from 6.8 mg/L to 68 mg/L.

FECAL COLIFORM

The NPDES permit limits for fecal coliform bacteria are 200 per 100 ml on a monthly average basis and 400 per 100 ml on a maximum week. Effluent records for 2016 through 2020 are shown in Figure 7-10. The plant has been in compliance with the monthly and weekly permit limits throughout the period of record.

pH

Figure 7-11 shows that effluent pH has been in compliance with the permit range of 6.2 to 9.2, except in October 2020. Low effluent pH is many times a result of nitrification combined with low alkalinity in the wastewater. However, the ammonia and TIN data shown in Figures 7-8 and 7-9 do not indicate that significant nitrification occurred during that month. The low pH may have been caused by an industrial discharger to the sewer system, as evidenced by pH measurements in influent grab samples.

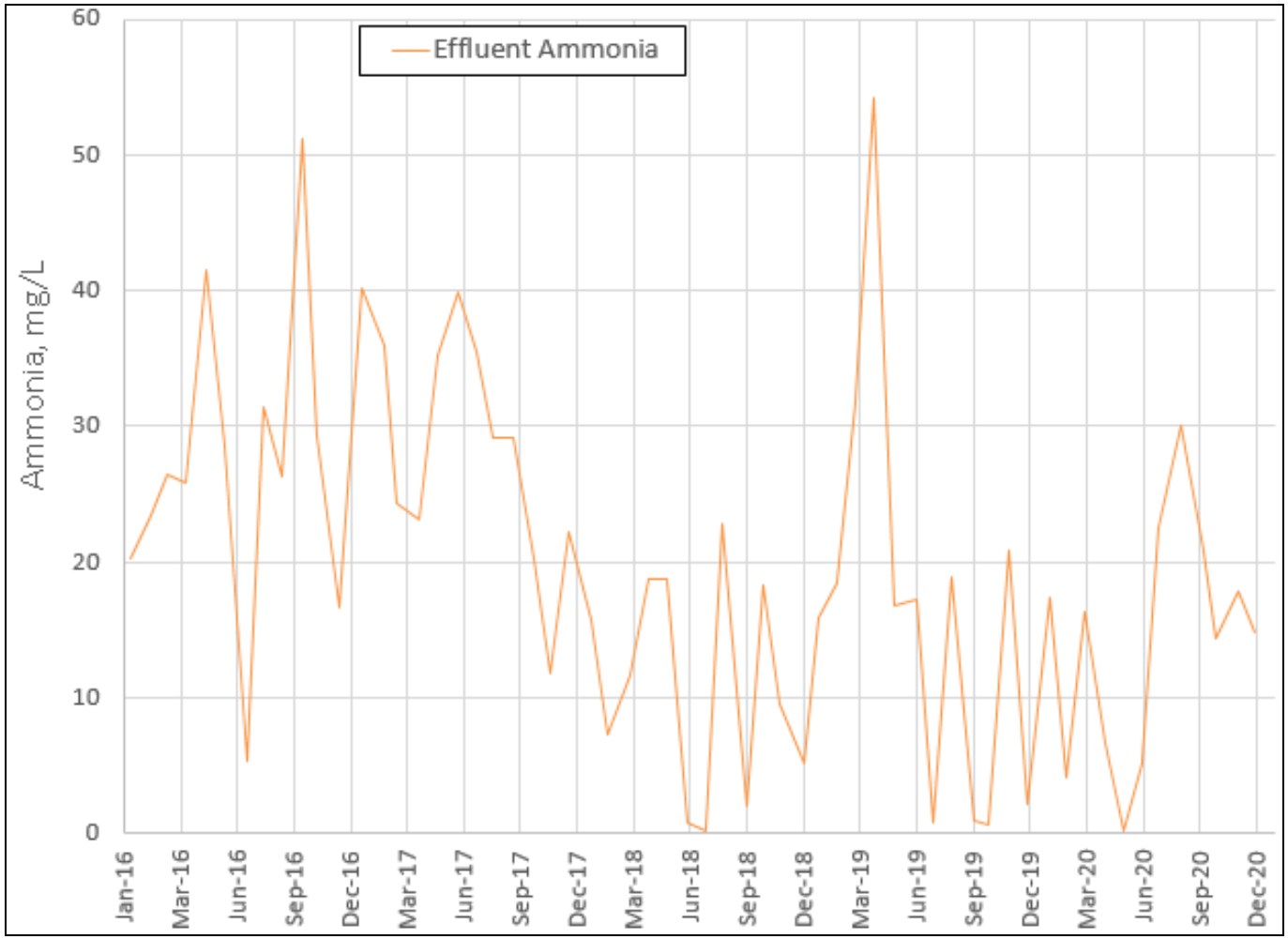


FIGURE 7-8

Effluent Ammonia (NH3-N) Concentrations

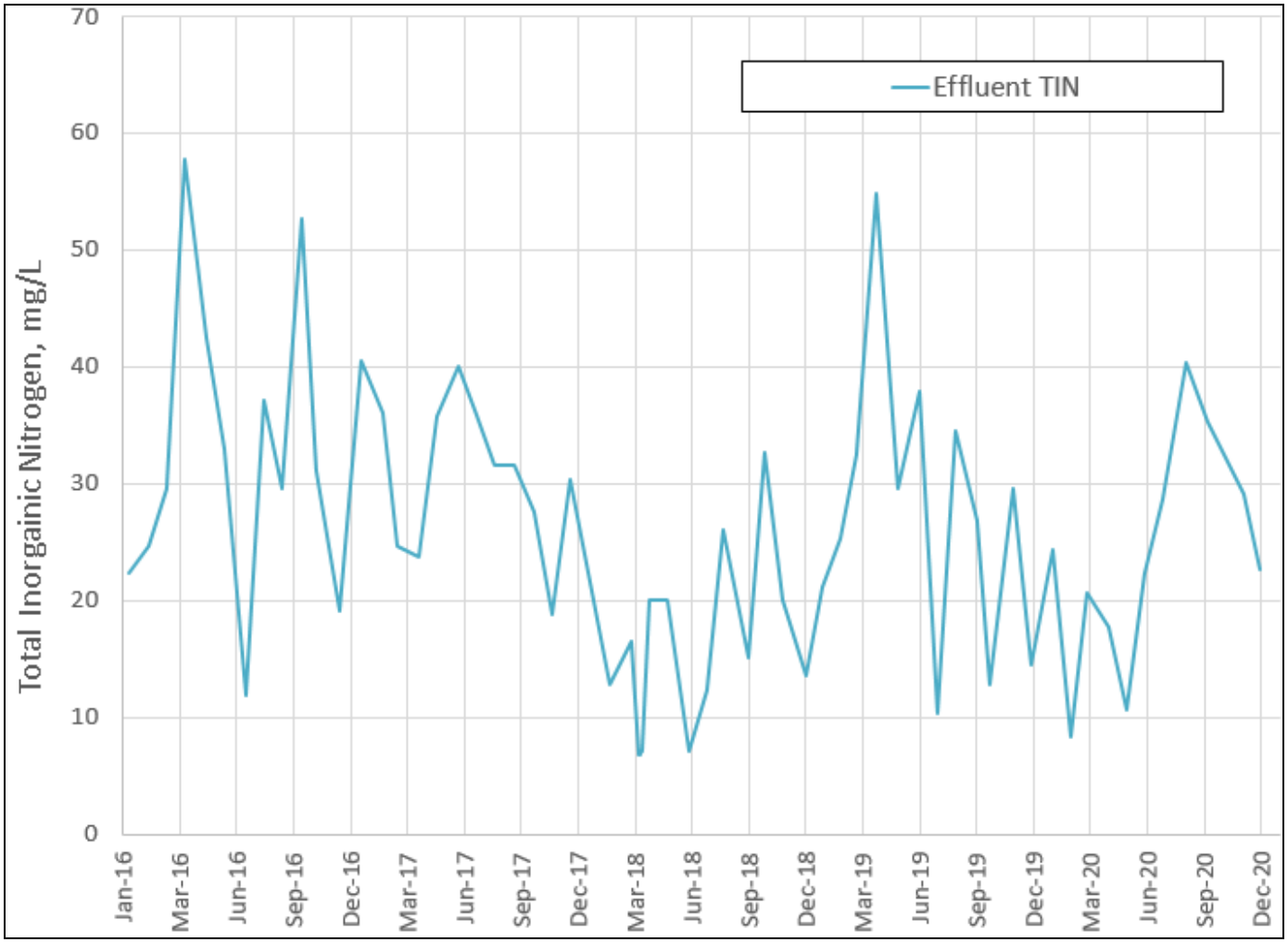


FIGURE 7-9

Effluent TIN Concentrations

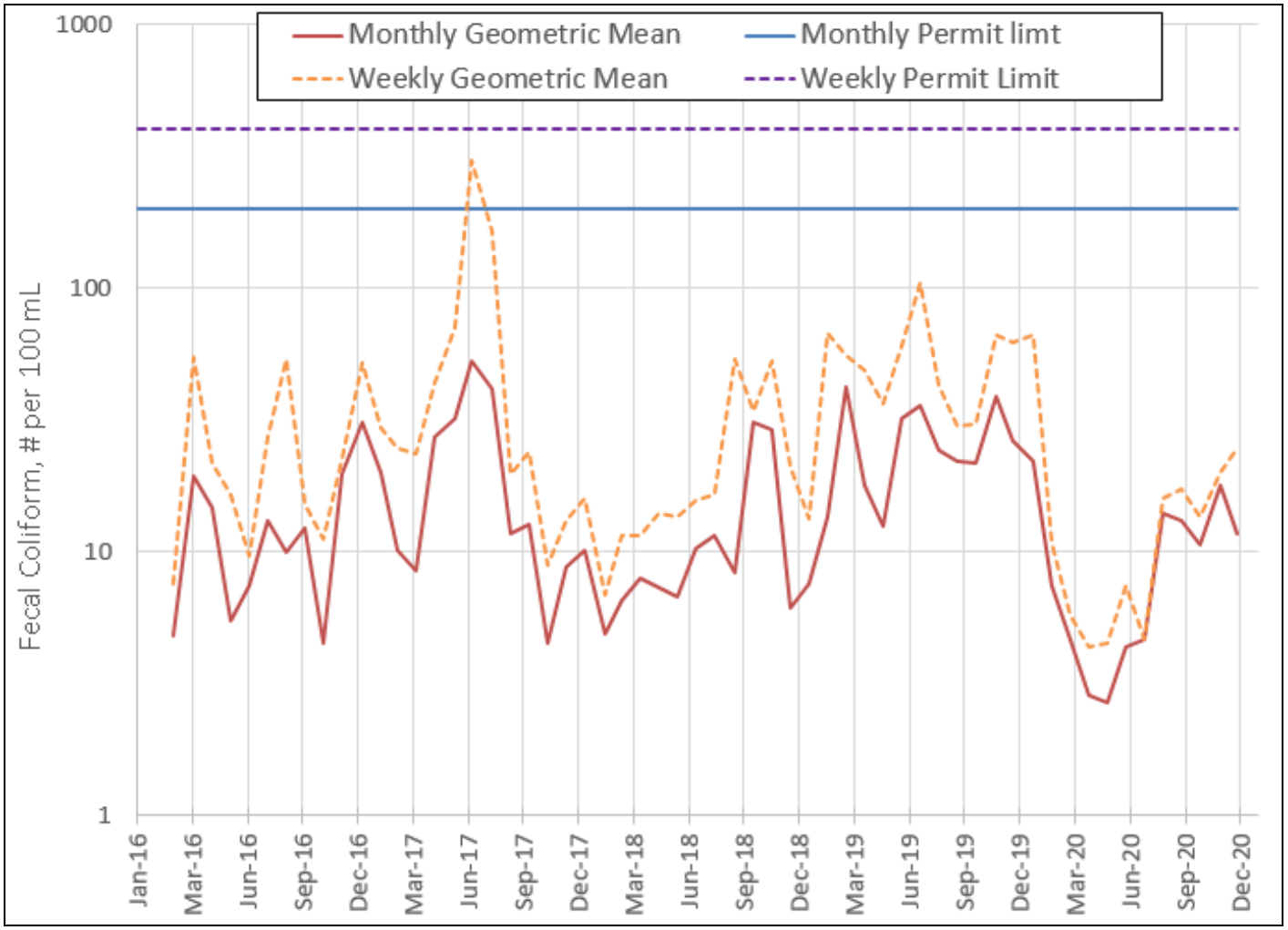


FIGURE 7-10

Effluent Fecal Coliform History – Monthly and Weekly Geometric Means

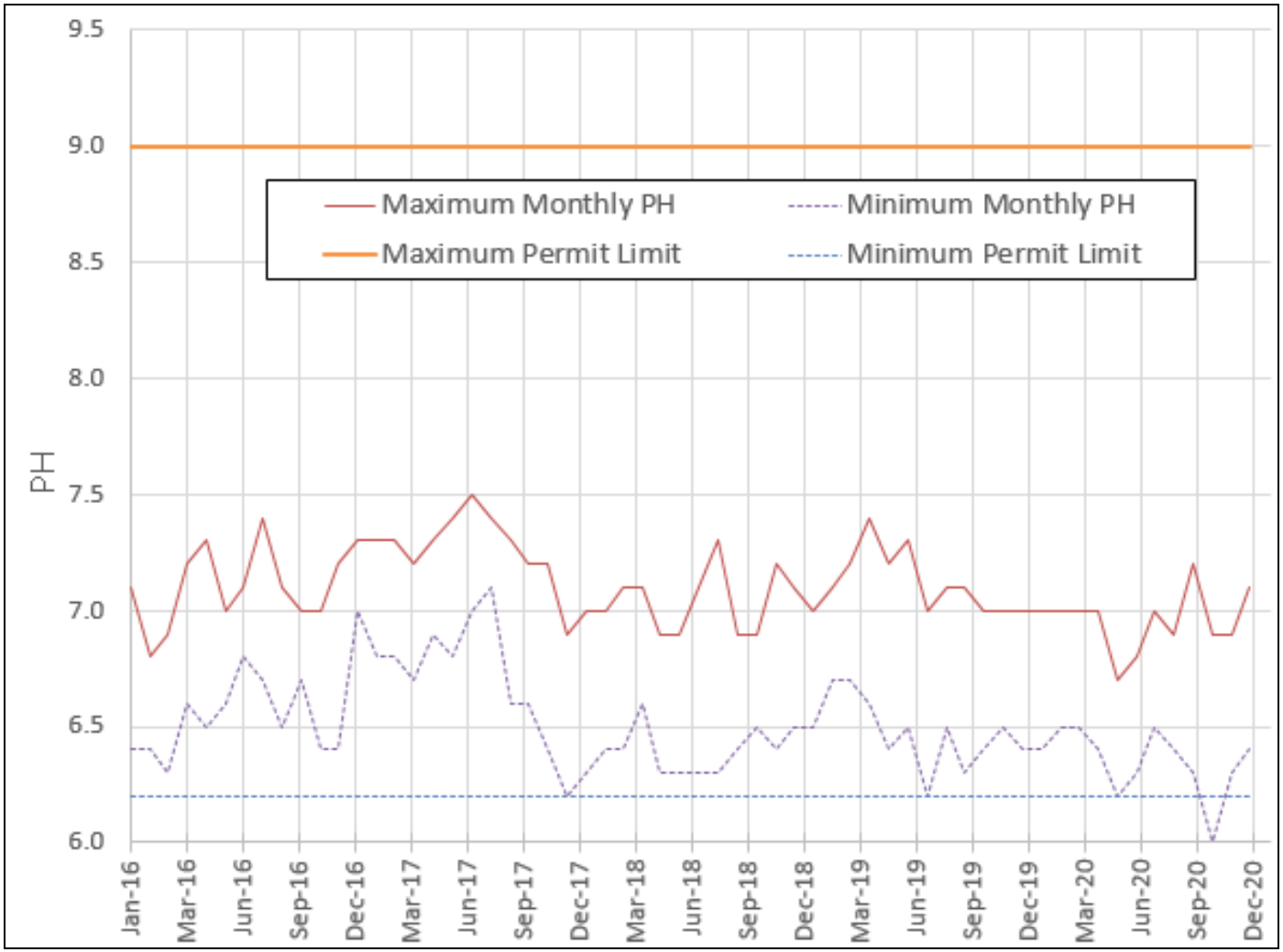


FIGURE 7-11

Effluent pH

OVERALL TREATMENT PLANT PERFORMANCE

Table 7-2 summarizes effluent data for four main performance parameters for the WWTP: BOD, TSS, Fecal Coliform, and ammonia (NH3-N). Table 7-3 presents data for percent removal of BOD and TSS.

TABLE 7-2

Monthly Effluent Concentration Data

Description	BOD (mg/L)	TSS (mg/L)	NH3-N (mg/L)	Fecal Coliform (1/100 ml)
Permit Requirement	30	30	N/A	200
Average	9.0	10.8	19.6	15.8
Minimum	5.1	6.0	0.2	2.7
Maximum	16.9	20.5	54.2	53.2
2016 Average	8.9	9.2	27.2	10.0
2017 Average	11.4	13.4	28.9	21.8
2018 Average	8.1	10.7	10.9	11.7
2019 Average	10.0	11.4	16.6	24.5
2020 Average	6.8	9.4	14.2	9.7

TABLE 7-3

Effluent Percentage Removal Data

Description	BOD (%)		TSS (%)	
Permit Requirement	85		85	
Average	96.6		96.6	
Minimum	92.0		92.0	
Maximum	98.3		98.3	
Year	**Average**	**Minimum**	**Average**	**Minimum**
2016	96.7	93.6	96.8	94.8
2017	96.1	93.3	95.7	92.0
2018	97.1	94.0	96.8	95.9
2019	96.9	96.2	96.8	95.1
2020	97.4	95.7	96.9	96.1

PROJECTED FUTURE PERMIT LIMITS

As discussed in Chapter 2, an Outfall Evaluation and Mixing Zone Study was completed for the WWTP in September of 2020. This study concluded that there is no reasonable potential to exceed water quality criteria in the Skagit River for the relevant pollutants. Thus, it was concluded that no new permit limits were necessary. An updated assessment of reasonable potential evaluation, using currently projected future flows, is included in Appendix H.

However, EPA and Ecology revise water quality standards (typically to be more stringent) on a periodic basis, so it is possible that new permit limits will be implemented. As discussed in Chapter 2 and later in this chapter, effluent limits for nutrients (TIN, Total Inorganic Nitrogen) in the future are a distinct possibility. In addition, Ecology has indicated that the indicator for effluent pathogen limitations may change from fecal coliform to E. coli (for fresh waters) in the future, since E. coli was recently adopted as a water quality standard.

TREATMENT EVALUATION AT PROJECTED FLOW AND LOADING RATES

This section provides an evaluation of the capacity, condition, and performance of major WWTP process components based on 2016-2020 plant process data, design criteria, discussions with staff and site visits. Where applicable, current and projected flows and loadings to process components are compared to manufacturers' and published design criteria, such as those published in the Ecology's *Criteria for Sewage Works Design* (Orange Book, 2018), WEF *Design of Municipal Wastewater Treatment Plants, Manual of Practice No. 8* (2018) and *Wastewater Engineering, Disposal and Reuse* (Metcalf and Eddy, 2014) to determine if capacity is sufficient for the projected loading rates and define the maximum capacity.

The process unit evaluation is provided in Table 7-4.

The NPDES permit requires the Burlington WWTP to maintain a Reliability Class I in accordance with *Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability* (EPA Publication 430-99-74-001, 1973). Table 7-4 also shows reliability requirements for specific unit processes based on this publication.

TABLE 7-4

Comparison of Component Design Capacity/Criteria and Projected Condition

Component (Parameter)	Recommended Criteria/Capacity	Reliability Requirement (EPA Publication 430-99-74-001)	Reference	Current Operating Condition (Criteria Met?)	2025 Operating Condition (Criteria Met?)	2030 Operating Condition (Criteria Met?)	2035 Operating Condition (Criteria Met?)	2040 Operating Condition (Criteria Met?)	Buildout Operating Condition (Criteria Met?)
Max Month Flow	3.79 mgd		Plant Design Data	2.12 mgd (yes)	2.29 mgd (yes)	2.37 mgd (yes)	2.54 mgd (yes)	2.78 mgd (yes)	7.34 mgd (no)
Maximum Month BOD	7,356 lb/d		Plant Design Data	3,870 lb/d (yes)	4,670 lb/d (yes)	5,000 lb/d (yes)	5,500 lb/d (yes)	6,130 lb/d (yes)	21,890 lb/d (no)
Maximum Month TSS	7,660 lb/d		Plant Design Data	4,220 lb/d (yes)	5,190 lb/d (yes)	5,540 lb/d (yes)	6,040 lb/d (yes)	6,650 lb/d (yes)	20,750 lb/d (no)
Influent Pump Station	6.62 mgd capacity, PHF	Equipment sized to provide design capacity with the largest unit out of service.	Manufacturer	4.5 mgd (yes)	4.7 mgd (yes)	4.9 mgd (yes)	5.3 mgd (yes)	5.9 mgd (yes)	16.4 mgd (no)
Influent Flow Meter	21.4 mgd capacity, PHF	All units in service for maximum flow conditions.	Manufacturer	4.5 mgd (yes)	4.7 mgd (yes)	4.9 mgd (yes)	5.3 mgd (yes)	5.9 mgd (yes)	16.4 mgd (yes)
Influent Screen	15.98 mgd capacity, PHF	Equipment sized excluding backup manual bar screen capacity. Manually cleaned backup bar screen is permissible.	Manufacturer	4.5 mgd (yes)	4.7 mgd (yes)	4.9 mgd (yes)	5.3 mgd (yes)	5.9 mgd (yes)	16.4 mgd (no)
Primary Clarifiers	3.81 mgd capacity, MMF	All units in service for maximum flow conditions. With the largest unit out of service, the remaining units shall have a capacity of at least 50 percent of the design flow.	Ecology, 2019	2.1 mgd (yes)	2.3 mgd (yes)	2.4 mgd (yes)	2.5 mgd (yes)	2.8 mgd (yes)	7.3 mgd (no)
	11.4 mgd capacity, PHF		Ecology, 2019	4.5 mgd (yes)	4.7 mgd (yes)	4.9 mgd (yes)	5.3 mgd (yes)	5.9 mgd (yes)	16.4 mgd (no)
Aeration Basins	8,116 lb/d, MMF BOD	At least two equal volume basins shall be provided.	Ecology, 2019	3,870 lb/d (yes)	4,670 lb/d (yes)	5,000 lb/d (yes)	5,500 lb/d (yes)	6,130 lb/d (yes)	21,890 lb/d (no)
Secondary Clarifiers	3.9 mgd capacity, MMF	All units in service for maximum flow conditions. With the largest unit out of service, the remaining units shall have a capacity of at least 75 percent of the design flow.	Ecology, 2019	2.1 mgd (yes)	2.3 mgd (yes)	2.4 mgd (yes)	2.5 mgd (yes)	2.8 mgd (yes)	7.3 mgd (no)
	7.8 mgd capacity, PHF		Ecology, 2019	4.5 mgd (yes)	4.7 mgd (yes)	4.9 mgd (yes)	5.3 mgd (yes)	5.9 mgd (yes)	16.4 mgd (no)
UV Disinfection	3.79 mgd capacity, MMF	Equipment sized to provide maximum daily dose with single largest unit out of service.	Manufacturer	2.1 mgd (yes)	2.3 mgd (yes)	2.4 mgd (yes)	2.5 mgd (yes)	2.8 mgd (yes)	7.3 mgd (no)
Effluent Pump Station	14.3 mgd capacity, PHF	Equipment sized to provide design capacity with the largest unit out of service.	Manufacturer	4.5 mgd (yes)	4.7 mgd (yes)	4.9 mgd (yes)	5.3 mgd (yes)	5.9 mgd (yes)	16.4 mgd (no)

TABLE 7-4 – (continued)

Comparison of Component Design Capacity/Criteria and Projected Condition

Component (Parameter)	Recommended Criteria/Capacity	Reliability Requirement (EPA Publication 430-99-74-001)	Reference	Current Operating Condition (Criteria Met?)	2025 Operating Condition (Criteria Met?)	2030 Operating Condition (Criteria Met?)	2035 Operating Condition (Criteria Met?)	2040 Operating Condition (Criteria Met?)	Buildout Operating Condition (Criteria Met?)
Outfall	11.2 mgd capacity, PHF	No specific requirement.	Pipe Hydraulic Capacity	4.5 mgd (yes)	4.7 mgd (yes)	4.9 mgd (yes)	5.3 mgd (yes)	5.9 mgd (yes)	16.4 mgd (no)
Gravity Thickener	19,600 lb/d, MM TSS	No specific requirement.	Ecology, 2019	4,220 lb/d (yes)	5,190 lb/d (yes)	5,540 lb/d (yes)	6,040 lb/d (yes)	6,650 lb/d (yes)	20,750 lb/d (no)
WAS Rotary Drum Thickener	8,565 lb/d, MM BOD		Manufacturer	3,870 lb/d (yes)	4,670 lb/d (yes)	5,000 lb/d (yes)	5,500 lb/d (yes)	6,130 lb/d (yes)	21,890 lb/d (no)
Anaerobic Digesters	7,356 lb/d, MM BOD	At least two digestion tanks shall be provided	Manufacturer	3,870 lb/d (yes)	4,670 lb/d (yes)	5,000 lb/d (yes)	5,500 lb/d (yes)	6,130 lb/d (yes)	21,890 lb/d (no)
	7,660 lb/d, MM TSS		Manufacturer	4,220 lb/d (yes)	5,190 lb/d (yes)	5,540 lb/d (yes)	6,040 lb/d (yes)	6,650 lb/d (yes)	20,750 lb/d (no)
Belt Filter Press	14,000 lb/d, MM BOD	No specific requirement	Manufacturer	3,870 lb/d (yes)	4,670 lb/d (yes)	5,000 lb/d (yes)	5,500 lb/d (yes)	6,130 lb/d (yes)	21,890 lb/d (no)
	14,650 lb/d, MM TSS		Manufacturer	4,220 lb/d (yes)	5,190 lb/d (yes)	5,540 lb/d (yes)	6,040 lb/d (yes)	6,650 lb/d (yes)	20,750 lb/d (no)
Sludge Dryer	14,000 lb/d, MM BOD	No specific requirement	Manufacturer	3,870 lb/d (yes)	4,670 lb/d (yes)	5,000 lb/d (yes)	5,500 lb/d (yes)	6,130 lb/d (yes)	21,890 lb/d (no)
	14,650 lb/d, MM TSS		Manufacturer	4,220 lb/d (yes)	5,190 lb/d (yes)	5,540 lb/d (yes)	6,040 lb/d (yes)	6,650 lb/d (yes)	20,750 lb/d (no)

OVERVIEW OF TREATMENT CAPACITIES

This section provides an evaluation of the capacity of the liquid and solids treatment processes to treat the projected flow and loading rates. The resulting process loading rates are compared to accepted design criteria for each treatment process as presented in Table 4-5. In general, none of the WWTP unit processes will require capacities upgrades throughout the planning period (through 2040) unless NPDES permit effluent limits become more stringent. Most treatment units will have to be expanded to accommodate buildout conditions. All the treatment units meet Class I Reliability Requirements.

This section also provides a brief analysis of each component and the applicable criteria and develops recommended improvements.

INFLUENT PUMP STATION

The capacity of the existing influent pump station needs to be expanded for build-out conditions. It is estimated that the three existing pumps need to be replaced with three pumps, each with a capacity of 5,700 gpm to meet the build-out conditions and the reliability requirements.

The existing force mains from the influent pump station to the headworks are dual 16-inch diameter force mains. At the buildout peak hour flow of 16.4 mgd a flow velocity of 8.7 fps will result. This is slightly above the recommended maximum velocity of 8 fps. However, because the peak hour flow is a relatively rare occurrence, the installation of additional force main capacity is not warranted.

HEADWORKS

The existing headworks consist of a Parshall flume flow meter and a fine screen. The Parshall flume influent flow meter has a capacity of 21.4 mgd, which is more than adequate for buildout conditions. The existing influent screens each have a rated peak hour flow capacity of 7.99 mgd, for a total capacity of 15.98 mgd. This capacity is slightly less than the buildout peak hour flow of 16.4 mgd. This shortfall can be accommodated by the manually cleaned emergency bar screen. Therefore, no additional fine screen capacity is required for buildout.

PRIMARY CLARIFIERS

The primary clarifiers have a maximum month flow capacity of 3.81 mgd and a peak hour flow capacity of 11.4 mgd. Two more clarifiers equal to Primary Clarifier 2 are required to accommodate buildout peak month flows, resulting in four primary treatment trains. This will also require modifications to the Primary Clarifier Splitter Box, which is an integral part of the headworks structure. The existing Primary Clarifier Splitter Box can only accommodate three primary clarifier treatment trains. Associated modifications to the primary sludge pumping systems will also be required.

AERATION BASINS

The existing aeration basins are estimated to have a capacity equivalent to an influent maximum month BOD_5 load of 8,116 pounds per day. Five more aeration basins equal to Aeration Basin 2 (or 3) are required for the projected buildout BOD loading, resulting in eight aeration basin treatment trains. This will also require modifications to the Aeration Basin Splitter Box, which presently can accommodate four aeration basin treatment trains. Associated modifications to the aeration blower systems will also be required.

If future effluent limits on ammonia or total inorganic nitrogen are implemented, additional aeration basin capacities will have to be provided.

SECONDARY CLARIFIERS

The capacity of the secondary clarifiers is limited to a peak hour flow of 7.80 mgd. Two more secondary clarifiers equal to Secondary Clarifier 2 will provide a total peak hour flow capacity of 15.6 mgd, which is slightly less than the projected buildout peak hour flow of 16.4 mgd. However, recognizing the fact that the projected peak hour flow will be a rare occurrence and flows will be attenuated by the time the flows reach the secondary clarifiers, the installation of four equal-flow secondary treatment trains will be appropriate. This will also require modifications to the Secondary Clarifier Splitter Box, which presently can accommodate three secondary clarifier treatment trains. Associated modifications to the return and waste activated sludge pumping systems will also be required.

ULTRAVIOLET DISINFECTION SYSTEM

The existing ultraviolet disinfection system was originally designed for a maximum month flow of 3.79 mgd. At this capacity, existing ultraviolet disinfection system should be adequate throughout the planning period. Replacing the original low-pressure low-intensity UV disinfection system (presently used as a back-up) with a low-pressure high-intensity system will double the existing UV disinfection capacity to 7.58 mgd, which exceeds the projected buildout maximum month flow of 7.3 mgd.

EFFLUENT PUMP STATION

The existing effluent pump station has a capacity of 14.3 mgd. The existing pumps should be replaced with larger pumps to accommodate the buildout peak hour flow of 16.4 mgd

OUTFALL

The outfall piping system has a capacity of about 11.2 mgd. Additional outfall pipes need to be installed to accommodate the buildout peak hour flow of 16.4 mgd.

GRAVITY THICKENER

The gravity thickener, thickening primary sludge following grit removal, has an equivalent maximum month TSS load capacity of 19,600 pounds per day, which is almost equal to the projected TSS load of 20,750 pounds per day for buildout conditions. Thus, the performance of the gravity thickener should be monitored. It is likely that additional gravity thickener capacity may not be required for buildout conditions by allowing the thickener to operate slightly less efficiently during peak month loadings.

WASTE ACTIVATED SLUDGE (WAS) ROTARY DRUM THICKENER

The WAS rotary drum thickener has an estimated capacity equivalent to a maximum month BOD_5 load of 8,565 pounds per day when operated six hours per working day. Providing the capacity of a maximum month BOD load of 21,890 pounds per day could be accomplished by increasing the operating time of the existing drum thickener, install a new, higher-capacity drum thickener, or a combination of both.

ANAEROBIC DIGESTERS

The capacity of the anaerobic digestion system is basically the same as the maximum month permitted BOD_5 and TSS loads to the wastewater treatment plant, 7,356 pounds per day and 7,660 pounds per day, respectively (see Table 7-1). Two additional anaerobic digesters, equivalent to the Primary Anaerobic Digester should be provided to accommodate buildout conditions.

SLUDGE DEWATERING

The capacity of existing belt filter press used for digested sludge dewatering can be increased to accommodate buildout conditions by extending the hours of operation from 6 hours per working day to 9.5 hours per working day, or extend operation to 7 days per week at 6.5 hour per day.

SLUDGE DRYING

The sludge drying unit producing Class A biosolids would provide adequate capacity throughout the planning period. The schedule of operation will have to be adjusted to meet the biosolids load.

The existing sludge dryer may be reaching the end of its useful life, however, and may be in the need of replacement. This will be discussed in further detail in Chapter 8.

WASTEWATER TREATMENT PLANT CONDITION ASSESSMENT

As discussed above, the capacities of the various treatment unit processes will be adequate throughout the planning period. However, the mechanical, electrical, and structural components may be reaching the end of their useful life and should be replaced/upgraded to enable the various unit processes to operate satisfactorily.

The Wastewater Treatment Plant (WWTP) Condition Assessment conducted for the City of Burlington, included in Appendix G, provides an assessment of the condition of the infrastructure at the City's WWTP, and corresponding evaluation of the short-term and long-term capital needs to repair and replace WWTP infrastructure. The assessment of the facilities included conducting field inspections, performing a desktop estimate of remaining life, and preparing a cost opinion range for equipment renewal.

The assessment took into consideration the condition, performance, and reliability of each facility to determine how it compares to standards. Using the field observation and desktop data analysis results, a facility rating by asset class was designated and an overall rating was developed. The findings and recommendations were summarized on individual facility inspection forms included in Appendix B. Cost estimates for improvements were then developed and served as the basis for the development of both a short-term (1 to 6 year) and long-term (10 to 20 year) capital improvement plan (CIP) that would be incorporated into the City's 2022 Sewer Comprehensive Sewer Plan Update.

SITE VISIT

On July 23, 2021, a site visit and inspection of the WWTP was conducted by staff from Gray and Osborne and Conley Engineering (including a treatment process engineer, an electrical engineer, an architectural engineer, and a structural engineer) accompanied by plant staff. The intent of the inspection was to note the general condition of structures and equipment. A Facility Condition Assessment Form was completed for each facility evaluated. These forms, together with notes from the walkthrough, are included in Appendix G. Elements from each facility were given a condition rating based on the scale shown in Table 7-5.

TABLE 7-5

Condition Ranking Scale

Ranking	Description
1	Very Good Condition
2	Minor Defects
3	Maintenance Required to Return to Accepted Level of Service
4	Requires Rehabilitation
5	Facility Unserviceable or Function Lacking and Should Be Added

A summary of the rankings for each facility is shown in Table 7-6.

TABLE 7-6

Summary of Condition Rankings

Area	Facility	Condition Ranking
1	Influent Pump Station	4.20
	Headworks	3.50
2	Primary Clarifier 2	3.00
3	Primary Clarifiers 1A and 1B	1.67
4	Aeration Basin Splitter Box	2.00
5	Aeration Basins 2 and 3	3.40
6	Aeration Basins 1A and 1B	3.25
7	Blower Building	3.60
	Generator Building	3.00
	Gravity Thickener	2.33
	Grit Classifier	3.50
8	Secondary Clarifier Splitter Box	2.00
9	Secondary Clarifier 2	3.33
10	Secondary Clarifiers 1A and 1B	2.00
11	Ultraviolet Disinfection Systems	3.17
	Effluent Pump Station	3.67
	Disinfection Building	3.40
	Effluent Structure	2.00
	Non-Potable Water System	3.67
	Vactor Dump Station and Drain Pump Station	3.00
12	Anaerobic Digesters	3.25
	Sludge Thickening and Dewatering Facilities	3.43
	Sludge Drying and Storage	3.25
	Septage Receiving Station	2.67
	Plant Drain Pump Station	2.67
13	Vehicle Storage Building	3.00
14	Administration Building	3.00
15	Sludge Storage Tank	3.00

RECOMMENDED IMPROVEMENTS BASED ON THE CONDITION ASSESSMENT

With a few exceptions (the facilities that would only include the replacement of VFDs, PLCs, and communication equipment), it is recommended that the deficiencies noted for the facilities with a condition rating of 3.0 or less be remediated as a part of the treatment plant's operations and maintenance program. The work could be performed by City personnel or outside contractors from a small works roster.

Major improvements recommended include the following:

1. Upgrades to the Influent Pump Station.
2. Electrical and instrumentation modifications to the Headworks.
3. Installation of air supply isolation valves and pH monitoring at Aeration Basins 2 and 3.
4. Installation of pH monitoring at Aeration Basins 1A and 1B.
5. Upgrades to the Blower Building.
6. Upgrades to the Grit Classifier.
7. Installation of an access platform around Secondary Clarifier 2.
8. Installation of pH monitoring at the Ultraviolet Disinfection Channel.
9. Upgrades to the Effluent Pump Station.
10. Upgrades to the Non-Potable Water System.
11. Upgrades to the Disinfection Building.
12. Upgrades to the Anaerobic Digester equipment.
13. Upgrades to Sludge Thickening and Dewatering equipment.
14. Replacement of the Sludge Dryer.
15. Electrical upgrades in the Vehicle Storage Building.
16. Electrical Upgrades in the Administration Building.

RECOMMENDED WASTEWATER TREATMENT PLANT IMPROVEMENT PLAN

In defining projects for the improvements listed above, one consideration made was that it is most cost-effective that work of similar trades be included in the same project to the extent practicable unless the facility is undergoing a major rehabilitation (such as is proposed for the Influent Pump Station). Based on this concept, the following capital improvement projects at the WWTP are recommended for implementation over the next 5 years:

1. Upgrades to the Influent Pump Station

   This project would include the abandonment of the existing motor control center and canopy and the construction of a new building housing a new motor control center, including three new variable frequency drives (VFDs), a new programmable logic controller (PLC), input/output (I/O) cards, and communication terminations. Also, the existing wet well would be covered and a new ventilation and odor control system would be installed. The project would include the installation of a new standby generator dedicated to the Influent Pump Station, to be activated if the wastewater treatment plant standby generator fails during a power outage. All the piping and hardware inside the wet well would either be replaced or receive surface preparation and coating, if salvageable.

2. Upgrades to the Effluent Pump Station

   This project would include the installation of a new standby generator dedicated to the Effluent Pump Station, to be activated if the wastewater treatment plant standby generator fails during a power outage. If feasible, the new standby generator for the Effluent Pump Station could be combined with the new standby generator for the Influent Pump Station. Obsolete electrical gear, including a PLC, I/O cards, and communication terminations, would be replaced.

3. Upgrades to HVAC systems

   Conduct a detailed building code and NFPA 820 conformance evaluation on the Blower Building, Grit Classifier Structure, Disinfection Building, and Solids Handling Building (Anaerobic Digester and Sludge Thickening /Dewatering areas) to follow up on the preliminary evaluation conducted for this Condition Assessment. This detailed evaluation will be followed by the design and construction of the improvements recommended by the evaluation. These improvements need to be in place before any electrical improvements are made in these facilities. This work

should include installing a permanent ductless split air conditioning system in the Solids Handling Building electrical room.

4. pH Monitoring

   Install pH monitoring equipment at the Headworks; Aeration Basins 1A, 1B, 2, and 3; and the UV Disinfection Channel.

5. Blower Building Improvements

   Replace the existing centrifugal blowers and VFDs with new positive displacement blowers and VFDs. Replace all other VFDs in the blower building. Replace the PLCs, I/O cards, and communication terminations in the Blower Building Control Panel, Aeration Control Panel, and Generator Building Control Panel. Replace the communication terminations in the Blower Building motor control centers (MCCs). Install new isolation valves on the air supply pipes to Aeration Basins 2 and 3. Replace Grit Cyclone and Classifier. Complete miscellaneous surface preparation and painting of piping and hardware.

6. Solids Building Improvements

   Replace PLC, I/O cards and communications terminations in the MCCs and control panels. Replace waste activated sludge thickening and digested sludge dewatering polymer feed systems.

7. Control Building Improvements

   Replace communications terminations.

   Install access platform around Secondary Clarifier 2.

8. Upgrades to Disinfection Building Equipment

   This project includes replacement of the sodium hydroxide and sodium hypochlorite feed equipment. An evaluation to use magnesium hydroxide rather than sodium hydroxide for the control of pH should be conducted prior to design.

9. Dedicated Non-Potable Water Supply to Sludge Dryer

   A dedicated non-potable water supply line to the sludge dryer should be installed to eliminate capacity problems in the non-potable water system when the sludge dryer is operating. This would include the installation of a new 4-inch non-potable waterline from the non-potable water pumps to

the sludge dryer. This would also either include replacement of the existing non-potable with larger pumps to provide adequate capacity to supply water to the dryer or the installation of a third non-potable water pump which would run when the sludge dryer is operating. Obsolete electrical gear, including a PLC, I/O cards, and communication terminations, would be replaced.

10. Anaerobic Digester Struvite Mitigation

    Initiate an investigation of the struvite accumulation under the manway cover at the top of the primary digester cover. Establish and implement solutions.

These projects are further described in Chapter 9 – Capital Improvement Plan, including budgetary costs for each item.

NITROGEN REMOVAL

INTRODUCTION

As indicated in Chapter 2, Ecology is moving forward with efforts to reduce Total Inorganic Nitrogen (TIN) in the Salish Sea, including Puget Sound. In December 2021, Ecology released the Puget Sound Nutrient General Permit (PSNGP), following release of prior drafts in January 2021 and July 2021. The Nutrient Permit went into effect in January 2022. The permit has been appealed by several dischargers who have filed a legal challenge. The PSNGP would establish annual effluent loads of Total Inorganic Nitrogen (TIN) for WWTPs that discharge to Puget Sound. TIN is the sum of nitrate-nitrogen, nitrite-nitrogen and ammonia-nitrogen. The PSNGP established loading "Action Level" thresholds in terms of pounds per year of TIN. Burlington is not covered by the initial phase of the PSNGP since it does not discharge directly to Puget Sound (although Mount Vernon is covered); however, Ecology has indicated that the Burlington WWTP may be covered in future phases of the PSNGP and thus subject to TIN limits sometime in the future. Although it is not certain that this will happen during the planning period, this Plan will address the modifications to the WWTP that would be required to meet a future total nitrogen effluent limit of 10 mg/L, which is expected to be reasonably consistent with what an Action Level would be for the City, based on Action Levels set for other WWTPs.

There are several methods available for the removal of nitrogen from wastewater. However, because the Burlington WWTP is an activated sludge process capable of seasonal nitrification, only nitrogen removal processes that will build on the activated sludge process will be considered. Other processes, such as ammonia stripping or ion exchange, require a high-quality effluent (filtered) and would only remove ammonia from the effluent.

The process that would be most appropriate to be incorporated into the existing Burlington WWTP would be the Modified Ludzack-Ettinger (MLE) process. In this process, the denitrification step takes place before the aeration basins, so that the food (readily degradable BOD) in the aeration basin influent can be used by denitrifying bacteria. Anoxic zones are created upstream of the aeration basins and nitrified aeration basin effluent mixed liquor is recycled to the anoxic zone. This recycle flow is typically 3 to 4 times the normal mixed liquor flow through the aeration basins. The magnitude of the recycle flow will determine the efficiency of nitrogen removal through this process. A flow diagram of this process is shown on Figure 7-12.

INFLUENT NITROGEN LOAD

The nitrogen in wastewater usually appears predominantly in the form of ammonia and organic nitrogen. Other forms of nitrogen, such as nitrate and nitrite, are usually not found in untreated wastewater in high concentrations. Ammonia and organic nitrogen are measured by the Total Kjeldahl Nitrogen (TKN) test which represents the total amount of nitrogen that will be subject to treatment in a wastewater treatment plant. TKN in the influent is normally in the range of 15 percent to 25 percent of the influent BOD_5 load. The City of Burlington tested the TKN and BOD_5 from composite samples of the influent collected on February 10, 2022, and February 16, 2022. The results of these tests are shown in Table 7-7.

TABLE 7-7

Results of TKN Sampling and Analyses

Sampling Date	TKN (mg/L)	BOD_5 (mg/L)	TKN/BOD_5
Feb. 10, 2022	38.0	169	0.225
Feb. 16, 2022	40.4	308	0.131

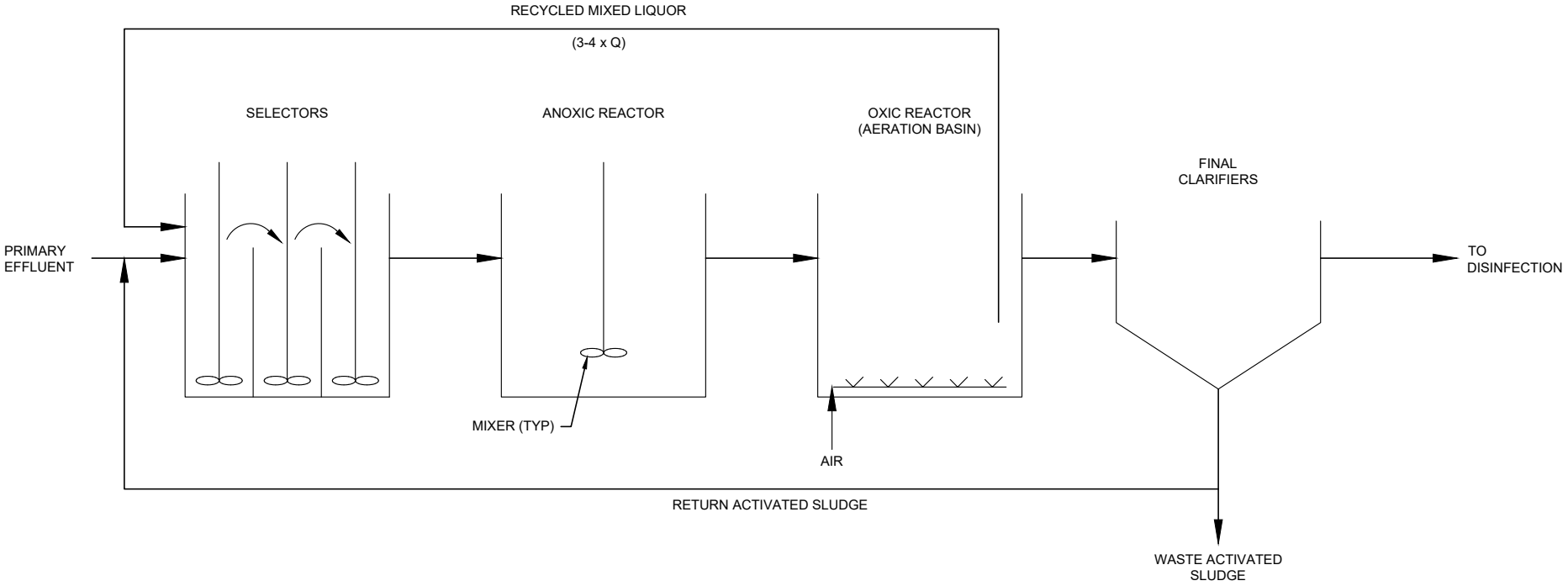
For the Burlington wastewater treatment plant, it is proposed to use a TKN:BOD_5 ratio of 0.225. Table 7-8 shows the projected TKN loads to the Burlington WWTP.

TABLE 7-8

Summary of Projected TKN Loads to the Wastewater Treatment Plant

Parameter	NPDES Permit Limit	Existing (2020)	2025	2030	2035	2040	Buildout
Annual Average TKN (lb/d)	N/A	693	772	828	911	1,017	3,724
Maximum Month TKN (lb/d)	N/A	871	1,051	1,125	1,238	1,379	4,905

L:\BURLINGT\21526.00 - Sewer Comp. Plan Update - WW Facilities Plan\Figures\FIG 7-12.dwg, 6/7/2022 10:28 AM, MARK NAGEL



CITY OF BURLINGTON

WASTEWATER COMPREHENSIVE PLAN

FIGURE 7-12

MODIFIED LUDZACK-ETTINGER (MLE)
PROCESS FLOW DIAGRAM

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CONSULTING ENGINEERS

Some of the organic nitrogen is associated with the suspended solids in wastewater. Thus, it is estimated that 15 percent of the influent TKN will be removed in the primary clarifiers. Table 7-9 shows the estimated TKN loads in the primary effluent.

TABLE 7-9

Summary of Projected TKN Loads in the Primary Effluent

Parameter	NPDES Permit Limit	Existing (2020)	2025	2030	2035	2040	Buildout
Annual Average TKN (lb/d)	N/A	589	656	704	828	864	3165
Maximum Month TKN (lb/d)	N/A	740	893	956	1,052	1,172	4.169

DISCUSSION OF RECOMMENDED IMPROVEMENTS

Based on typical values found in the literature, primary effluent would first enter three selector zones with a total volume of 10,600 cubic feet. The selectors would be followed by anoxic zones, where denitrification would take place, with a total volume of 41,800 cubic feet. Finally, the wastewater would enter the aeration zones, where nitrification takes place, with a total volume of 120,400 cubic feet. The solids retention time (SRT) for total nitrification has been estimated to be 12 days. A mixed liquor flow of 3.3 times the influent flow, or 9.17 mgd (6,371 gpm) would be recirculated from the aeration basins outlets to the selector zones to bring nitrates back to the anoxic zones to be removed by denitrifying bacteria. These parameters have been estimated for 2040 conditions. Adding these tank volumes gives a total tank volume of 172,800 cubic feet.

The existing Burlington WWTP has a total selector zone volume of 22,600 cubic feet and an aeration volume of 109,600 cubic feet, for a total volume of 132,200 cubic feet. This results in a total tank volume shortage of 40,600 cubic feet if effluent total nitrogen is limited to 10 mg/L.

During the design of the 2000 improvements to the WWTP, provisions for the installation of a future aeration basin, north of Aeration Basin 3, were made. This future basin would have a volume of 44,000 cubic feet. The construction of this basin, when and if nitrogen limits are implemented, will provide adequate tankage for the installation of an MLE process for nitrogen removal to meet a 10 mg/L total nitrogen effluent limit.

One option considered (Option 1) is to utilize the original aeration basins (Aeration Basins 1A and 1B) as an anoxic basin. With a volume of 43,920 cubic feet, these two basins would be appropriate for this purpose. However, the anoxic zone must be downstream of the selector zones and upstream of the aerated zones. Therefore, it is proposed that new selectors with a total volume of 10,600 cubic feet be constructed upstream of Aeration Basins 1A and 1B. The existing diffused air supply system in Aeration Basins 1A and 1B would be removed and mixers would be installed to keep the

solids in suspension. Aeration Basins 2 and 3 as well as the future Aeration Basin 4 would serve strictly as aeration basins, providing a total volume of 132,000 gallons.

One major challenge with this flow scheme will be to provide the interconnecting piping from the Aeration Basin Splitter Box to the Secondary Clarifier Splitter Box. The existing piping is designed to allow for three existing and one future activated sludge aeration basin treatment trains to operate in parallel. If the existing Aeration Basins 1A and 2B were converted to anoxic basins, the entire primary effluent flow would have to be diverted to the new selector zones. The recirculated flow of 3.3 times the influent flow plus the return activated sludge (RAS) flow would be introduced to the selector zones and all these flows would be conveyed to the anoxic zones. This flow is estimated to be 16.5 mgd (11,500 gpm). If the selector zones are constructed immediately adjacent to the anoxic zones, conveyance of the mixed liquor from the selectors to the anoxic basin could readily be accomplished. The primary effluent would be conveyed directly to the selector zones from the primary clarifiers.

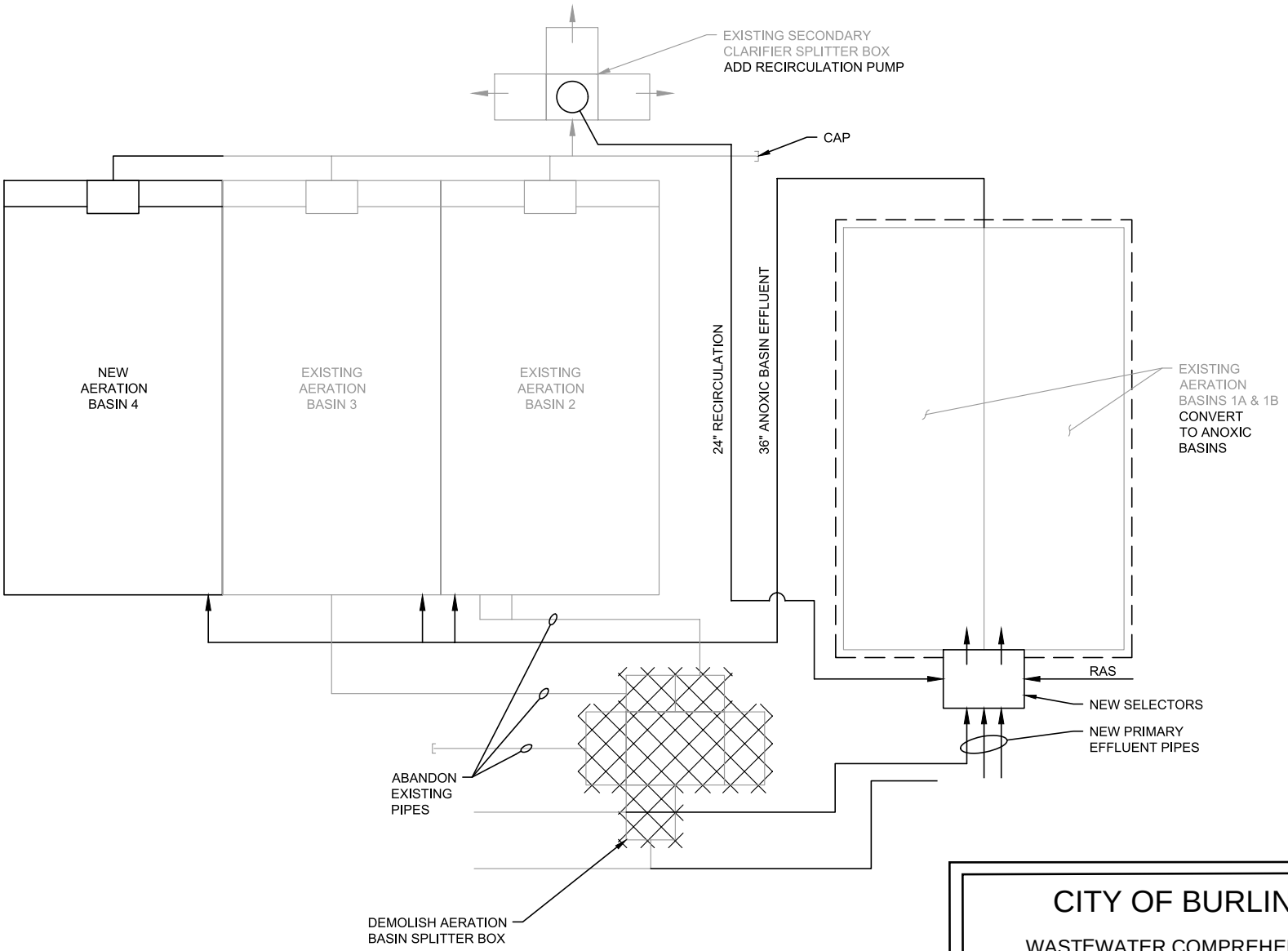
If the operating water levels in the anoxic basins are raised one foot above the present water level in Aeration Basins 1A and 1B, the total flow of 11,500 gpm could be conveyed to the influent end of the aeration basins through a 36-inch diameter pipe, without utilizing an aeration basin splitter box. Flow splitting to the aeration basins would be controlled by the aeration basin effluent weirs, the elevation of which may have to be adjusted to pass the added recirculated flow and to ensure proper flow splitting between the three aeration basins.

Recirculation pumps would be installed in the Secondary Clarifier Splitter Box, to convey the recirculated flow of 6,371 gpm through a new 24-inch diameter force main to the new selector zones. The Secondary Clarifier Splitter Box may have to be expanded to provide space for the pumps.

A flow diagram of this option for modifying the Burlington WWTP in shown on Figure 7-13.

Another option for modifying the Burlington WWTP for nitrogen removal (Option 2) would be to create four treatment trains in each of the existing aeration basins and the new Aeration Bain 4. The dividing walls in the existing aeration basins could be relocated to create the revised selector zone volumes and new dividing walls could be installed to create the anoxic zones. This way, the interconnecting piping would not have to be revised. Internal recirculation pumps could be installed in each of the aeration basin effluent drop structures and returned to the selector zones with piping installed inside each aeration basin. All the selectors and the anoxic zones would be equipped with mixers, and aeration will be limited to the oxic zones. A flow diagram of this option for modifying the Burlington WWTP for nitrogen removal is shown on Figure 7-14.

L:\BURLINGT\21526.00 - Sewer Comp. Plan Update - WW Facilities Plan\Figures\FIG 7-14.dwg, 5/10/2022 12:22 PM, MARK NAGEL

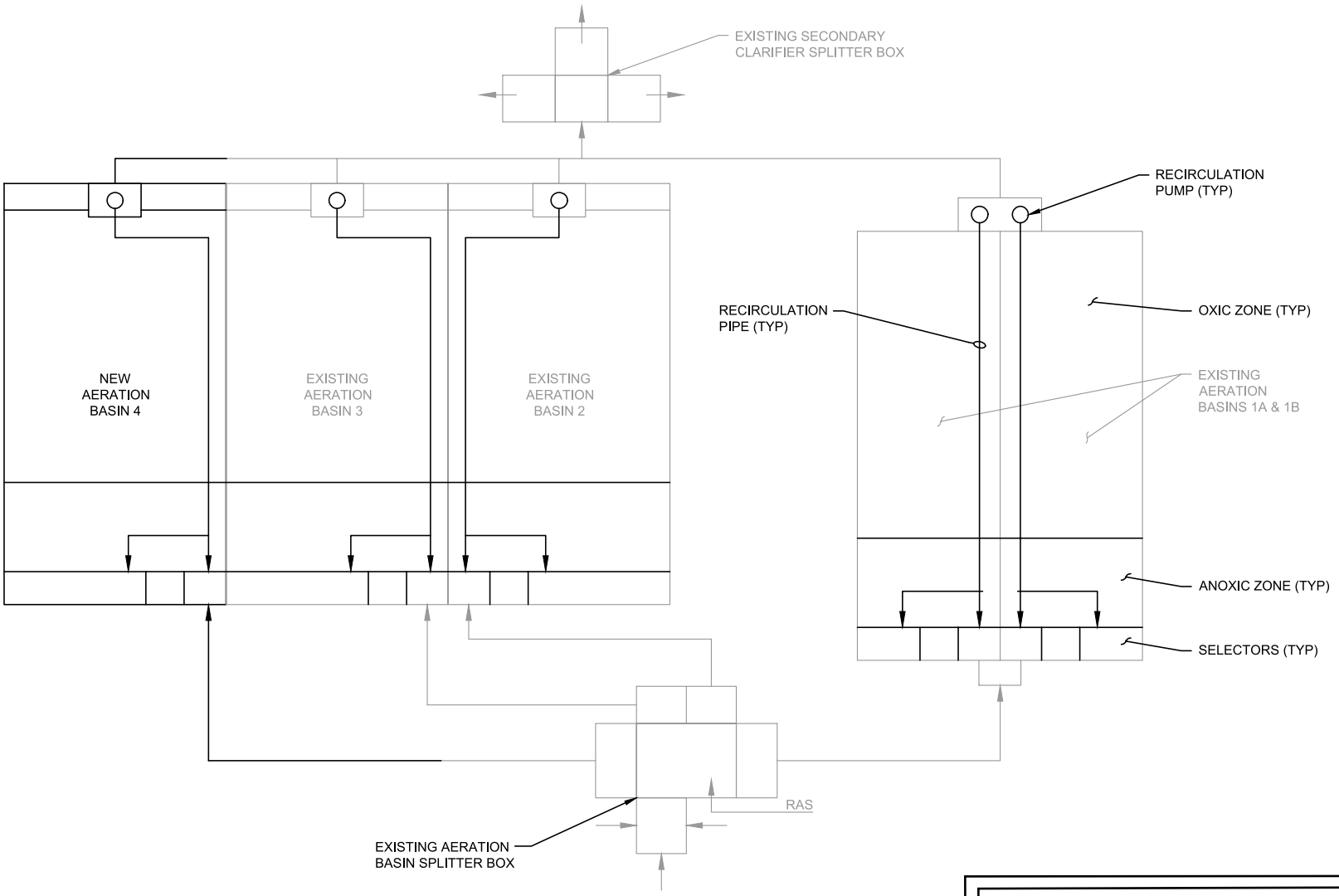


CITY OF BURLINGTON

WASTEWATER COMPREHENSIVE PLAN
FIGURE 7-13
NITROGEN REMOVAL ALT1: CONVERT EXISTING
AERATION BASINS 1A AND 1B TO ANOXIC TANKS FLOW

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L:\BURLINGT\21526.00 - Sewer Comp. Plan Update - WW Facilities Plan\Figures\FIG 7-15.dwg, 5/10/2022 12:23 PM, MARK NAGEL



CITY OF BURLINGTON

WASTEWATER COMPREHENSIVE PLAN
FIGURE 7-14

NITROGEN REMOVAL ALT2: FOUR SECONDARY TREATMENT TRAINS FLOW DIAGRAM

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It appears that the existing aeration equipment is adequate for complete nitrification. The estimated blower capacity required for the removal of BOD and nitrification is approximately 3,300 cubic feet per minute (cfm). The capacity of the positive displacement blower and the three existing centrifugal blowers is 5,215 cfm with the largest unit out of service.

Cursory budgetary estimates of capital costs for the two options described above have been prepared. The total capital cost for the option of converting the existing Aeration Basins 1A and 1B to anoxic basins, operating in series with three aeration basins (Option 1), is $6,900,000, including construction cost, Sales Tax, Engineering, Permitting, and a 30 percent contingency. An equivalent capital cost for the creation of four treatment trains (Option 2) is $5,800,000.

As can be seen, Option 2 is estimated to have a capital cost of about $1,100,000 less than Option 1. The annual costs, including power, labor, maintenance, and supplies, should be very similar for each option. It, therefore, on a preliminary basis, appears that constructing selectors, anoxic zones, aerated zones, and mixed liquor recycling entirely within each of the four existing and one additional tank is the most cost-effective method to incorporate nitrogen removal at the Burlington WWTP.

It is not known when, or even, if, the Burlington WWTP will be subject to nitrogen limits. The existing NPDES permit expires in 2023 and does not include nitrogen limits. Indications are that the next discharge permit, which would expire in 2028, will not include nitrogen limits, as well. Therefore, the implementation of nitrogen limits is not expected to take place until after 2028.

The analysis presented herein is based on limited influent TKN data and typical reaction rate coefficients found in the literature. It is recommended that, if it becomes known that nitrogen limits will be implemented, an extensive nitrogen sampling program be conducted, including sampling and analysis of primary effluent, gravity thickener supernatant, and rotary drum thickener and belt filter press filtrate. For some WWTPs utilizing the MLE process for nitrogen removal, the overflows, centrates, and filtrates from anaerobic digestion are introduced downstream of the influent sampling location and will, thus produce an ammonia load that is not accounted for by sampling the WWTP influent. This additional ammonia load must be accounted for in the design of a Nitrogen removal system.

The influent BOD may not be adequate for a food supply for the denitrification bacteria in the anoxic zones. In these plants, an additional food supply, in the form of methanol, ethanol, acetic acid, or glycerin. This should be evaluated in the predesign effort for the nitrogen removal system.

If the City is informed that nitrogen limits are going to be imposed, it is recommended that, following the evaluation of nitrogen sources, modeling of the treatment process be performed as a part of the predesign effort.

WATER RECLAMATION AND REUSE EVALUATION

INTRODUCTION

The State Legislature has declared there is "a primary interest in the development of facilities to provide reclaimed water to replace potable water in non-potable applications, to supplement existing surface and groundwater supplies, and to assist in meeting the future water requirements of the state." In accordance with this declaration and RCW 90.48, this Wastewater Comprehensive Plan must evaluate the potential for water reuse. The preparation of this evaluation is consistent with the requirements of the Revised Code of Washington (RCW) Chapters 90.46 Reclaimed Water Use and 90.48 Water Pollution Control; Washington Administrative Code (WAC) Section 173-240-060, WAC Chapter 173-219 Reclaimed Water Rule, and other Washington State Department of Ecology (Ecology) and Department of Health (DOH) regulations governing such analyses, including Ecology's *Criteria of Sewage Works Design* (Orange Book) and *Reclaimed Water Facilities Manual* (Purple Book).

Wastewater reclamation and reuse can have benefits for a community's water supply and wastewater management. Production of reclaimed water for use in non-potable applications can be especially beneficial to public water systems facing water supply shortages through physical or water rights supply limitations. Reclaimed water can delay or eliminate the need for additional water rights or potable water system capital improvements. The utility may be able to generate additional revenue by selling reclaimed water. Reclaimed water, in some cases, may be stored in the groundwater aquifer and recovered for later use by the utility. Water reclamation may also provide benefits to wastewater disposal responsibilities where receiving water constraints preclude increased discharge into a surface water body. Beyond the benefits to utilities, reclaimed water may provide environmental and aesthetic benefits to the community, such as augmenting stream flow, creating wetlands habitat, or improving recreation facilities.

This chapter presents a brief evaluation of the feasibility of reclaiming effluent from the WWTP and reusing it in the City.

REGULATORY REQUIREMENTS

RCW 90.48.112 requires consideration of reclaimed water in wastewater plans. Although the law does not specifically require implementation of a reclaimed water alternative, it strongly encourages it. RCW 90.46.005 states, in part, that to the extent that reclaimed water is appropriate for beneficial uses, it should be so used to preserve potable water for drinking purposes.

Various federal, state and local regulations affect system planning, construction and operation of water reuse facilities.

Federal Statutes, Regulations and Permits

The following federal laws and regulations that may affect water reclamation facility construction and operations:

- Federal Endangered Species Act
- National Environmental Policy Act
- Federal Safe Drinking Water Act
- Federal Guidance on Water Reuse

Many of these are discussed in detail in Chapter 2 of the Facility Plan. The impact of each of these laws and regulations is summarized below.

Federal Endangered Species Act

Impacts to endangered species, discussed in Chapter 2, would need to be addressed before a reclaimed water project could go forward.

National Environmental Policy Act

If a project involves federal action (through, for example, an Army Corps of Engineers Section 404 permit), and is determined to be environmentally insignificant, a Finding of No Significant Impact (FONSI) is issued, otherwise an Environmental Impact Statement (EIS) is required. NEPA is not applicable to projects that do not include a Federal component that would trigger the NEPA process.

Federal Safe Drinking Water Act

The Safe Drinking Water Act (SDWA, 1974) is primarily concerned with the quality of drinking water. Because the analysis does not examine reclaimed water treatment for potable use, this law largely does not affect the analysis herein. However, the Wellhead Protection Program (42 U.S.C. § 300h–7) of this law is relevant to the application of reclaimed water. This part of SDWA makes states responsible for assigning the agency responsible for protecting underground water resources, defining wellhead area, and identifying potential sources of contaminants. Given this, the application of reclaimed water should be considered in relationship to nearby underground water resources.

Federal Guidance on Water Reuse

EPA issued its Guideline for Water Reuse in 2012, which include general water reuse guidelines. However, EPA does not require or restrict any type of reuse. Generally, states maintain primary regulatory authority over allocating and developing water resources (including reclaimed water) by using the Safe Drinking Water Act and the Clean Water Act as foundation.

STATE STATUTES, REGULATIONS AND PERMITS

Regulatory requirements for wastewater treatment and water reclamation are delegated to each state by the federal government, as discussed above. The following discussion of relevant regulatory requirements focuses on those for water reclamation and regulations that may affect the planning for water reclamation and reuse for the City.

State Reclaimed Water Rule

In 2018, Ecology adopted the Reclaimed Water Rule (Chapter 173-219). In general, the rule establishes requirements for the production, distribution, and use of reclaimed water as authorized by the Department of Ecology (Ecology) and Department of Health (DOH). The rule sets the framework for how state agencies regulate the following:

a) Planning, designing, constructing, operating, and maintaining reclaimed water facilities.

b) Permitting of reclaimed water facilities.

c) Technology-based treatment, operational storage and distribution, treatment reliability, and use-based requirements.

d) Preventing impairment of existing water rights.

For the water reuse implementation contemplated in this plan, the Ecology is the agency that sets the requirements for the above. For proposed water reclamation facilities that are originally wastewater facilities, Ecology is the primary lead with DOH as the secondary lead agency. DOH issues Waste Discharge Permits for reclaimed water use in conjunction with Ecology. In general, DOH is the lead agency or has greater involvement for industrial wastewater sources, when reclaimed water is proposed for eventual potable use, or for small systems. The following sections summarize the rule's requirements on each of the above.

<u>Planning, Design, Construction, Operation and Maintenance</u>

Potential generators must arrange and attend a preplanning meeting with the lead and secondary lead agency to determine the scope of the feasibility analysis, as well as other planning, permitting, or technical matters related to their intention to generate and distribute reclaimed water for use. If water reuse appears desirable for the City, and the City wished to move forward with implementation, a preplanning meeting would need to be held as part of a formal feasibility analysis. The feasibility analysis must consist of the following:

(i) Explanation of who will own, operate, and maintain the reclaimed water facility.

(ii) For a planning period of 20 years, projected capital and operational costs, in terms of total annual cost and present worth, and projected revenues from user fees and other sources, if applicable.

(iii) Estimate of the annual or seasonal volumes of wastewater required and available and proposed production (generation) rate of reclaimed water.

(iv) Description of the proposed level of reclaimed water quality the project will generate, along with general descriptions of the treatment systems and reliability features used by the proposed facility. The project proponent must demonstrate that the proposed facility concept is capable of meeting and ensuring the minimum requirements for water quality, treatment and reliability for the proposed uses.

(v) Description of plans for alternative use, storage, or release of any reclaimed water or inadequately treated water.

(vi) Initial assessment of potential water quality and quantity impairment and potential strategies to prevent, compensate, and/or mitigate for such impairment.

(vii) List of all public potable water suppliers that provide water to the reclaimed water generation, storage, and distribution facilities in addition to proposed reclaimed water use areas. Describe proposed methods to coordinate with potable water suppliers on reclaimed water service including cross connection prevention actions in design and operation of the reclaimed water system. Results of coordination with the listed potable water suppliers must be included in the engineering report under WAC 173-219-210 (2) (f).

(viii) Description of the contingency plan for both temporary and permanent reversion to domestic wastewater facilities and alternative water supply systems where applicable, if reclaimed water production (generation) is discontinued. Include the impact of increased demand to water purveyors.

(ix) A brief description of the community outreach and public involvement conducted or planned to be conducted, as you determine feasibility, to demonstrate awareness of and community support for the reclaimed water project.

(x) Identification of existing or proposed interlocal or interagency agreements related to reclaimed water, if any, with local governments or local potable water utilities within the area of existing or proposed distribution and use of reclaimed water.

(xi) Statement of compliance with the State Environmental Policy Act (SEPA) and the National Environmental Policy Act (NEPA), where applicable.

The analysis related to planning, design, construction, operation and maintenance would need to reasonably adhere to the guidelines presented in Ecology's guidance, Criteria for Sewage Works Design (Orange Book) and Ecology and DOH's guidance, Reclaimed Water Facilities Manual (Purple Book). The guidelines presented in the Orange Book and Purple Book form the basis of Ecology's review of the feasibility analysis.

Although the objective of this Analysis is to address key elements of a feasibility analysis, any construction and/or modification of a water reclamation facility must be preceded by Ecology's approval of an engineering report that represents the technical basis of the facility. The detailed requirements of this report are described in WAC 173-219-210 and the Purple Book, many of which are similar to the content of the feasibility analysis. As a summary of these requirements, the report must include the following key items:

- Proposed quantity and quality of the reclaimed water generated by the reclaimed water facility, including an assessment that the proposed water quality meets the requirements for all proposed beneficial uses (i.e., reclaimed water classifications, Tables 7-10 and 7-11).

- The anticipated amount, characteristics, and strength of the source water to be treated, including BOD5, DO, TSS, and nitrate levels, and the degree of treatment required to generate proposed reclaimed water quality, and other influencing factors.

- Descriptions of proposed treatment processes, including preliminary flow diagrams of critical reclaimed water unit processes, as well as anticipated reliability features and controls. The report must contain sufficient detail to verify that the proposed facility will comply with the water quality and reliability requirements of this chapter.

- Summary of preliminary engineering design criteria for reclaimed water treatment processes, including the technology-based treatment and reliability requirements discussed in a later section.

TABLE 7-10

Minimum Biological Oxidation Performance Standards

Parameter[1]	**Minimum Biological Oxidation Performance Standard**	
Dissolved Oxygen	Must be measurably present	
BOD5	**Monthly Average**	**Weekly Average**
	30 mg/L	45 mg/L
CBOD5	25 mg/L	40 mg/L
TSS	30 mg/L	45 mg/L
pH	**Minimum**	**Maximum**
	6 s.u.	9.0 s.u.
pH (Groundwater recharge)	6.5 s.u.	9.0 s.u.

(1) The parameter must be measured at the end of the unit process or alternative monitoring location as set in a reclaimed water permit.

TABLE 7-11

Class A and B Performance Standards

Parameter[1]	**Class A Reclaimed Water**		**Class B Reclaimed Water**	
	Coagulation/Filtration			
Turbidity[2]	Monthly Average	Sample Maximum	Monthly Average	Sample Maximum
	2 NTU	5 NTU	Not Applicable	Not Applicable
	Membrane Filtration			
Turbidity[2]	Monthly Average	Sample Maximum	Monthly Average	Sample Maximum
	0.2 NTU	0.5 NTU	Not Applicable	Not Applicable
	Disinfection			
Total Coliform	7-Day Median	Sample Maximum	7-Day Median	Sample Maximum
	2.2 MPN/100 mL	23 MPN/mL	23 MPN/mL	240 MPN/mL
Virus Removal	4 Log-Removal		Not Applicable	Not Applicable
	Nitrogen Removal[3]			
Total Nitrogen	Monthly Average	Weekly Average	Monthly Average	Weekly Average
	10 mg/L	15 mg/L	Not Applicable	Not Applicable

(1) The parameter must be measured at the end of the unit process or alternative monitoring location as set in a reclaimed water permit.
(2) Sample maximum for turbidity is the highest value for the day that lasts longer than 5 minutes.
(3) Total nitrogen standards apply to release to wetlands, surface water augmentation, groundwater recharge, and direct potable reuse.

Permitting

Applications for reclaimed water permits must be submitted to the lead agency no later than 180 calendar days before planned distribution of reclaimed water for use. Prior to the application submission, the feasibility analysis must be approved by Ecology. Similarly, the required engineering report must be submitted for approval prior to or in conjunction with the permit application.

Technology-Based Treatment and Disinfection

Depending on the classification of reclaimed water, certain technology-based treatment requirements apply to the generation of reclaimed water. Class B reclaimed water must include biological oxidation followed by disinfection. Class A water requires one of the following alternative treatment processes/technologies to meet the performance requirements listed in Tables 7-10 and 7-11.

a) Biological oxidation, followed by coagulation, filtration, and disinfection, demonstrating at least a 4-log virus removal or inactivation.

b) Biological oxidation, followed by membrane filtration and disinfection, demonstrating at least a 4-log virus removal or inactivation.

c) Combination of biological oxidation and membrane filtration via a membrane bioreactor, followed by disinfection, demonstrating at least a 4-log virus removal or inactivation.

d) An alternative treatment method, that demonstrates to the satisfaction of the lead agency that it provides for equivalent treatment and reliability.

As an activated sludge facility with secondary clarifiers, it is assumed that the Burlington WWTP would use method "a" or "b" above.

Disinfection may be accomplished by the methods described in the Purple Book, including ultraviolet, chlorine, or other chemical disinfection methods. However, a minimum chlorine residual of ≤0.2 mg/L free chlorine or ≤0.5 mg/L total chlorine is required in pipeline distribution systems conveying the reclaimed water from the facility to the point of use. Ecology may waive or modify this requirement if the generator demonstrates a benefit from reducing or eliminating the chlorine residual.

The Burlington WWTP currently uses ultraviolet disinfection, and it is assumed that this disinfection method would be used if the plant generated reclaimed water.

Storage and Distribution

Storage and distribution systems for reclaimed water are governed by several regulations, all of which are detailed in the Purple Book. The following list of regulations and guidelines contains notable requirements that will affect the planning and design of the modifications to the existing wastewater treatment system to store and distribute reclaimed water:

- Reclaimed water distribution systems must provide adequate separation between the underground reclaimed waterlines and sanitary sewer lines, storm sewer lines, potable waterlines, and potable water wells.

- A minimum of 200 feet must separate reclaimed water storage and distribution from potable water supply intakes, including wellheads, springs, surface water, or designated groundwater under the influence of surface water.

- The design of storage ponds and reservoirs must prevent exchange with groundwater.

- The design and location of storage ponds or reservoirs must be protected from stormwater runoff from surrounding property.

- All water that enters the distribution system from open reservoirs should be filtered or screened to protect the system from algal growth or residual suspended solids.

- The installation of new or replacement distribution pipelines for reclaimed water distribution systems must comply with the most recent edition of Planning for the Distribution of Reclaimed Water, Manual M24, American Water Works Association, the most recent edition of the Department of Health Water System Design Manual, or equivalent standard engineering practices (WAC 173-219-360(3)). The distribution system must be able to provide positive pressure to the point of use at peak hour demand.

Treatment Reliability

Generators may not distribute water that has not received adequate and reliable treatment based on the requirements of the Reclaimed Water Rule and the facility's reclaimed water permit. Treatment reliability requirements are described in detail in the Purple Book. In general, these guidelines consist of the application of alarms and redundant or standby treatment equipment such that untreated or partially treated water does not enter the reclaimed water distribution system or at least indicates when water has not been adequately treated. The specific guidelines are detailed in Table 6-6 of the Purple Book.

Water that does not receive treatment meeting requirements in the Reclaimed Water Rule and reclaimed water permit must be diverted to temporary storage and re-treatment or discharged under authorization by a state waste discharge permit or NPDES permit. The method of handling partially treated water must be coordinated with Ecology. For this part of the Reclaimed Water Rule, Ecology has the authority to do the following:

- Require a reclaimed water generator to maintain either storage or disposal options for inadequately treated water sized to accommodate the full design flow.

- Specify when and how the reclaimed water treatment facility must cease or otherwise control the generation, distribution, and use of reclaimed water including, but not limited to, the reduction, loss, failure, or bypass of any unit processes of the reclaimed water facility.

- Specify procedures to establish when the treatment processes are sufficiently restored to allow the generation, distribution, or use of the reclaimed water.

- Prohibit bypassing of inadequately treated water from the approved reclaimed water facility to the distribution system or to the point of use.

With a permitted outfall with adequate capacity, it is assumed that the WWTP would discharge to the Burlington River in situations when reclaimed water is not generated.

Water Rights

Facilities that reclaim water must not impair any existing water right downstream from any freshwater discharge points of such facilities unless compensation or mitigation for such impairment is agreed to by the holder of the affected water right. To show how water rights may be affected, the feasibility analysis must include a water impairment assessment, as previously described.

Ecology and the City would need to jointly notify and consult with affected tribes and the Washington state Department of Fish and Wildlife (WDFW) before Ecology makes its final determination of compliance.

State Water Quality Standards for Groundwaters

The Water Quality Standards for Groundwaters of the State of Washington (WAC 173-200) apply to all groundwaters of the state that occur in a saturated zone or stratum beneath the surface of land or below a surface water body. This rule does not apply to any contaminants or nutrients applied to the land that do not travel deeper than the root zone. If the proposed application of reclaimed water includes groundwater recharge (direct or indirect) or is within 1,000 feet of potable water wellheads, critical aquifer recharge areas, and wellhead protection areas, this rule may apply. Guidance on defining wellhead protection areas and relevant contaminant sources is described in DOH's Wellhead Protection Program Guidance Document.

A large portion of this rule consists of the anti-degradation policy, which includes the following:

1. Existing and future beneficial uses shall be maintained and protected and degradation of groundwater quality that would interfere with or become injurious to beneficial uses shall not be allowed.

2. Degradation shall not be allowed of high quality groundwaters constituting an outstanding national or state resource, such as waters of national and state parks and wildlife refuges, and waters of exceptional recreational or ecological significance.

3. Whenever groundwaters are of a higher quality than the criteria assigned for said waters, the existing water quality shall be protected, and contaminants that will reduce the existing quality thereof shall not be allowed to enter such waters.

In sum, existing groundwater quality must not change from water reclamation activities. A key to adhering to the anti-degradation policy is to locate water reclamation facilities, pipes, and uses away from wellhead protection areas.

POTENTIAL FOR REUSE IN THE CITY OF BURLINGTON

The potential benefits and uses of reclaimed water were evaluated for applicability to the City of Burlington.

Upland Water Reuse

The Skagit River reach near the City's effluent discharge meets all the applicable water quality standards. Ecology has determined that the City's effluent discharge does not have a reasonable potential to cause exceedances of water quality standards in the Skagit River. Therefore, the City does not have a need to implement water reuse in order to reduce discharge into the Skagit River based on the current NPDES permit and water quality standards.

Offsets to Existing Water Rights

The water system in the City of Burlington is owned and operated by Skagit County PUD, which owns and administers all water rights associated with water supply. The City of Burlington could negotiate water rights agreements with Skagit County PUD.

Substitution of Potable Water Uses

Potable water in the City of Burlington is used for residential, commercial, industrial, municipal, and irrigation uses. Substitution of potable water with reclaimed water for uses not requiring potable water quality reduces the demand on potable water.

Landscape Irrigation

The most visible water application in the City that does not require potable quality water is landscape irrigation of City parks, schools, and other facilities. Landscape irrigation of sites with public access requires Class A reclaimed water.

In 2004, the City of Burlington commissioned an evaluation of utilizing reclaimed water to irrigate the Skagit River Park and the Rotary Park, located south of the existing Burlington WWTP. This evaluation concluded that the most cost-effective alternative to supply irrigation water to these parks was purchasing water from Skagit County PUD. The City of Burlington is already using secondary effluent for landscape irrigation at the WWTP site.

In 2021, the City used 23.2 million gallons to irrigate Skagit River Park, at a cost (paid to the PUD) of $71,557. Assuming the same annual costs for the 20-year planning period, the expected 20-year life cycle cost of continuing to use PUD water is $1.43 million.

Since daily irrigation demands are significantly less than WWTP flows, it is anticipated that, if reclaimed water were generated at the site, only a portion of the final effluent flow would be further treated to Class A standards. The anticipated 20-year life cycle cost to construct and maintain effluent filtration, additional UV, and pipelines to convey reclaimed water to the fields exceeds $5 million. Thus, use of reclaimed water to irrigate the fields does not appear to be feasible at this time.

Sanitary Sewer Flushing

Another potential use for reclaimed water in Burlington is sanitary sewer flushing. Reclaimed water used for flushing sanitary sewers must at least meet Class B standards.

City of Burlington has used secondary effluent in the past for sanitary sewer flushing. In order to continue to use effluent for sanitary sewer flushing, the effluent would need to meet the Class B standards shown in Table 7-11. The major change in what is currently provided for treatment would be to provide additional UV dose to meet the *total* coliform standard, which are 23 MPN/mL 7-day median and 240 MPN/mL sample maximum. If the City is interested in using Class B reclaimed water for sanitary sewer flushing, additional testing and evaluation is necessary to determine if filtration and/or additional UV infrastructure would be required. It is possible that, at low flows, the current UV system could provide adequate dose to meet the standards, although perhaps not consistently.

Recommended Uses

It is recommended that the City of Burlington continue to utilize chlorinated effluent for landscape irrigation on the wastewater treatment plant site and for non-potable water uses. Other uses of reclaimed water do not appear to be feasible at this time. This evaluation should be updated if the typical drivers (water scarcity, water rights issues, water quality concerns) for reclaimed water projects emerge.

CHAPTER 8

BIOSOLIDS TREATMENT AND MANAGEMENT

This chapter provides an evaluation of the treatment and management of biosolids from the City's existing WWTP, and provide recommendations to ensure reliable service through the 20-year planning period and beyond. Alternatives are evaluated in terms of capital cost, annual operation and maintenance cost, ease of operations and maintenance, sustainability, and reliability.

As discussed in Chapter 7, Wastewater Treatment Plant Analysis, none of the solids treatment process units will require capacity increases throughout the planning period. Recommendations are provided for increasing the operational efficiency and performance, or replacing aging infrastructure.

A discussion of the applicable regulatory biosolids treatment and management requirements is provided in Chapter 3, Regulatory Requirements. A description of the existing WWTP and current anaerobic digestion and Class A biosolids treatment system is included in Chapter 4, Existing Facilities.

Background regarding the existing system and general issues regarding biosolids treatment and management is provided immediately below, followed by a discussion of alternatives and recommendations.

EXISTING SYSTEM

The liquid stream treatment processes at the City's WWTP produce two large waste sludge streams that are managed and treated by the solids handling systems. Primary sludge and waste activated sludge (WAS) are thickened before they are pumped to the anaerobic digestion system, where the volatile fraction of waste sludge is reduced to decrease the overall mass of biosolids leaving the facility. Anaerobic digestion also helps the solids handling system meet vector attraction reduction requirements in accordance with WAC (Washington Administrative Code) 173-308-180. Digested sludge is loaded to the belt press dewatering system to reduce the volume and water content of biosolids sent to the existing dryer system.

The WWTP uses an indirect thermal fluid dryer to produce Class A biosolids from its waste solids. Pathogen reduction requirements (WAC 173-308-170) for Class A biosolids are accomplished through the dryer, which uses heat to drive evaporation of dewatered sludge until the solids percentage of the sludge exceeds 90 percent dry solids by weight. The existing dryer is located outdoors under a canopy cover. The City successfully distributes Class A biosolids to the public, which is used as soil conditioner, fertilizer, or fertilizer supplement.

CONDITION

The existing dryer, Fenton Model RK48, was installed in 2002, and has been in operation for about 20 years. The dryer is fast approaching the end of its useful life. The City purchased a spare dryer and has used that for parts in recent years, since replacement parts have not been available. Given the age of the system as well as ongoing issues obtaining replacement parts and the expected difficulty of repairing and maintaining the system in the future, the City would like to replace the dryer system with another dryer or another technology.

ENERGY CONSUMPTION

Table 8-1 summarizes biosolids production and natural gas consumption by the existing dryer. At market industrial rates, the annual cost for natural gas has been $37,000 to $40,000.

TABLE 8-1

Natural Gas Consumption – Existing Fenton Dryer

Year	Biosolids Production, Dry Tons	Natural Gas Consumption, ccf	Natural Gas Consumption per ton of Biosolids Produced, ccf
2019	400.9	38,436	95.9
2020	421.2	42,180	100.1
2021 (Jan-May)	153.3	15,201	99.1

BIOSOLIDS QUALITY

Existing Standards

The City's existing treatment system easily meets the existing biosolids quality standards promulgated in WAC-173-308 and discussed in Chapter 2. As shown in Table 8-2, the City easily meets the Table 3 (Exceptional Quality) standards for trace pollutants. For pathogen reduction, the WWTP meets the Class B standards through digestion and follows that process with thermal drying to meet Class A standards. The pathogen reduction requirements appropriate for these two processes (anaerobic digestion for Class B and thermal drying for Class A) are shown in Tables 8-3 and 8-4, respectively. Table 8-5 summarizes the vector attraction reduction requirements.

TABLE 8-2

Allowable Biosolids Trace Pollutant Concentrations for Land Application[(1)]

Element	Symbol	Ceiling Concentration (mg/kg)[(1)]	EQ Limit (mg/kg)[(2)]	City of Burlington 2020 (mg/kg)
Arsenic	As	75	41	3.1
Cadmium	Cd	85	39	2.0
Copper	Cu	4,300	1,500	397
Lead	Pb	840	300	22
Mercury	Hg	57	17	0.457
Molybdenum	Mo	75	75 [(3)]	11
Nickel	Ni	420	420	26
Selenium	Se	100	100	2.3
Zinc	Zn	7,500	2,800	1,104

(1) WAC-173-308 Table 1.
(2) WAC-173-308 Table 3.
(3) Under review by EPA. Until the EPA completes its review, the effective limit is 75 mg/kg.

TABLE 8-3

Class B Pathogen Reduction Requirements Relevant for Anaerobic Digestion

Alternative 1	Fecal coliform less than 2,000,000 most probable number (MPN) or 2,000,000 colony-forming units per gram of total solids. Seven samples are collected at each sampling event. Geometric means are used to determine compliance.
Anaerobic Digestion	Biosolids are treated in the absence of air for a specific mean cell residence time at a specific temperature Values for the mean cell residence time and temperature must be between 15 days at 35 to 55°C (95 to 131°F) and 60 days at 20°C (68°F).

TABLE 8-4

Class A Pathogen Reduction Requirements Relevant for Heat Drying

All Alternatives	Fecal coliform <1,000 MPN per gram total solids, or salmonella <3 MPN per 4 grams total solids.
Heat Drying	Biosolids are dried by direct or indirect contact with hot gases to reduce the moisture content to 10 percent or lower. Either the temperature of the biosolids particles exceeds 80°C or the wet bulb temperature of the gas in contact with the biosolids as it leaves the dryer exceeds 80°C.

(1) Biosolids stabilized to these standards meet Class A pathogen reduction requirements if the end product has: Fecal coliform <100 MPN per gram total solids; or Salmonella <3 MPN per 4 grams total solids

TABLE 8-5

Vector Attraction Reduction Alternatives Relevant for Anaerobic Digestion and Heat Drying

No.	Description
1.	Biosolids digestion process with >38 percent volatile solids reduction.
2.	Test end product of an anaerobic digestion process: 40-day anaerobic test at 30 to 37 degrees C. Acceptable stabilization if <17 percent volatile solids reduction occurs during the test.
3.	Treatment by drying. Can include unstabilized primary wastewater solids. Total solids >90 percent before mixing with other materials.

Potential Future Standards – Microconstituents, including PFAS

Microconstituents are natural or manmade compounds that are detected in the environment with a potential effect on organism development and human health. Pharmaceuticals and personal care products (PPCPs) are significant sources of microconstituents in the environment; however, most of the concern about microconstituents currently is regarding PFAS (per- and polyfluoroalkyl substances).

PFAS are a class of several thousand different compounds that have been manufactured and used in a large number of products and applications since the 1940s. Their extreme chemical and biological stability, which provides their product usefulness, makes them very persistent and mobile in the environment. PFAS were incorporated into components of inks, varnishes, waxes, firefighting foams, metal plating, cleaning solutions, coating formulations due to their unique chemical properties as lubricants, water and oil repellents, paper, and textiles. They are frequently detected around the world in water, air, soil, wildlife, household dust and products, and humans. A growing number of studies have linked exposure to PFAS, primarily through ingestion, to a range of negative

health effects. Perfluorooctane sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA) are the best-studied perfluorinated chemicals, and the members of the family that carry the greatest health concerns. The compounds have been shown to affect liver function, alter reproductive hormones and increase infant mortality. Concern over the health effects led to a voluntary phase-out of the manufacture of several PFAS in the United States between 2000 and 2015. However, many forms of PFAS are still widely used, and even the phased-out forms are still produced in outside the US and found in products imported to the US.

Long chain PFAS compounds have been banned but the PFAS replacement compounds have the capability of degrading into long chain PFAS precursors. The carbon fluorine bond in PFAS is one of the strongest bonds and does not breakdown easily. Thus, conventional wastewater treatment technologies are not capable of removing PFAS. This results in PFAS leaching into agricultural soils and entering crops after land application.

PFAS can be found in high concentrations in industrial discharges. Several studies of industrial dischargers have shown that landfill leachate had the highest PFAS concentrations among the industries tested, although significant concentrations have been found in other industries including electronics manufacturing, the aviation industry and any producer or user of firefighting foams. In addition, many consumer products are known to contain, and serve as sources of, PFAS, including:

- Carpet and carpet cleaning and treatment products;
- Textiles for furniture and clothing and stain resistant and porous waterproofing materials;
- Treated paper food packaging – for water, oil, and grease resistance and non-stick performance;
- Non-stick cookware;
- Treated floor waxes and stone and wood sealants;
- Cosmetics;
- Many other consumer products.

Per the Washington State Department of Ecology, fire fighting foams are the leading cause of PFAS contamination in Washington State. PFOS and PFOA were discovered in drinking water in Airway Heights, leading the town near Spokane to advise residents to drink bottled water for several weeks while the city switched over to a different water supply. Private wells on Whidbey Island were also found to contain PFOS and PFOA. In past years, the chemicals have been found in wells serving DuPont and Issaquah as well.

Regulations

EPA has established health advisory levels (70 ppt, parts per trillion, for PFOA plus PFOS) in drinking water; however, there has not been any federal or statewide regulations for treated wastewater or biosolids. Maine has imposed some of the most

stringent regulations for PFAS, including for three PFAS compounds in biosolids, and other states have regulated PFAS or are looking to regulate.

Wastewater secondary sludge and biosolids have shown to be routes for PFAS emission to the environment. Treatment techniques for removal of PFAS in biosolids have been evolving but the results are not publicly available and have not been compared to each other.

Washington State

PFAS Chemical Action Plan (CAP) was issued by Washington State in November 2021. The State's objectives were to:

1. Ensure drinking water is safe.

2. Manage environmental PFAS contamination – contaminated sites and identified industries.

3. Reduce PFAS in products.

4. Understand and manage PFAS in wastewater (municipal and industrial), landfills, and biosolids.

The following are key elements in the PFAS CAP, relative to biosolids management for Burlington:

- CAP 4.1 – WWTP sampling plan for plants with known industrial PFAS dischargers or high drinking water concentrations; identify industrial dischargers of PFAS; based on results, develop monitoring rules for some or all domestic and industrial dischargers.

- CAP 4.3 – For biosolids, develop information and data gaps currently prevent risk assessment; recommend study; validate testing protocol, monitor, evaluate realistic exposure pathways, conduct risk assessment (premature to change rule).

Figure 8-1 summarizes PFAS effluent data for 2008-2009 for Burlington compared to several other WWTPs. As shown, concentrations at Burlington were lower that many of the other WWTPs. However, effluent PFAS levels at other WWTPs have shown considerable variability, and these data are over 10 years old, so it cannot be concluded that Burlington effluent always has low concentrations.

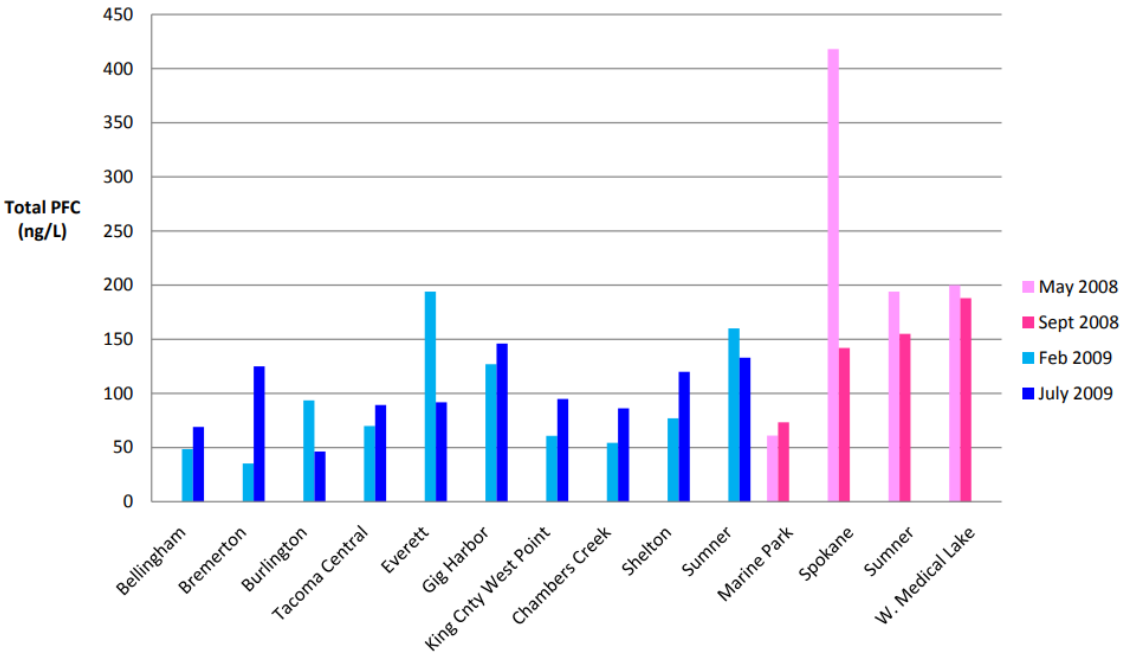


FIGURE 8-1

Comparison of PFAS Concentrations in WWTP Effluent

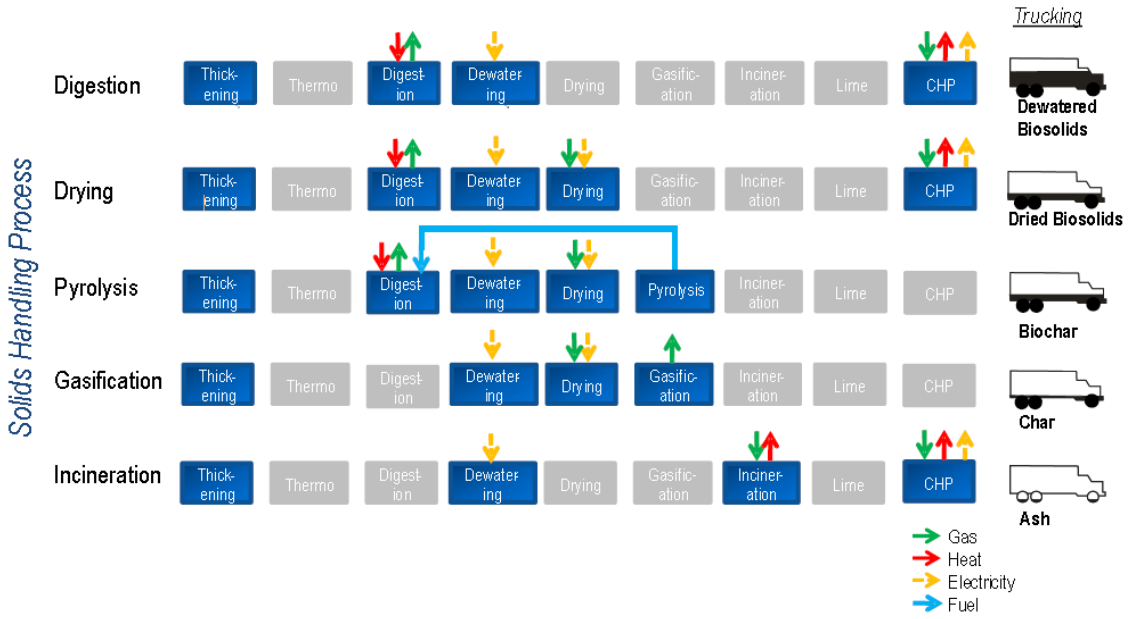
It is important to recognize that: (1) the concentrations in Figure 8-1 are extremely low (in parts per trillion); and (2) Washington State has not issued any PFAS regulations for biosolids. However, research, regulatory approaches and public perception regarding PFAS are evolving quickly.

CLASS A BIOSOLIDS TREATMENT TECHNOLOGIES

This section provides a summary of Class A biosolids treatment technologies. The technologies considered include:

1. Biosolids Drying.
2. Alkaline Stabilization.
3. Composting.
4. Gasification.
5. Pyrolysis.
6. Incineration.

These technologies (with the exception of composting and alkaline stabilization) are shown schematically in Figure 8-2.



Parry, 2014

FIGURE 8-2

Schematics of Biosolids Treatment Technologies

TECHNOLOGY ALTERNATIVE 1 – BIOSOLIDS DRYING

Drying of sludge has been successfully implemented at WWTPs since the 1920s and produces a marketable dry solids product that can be used as a fertilizer or biofuel. As of 2012, there were more than 60 drying systems operating in the U.S., and more than 100 in Europe. Drying is based on the removal of water from dewatered solids, which accomplishes both volume and mass reduction. At municipal WWTPs, dewatered biosolids are conveyed to the drying system where the temperature of the wet solids mass is raised and most of the water is removed via evaporation, resulting in a product with approximately 90 percent or higher total solids. This drying process retains the majority of the nutrient content of the biosolids.

For most systems, the high temperatures used in drying assure that the US EPA (40 CFR Part 503) and Ecology (WAC 173 308) time and temperature requirements for pathogen inactivation are met. Drying also meets the EPA vector attraction reduction standards by desiccating the wastewater solids to greater than 90 percent solids (or to greater than 75 percent solids if the solids have been previously stabilized). Although high temperatures are used in many drying systems, the temperatures are generally low

enough to prevent oxidation (burning) of the organic matter. Thus, most of the organic matter is preserved in the dried material.

Drying systems may produce a variety of forms of dry material, including fine dust, flakes, small pellets, or larger fragments, depending on the type of drying system used, the characteristics of the solids processed, and the intended use of the final product.

Process Description

In the most general terms, drying is the use of heat to evaporate water from wastewater residual solids. The drying system, in addition to the dryer itself, generally consists of materials handling and storage equipment, heat generation and transfer equipment, air movement and distribution equipment, emissions control equipment, and ancillary systems. These equipment systems can take many forms, using different methods for heat transfer, including convection, conduction, and radiation heating. To some extent, multiple methods of heat transfer are used by individual systems, but they are generally categorized by their primary method of heat transfer – direct or indirect.

Direct Dryers

Systems that primarily use convection for heat transfer are often referred to as "direct" dryers. In direct heat dryers, hot air/gas flows through a process vessel and comes into direct contact with particles of wet solids. The contact between the hot air and cold wet cake allows the transfer of thermal energy, which causes an increase in wet cake temperature and evaporation of water. The hot air/gas can be produced by almost any source of heat, but most often is produced by a gas or oil-fired furnace. Examples of direct drying equipment are rotary drum dryers and belt dryers. A schematic diagram and photograph of a typical rotary drum drying system are included in Figures 8-3 and 8-4, respectively.

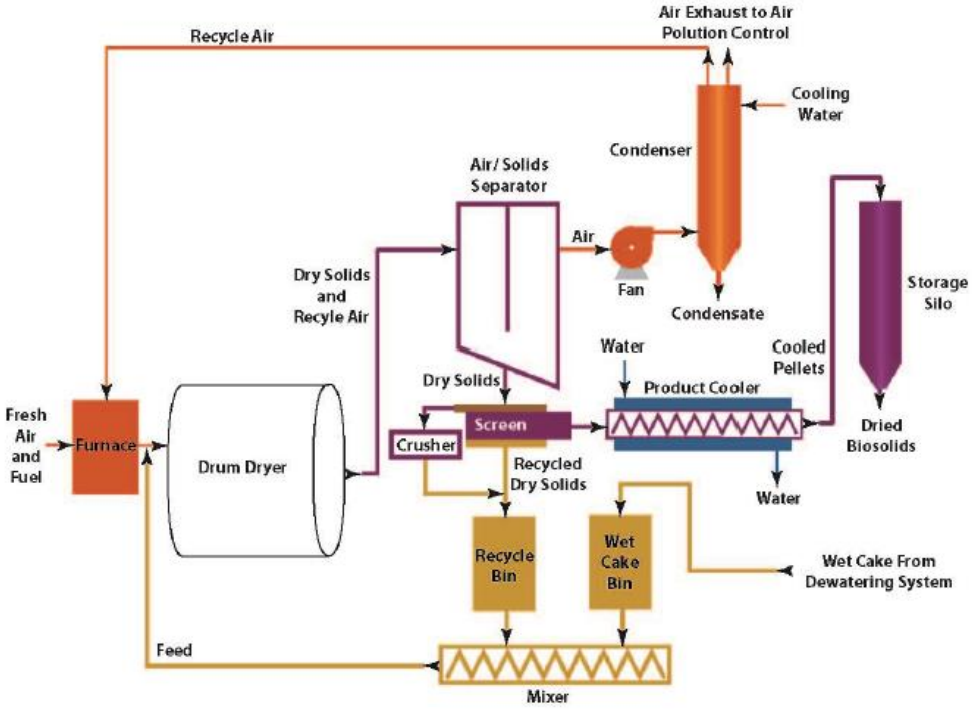


FIGURE 8-3

Typical Schematic of Direct Drying System (Drum)

In this type of system, the heat supply is via a fuel-burning furnace that exhausts directly to the dryer drum. The dried material is separated from the warm exhaust gas and is then screened and processed for either recycling back to the dryer or routed to storage silos. The exhaust air/gas is cooled and part of it is recycled back to the dryer. The remainder of the air/gas is treated in air pollution control equipment and then vented to the atmosphere. Recirculation of the dryer exhaust accomplishes three important functions. First, it increases the overall thermal efficiency of the dryer system, second, it minimizes the volume of exhaust gas requiring air pollution control (APC), and third, it provides a safety feature by limiting the oxygen concentration in the system, which reduces the risk for explosions. APC systems for drum dryers typically consist of additional particulate removal followed by regenerative thermal oxidation to destroy odors and volatile organic compounds (VOCs). Other methods of APC, such as biofilters, are often used with different drying systems. Present day direct drying systems typically recirculate 70 percent to 90 percent of the dryer exhaust, thereby greatly reducing the size of the APC equipment. Direct drying systems vary considerably depending upon the type of equipment used to process the wet and dried biosolids. Even rotary drum systems as shown in this figure vary considerably in general layout and the equipment used.



FIGURE 8-4

Drum Dryer System Diagram (by Andritz)

Another type of direct dryer that is seeing increased use in the U.S. and Europe is the belt dryer. This is typically a lower temperature system compared to a rotary drum system. The heat supply is usually a fuel-burning furnace, but in contrast to the rotary drum system, the system exchanges its heat to a thermal fluid, hot water or flue gas to air heat exchanger instead of the furnace exhausting directly into the dryer cabinet. The belt drying system distributes dewatered cake onto a slow-moving belt, allowing for high surface area exposure to the hot air. Belt drying systems can utilize multiple belts to help minimize the size of the dryer cabinet. High dryer air recirculation (>90 percent) and low vent rates are common. Due to the gentle handling on the slow-moving belts, dust generation within the dryer cabinet is low and the quantity of fines in the dried product should be low. Some belt drying technologies require dried product recycling to elevate the inlet solids composition to above the sticking point, while others inject dewatered sludge cake without additional recirculation equipment. The lower temperature belt drying system can more adequately utilize lower grade waste heat (in addition to high temperature waste heat). A photograph of a typical belt drying system is included in Figure 8-5.

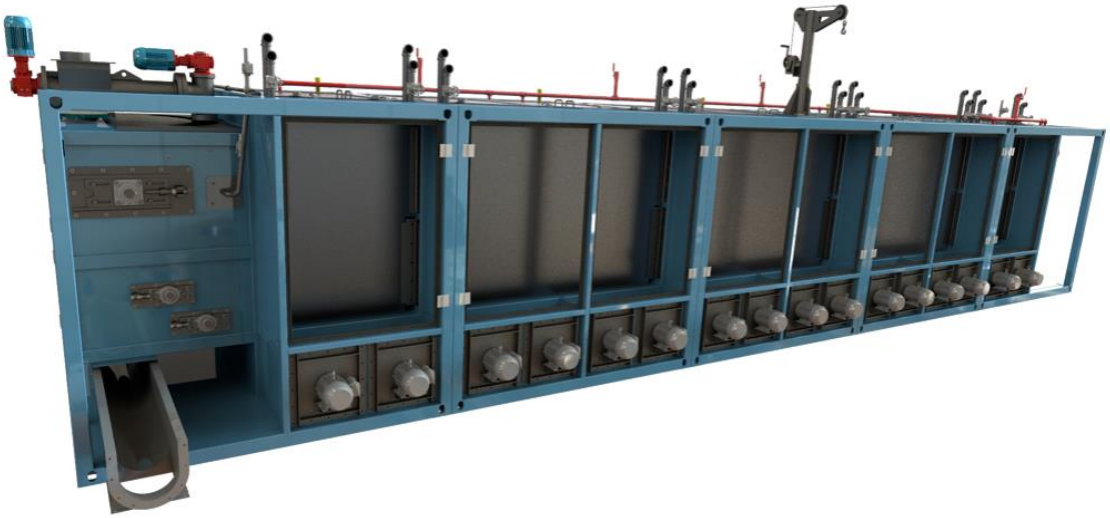


FIGURE 8-5

Belt Dryer System by Centrisys

Due to the relative simplicity of generating heat and heat recovery systems in these dryers, direct dryers generally have short startup times. The short start-up times are advantageous for batch operation. Some direct driers are also appropriate for continuous and nearly automated operation. This is particularly true for low-temperature belt dryers. However, staff at many WWTPs still prefer to have an operator present to ensure safe and reliable operation despite manufacturer claims of unattended operation capability.

The direct dryers typically require a minimum input cake dryness of 17 percent. Thus, a more effective dewatering device, such as a centrifuge, would be required to replace or augment the current belt filter press to increase the solids percentage of the dewatered sludge cake from the 15 percent to at least 17 percent.

Examples of belt drying systems in Washington State include the Andritz systems in Camas and Shelton.

Indirect Dryers

Systems that primarily use conduction for heat transfer are referred to as "indirect" dryers. The City's existing Fenton system is an indirect dryer. With indirect dryers, solid metal walls separate the wet cake from the heat transfer medium (such as steam, hot water, or oil). Thermal energy is transferred from the heat transfer medium into the metal wall and then from the metal wall into the cold cake. The solids temperature is elevated by contact with hot metal surfaces and the solids never come in direct contact with the primary heating medium. Some types of indirect dryers do not require recycle of dried material, simplifying the system. Indirect thermal drying equipment includes paddle

dryers with varying configurations, vertical tray dryers, and an indirect-type of fluidized bed dryer. A schematic diagram of an indirect drying system is shown in Figure 8-6, and a photograph of a paddle dryer is shown in Figure 8-7.

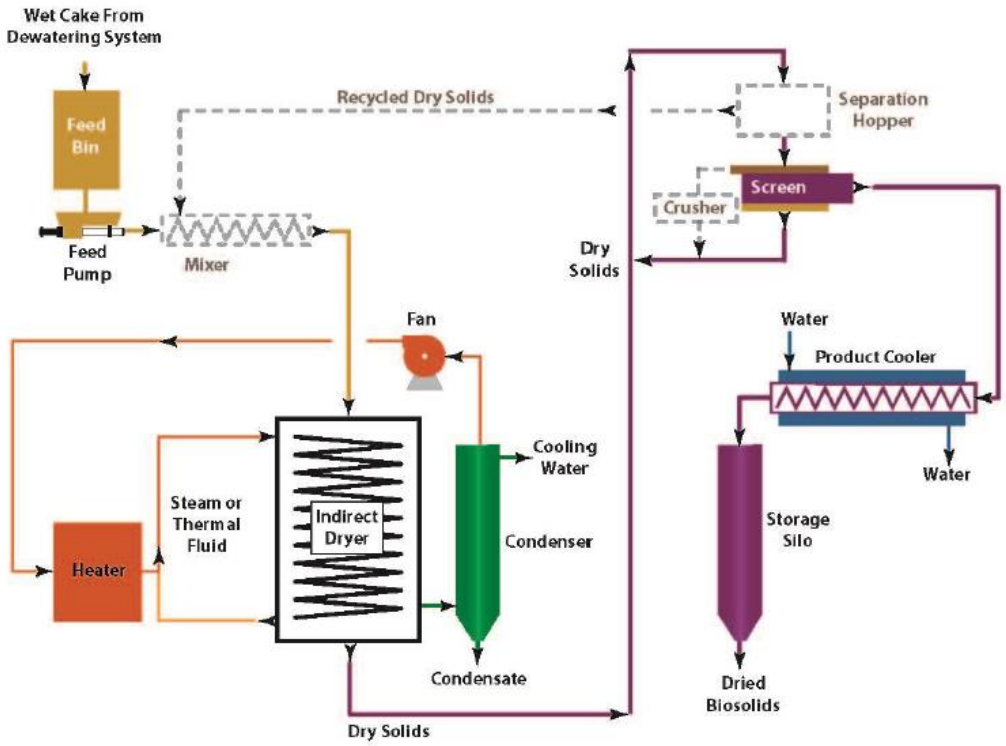


FIGURE 8-6

Typical Schematic of Indirect Drying System (Drum)

An important benefit of indirect dryer technologies for this application is the typically smaller and more flexible footprint requirements compared to direct dryers. This allows smaller ancillary equipment (e.g., thermal fluid heater, nitrogen purge system) to be installed away from the dryer unit and in unclassified areas of the existing canopy-covered space.

In this type of system, the heat supply is via a fuel-burning furnace that exhausts to a heat exchanger to heat oil, which is recirculated through the dryer. Steam, air, water, or other heat transfer fluids are other media that can be used. The solids are mechanically moved through the dryer and pick up heat from direct contact with the hot surfaces. Following the dryer, the material handling equipment is similar to that used in the direct system. In this system, the dryer exhaust primarily consists of water vapor and a small quantity of air which inadvertently enters the dryer with the wet feed. The exhaust from the dryer is sent to a condenser where the water vapor is condensed and sent back to the WWTP and the small air flow (containing some non-condensable organics) is then treated using

various air pollution control methods, depending on the system and supplier (WEF MOP No. 8).



FIGURE 8-7

Paddle Dryer System (by Komline-Sanderson)

Biodryers

Biodrying is a convective drying process that relies on heat generated by metabolic reactions by the microbes in the biosolids. Unlike the conventional drying technologies described above, biodrying uses aeration to drive biological heat generation and evaporation. In this way, biodrying uses a pathogen-reduction strategy similar to composting. For this scale, biodrying is a new technology. One regional installation by Bioforcetech is operational at the Yakima Legends Casino while another is planned for the City of Yelm's wastewater treatment facility. Typical biodrying equipment is shown in Figure 8-8.



FIGURE 8-8

Biodryer Diagram (by Bioforcetech)

Biodrying is expected to have low energy requirements; the predominant energy-consuming component is the blower for each unit whereas conventional dryers require higher levels of energy to generate heat. In addition, biodrying is a low-temperature drying technology, which reduces the air handling requirements.

Notably, this biodryer manufacturer (Bioforcetech) offers pairing their biodryer with additional equipment to conduct pyrolysis of dried solids. Pyrolysis breaks down materials at relatively high temperatures in the absence of oxygen. Pyrolysis, gasification, and incineration are three technologies able to reduce per- and polyfluoroalkyl substances (PFAS) in waste solids. As some states are beginning to tests biosolids for PFAS, pyrolysis could be an attractive treatment option for PFAS reduction when compared to incineration, which has environmental and cost concerns. However, at this moment, there is uncertainty over any potential regulations on PFAS in municipal biosolids in Washington State. Additionally, both pyrolysis and gasification are emerging technologies in the field and have a limited history of installations in the country. Therefore, there is no clear guidance on what magnitude of PFAS reduction will be necessary to meet potential limits and what technologies would be most suitable. While it is necessary to monitor potential PFAs regulations, no additional treatment of dried biosolids is necessary at this time.

Similar to the direct dryer, biodrying would require a minimum feed solids concentration of 17 percent, which means the current belt filter press dewatering system would need to be replaced by a more effective dewatering device such as a centrifuge to produce dewatered sludge with a higher solids concentration. Furthermore, this equipment may

only be operated as a batch process and is only offered in one unit size. As such, at least five units would be required to handle the quantity and frequency of dewatered solid loads. This would exceed the footprint available within the existing canopy covered space.

Solar Drying

Solar drying systems rely on radiant energy from the sun. Dewatered solids are distributed into the greenhouse uniformly, either by automated mechanical means or by a manually operated tractor or truck. The sun's radiant energy passes through the greenhouse enclosure (walls and roof) to heat and evaporate moisture from the sludge. The greenhouse enclosure prevents rain from adding water to the sludge and allows for a semi-controlled greenhouse environment, including air convection to help accelerate evaporation and enclosure of odors that can be processed through an odor control system. Solar drying systems are sensitive to local weather conditions, including solar radiation (considering typical cloud cover), relative humidity, and temperature. There are some successful solar drying installations in Eastern Washington, including at the City of Wenatchee. However, western Washington is generally considered to not have adequate sunshine or temperatures for solar drying (WEF, 2014).

Dryer Project Implementation Considerations

Dryer project implementation considerations include sustainability, relative costs and operational/safety considerations.

Sustainability

Sustainability is the ability of a process to endure and remain an economically and environmentally sound means of wastewater solids management. The demands and pressures on drying can come from state and federal regulatory agencies, the general public, or from economic conditions. Regulatory agencies are continually scrutinizing pollutant and odorous air emissions from drying plants and imposing tighter emissions criteria on new facilities. Recent drying plants have shown that they can meet the strictest odor and pollutant emissions criteria. Federal and state statutes also regulate the quality of the product. Specifically, for a heat-dried product to be applied to land as an Exceptional Quality (EQ) product, it must meet stringent quality parameters including pathogen density reduction (Class A), vector attraction reduction, and low metals concentrations. Operating experience at drying facilities (including at Burlington, as discussed above) has shown that these criteria can be confidently and consistently met.

In the past odors were one of the more problematic aspects of drying systems. However, present day design of drying plants has incorporated recirculation of dryer exhaust gas and the use of regenerative thermal oxidizers (and other techniques) to deodorize the final exhaust gas such that odorous emissions are no longer a significant impact. Dryers with high air recirculation rates or indirect dryers with low off-gas volumes can tie their low

vent flow directly to the plant's existing odor control system. In general, the public now perceives drying as an environmentally acceptable technology for solids processing.

Presently, one of the major pressures on drying systems is the energy demand of the process, particularly the high fuel usage. Drying does use a considerable amount of fuel in comparison with other beneficial reuse technologies; however, the value and acceptability of the final product is much higher for a heat-dried product than a product from most alternate technologies. Thus, the energy demands and associated costs of drying have been acceptable because the municipality is assured that the final product can be safely used and, in many cases, will generate income. Furthermore, innovations have been developed in the last decade to improve the ability of some systems to use waste heat to reduce energy consumption. Drying should continue to be a highly sustainable solids processing technology in the future (WEF, 2014).

Relative Costs

Because of the large variety in types of drying systems, levels of processing, procurement methods, and general equipment differences, the capital cost of thermal drying systems varies a great deal. Factors that affect capital cost include the type of system selected, existing infrastructure, such as buildings and utilities, conveyance needs for moving dewatered solids to the process, and finished product storage requirements. Due to the implementation of additional processing, safety and monitoring improvements, capital costs are significantly higher for new systems compared to the cost of the City's existing Fenton system.

The operating and maintenance (O&M) costs of thermal drying systems are also dependent on the type of system selected and the energy source. Energy recovery can make O&M costs very competitive with O&M costs for other methods of solids processing, especially other systems that create Class A stabilized products. The level of mechanization and automation used in the system will also have a significant effect on labor and maintenance costs.

Although drying systems may have higher capital costs than other processes, the substantial reduction in volume of material to be transported offsite, the flexibility of outlets available, and the value of the product can help make these systems cost-competitive with other solids processing systems (WEF, 2014).

Operational Safety Considerations

In the past there were serious concerns with the safety aspects of wastewater solids thermal drying plants. These safety concerns included the following:

- Potential for fires in the dryer.

- Potential for dust explosions in the process components containing dried material.

- Potential for fires in the product storage silos from auto-oxidation of the dried material.

As the design of drying plants has evolved, engineers and system suppliers have learned how to design safer drying facilities. The potential for fires in direct dryers has been greatly reduced by maintaining an oxygen-deficient atmosphere in the dryer. This is done by recirculating the dryer exhaust gas and limiting the amount of infiltration air such that the oxygen level in the dryer is held less 9 percent. In addition, dryers are equipped with quench sprays to extinguish a fire or burning embers in the dryer. Quench sprays are usually automatically activated based on a rise in the dryer exhaust gas temperature indicating that combustion is occurring in the dryer.

The potential for a dust explosion in many of the system components (dryer, solids separator vessel, recirculation duct) has been eliminated by maintaining an oxygen deficient atmosphere in these components. In some plants select equipment is provided with nitrogen blanketing to prevent explosions.

Similarly, the potential for fires in the product storage silo has been addressed by using inert gas (nitrogen) blanketing systems to maintain an oxygen deficient atmosphere in the product silo. In addition, cooling of the product prior to storage has proven to be an effective means of retarding auto-oxidation of the material and preventing fires. Storage silos are typically monitored by thermal sensors hung within the silos to detect any rise in temperature. Another monitoring technique is to use carbon monoxide monitors, which can detect the initiation of any combustion reactions. Thus, through experience and careful engineering the potential safety concerns with thermal drying systems have been satisfactorily addressed.

Advantages and Disadvantages of Drying

Drying technologies offer relative advantages and disadvantages as compared to other solids processing technologies. Some of these are listed below:

<u>Advantages</u>

Dried material typically meets the requirements of the US EPA Part 503 and WAC 173-308 standards for vector and pathogen control and the product is typically classified as Exceptional Quality and Class A with respect to pathogen density levels, but this is dependent on the type of system.

- Drying is a well-proven existing technology.

- Odors arising from the process can be contained and controlled.

- There is a wide range of outlet options for the dried material. Dried material can be used as a fertilizer, fertilizer supplement, soil conditioner, or biofuel.

- The heat-dried product is easily handled, conveyed and stored. The material can be delivered to consumers in bulk, bags, or another container.

- Drying reduces the volume and mass of wet cake produced at the plant. This results in reduced transportation costs for beneficial use.

- The product can be sold or given away which can partially offset the high costs associated with operation of the drying facility.

- Drying has a higher potential for public acceptance than many other processes.

- Drying has reduced regulatory record keeping and reporting requirements, if application to land is desired.

Disadvantages

- Safety concerns of drying include the explosive potential of the dust and the potential for product overheating and fires. Current design measures significantly reduce these safety hazards.

- The complexity of some drying systems requires a qualified operating staff. Maintenance requirements are typically high for direct and indirect systems.

- Air emissions are produced at any drying facility. Air permitting and air pollution control may be required.

- Capital and O&M costs of a drying facility are relatively high, typically higher than other solids processing alternatives (land application of digested biosolids, alkaline stabilization, etc.).

Drying of wastewater solids has proven to be a safe, reliable, environmentally acceptable, cost effective, and sustainable processing technology that can produce a high quality biosolids product suitable for use as a fertilizer or biofuel. Furthermore, in comparison with other solids processing alternatives, drying is one of the most environmentally and socially acceptable means of achieving beneficial reuse of wastewater solids.

TECHNOLOGY ALTERNATIVE 2 – ALKALINE STABILIZATION

Alkaline stabilization is the process of adding alkaline chemicals to biomass to inactivate harmful pathogens. The added lime or alkaline chemicals raise the pH levels of the biomass, creating unfavorable conditions for the growth of organisms. The types of chemicals traditionally used are hydrated lime and quicklime. Class A biosolids can be achieved through alkaline stabilization by maintaining the pH at greater than 12 for at least 72 hours, maintaining the temperature above 125°F for at least 12 hours within that period, and drying the solids to greater than 50 percent total solids. This short time frame and exothermic reaction of adding quicklime to a wet product results in shorter detention times and less heating than is required for anaerobic digestion. This can lead to lower initial capital costs.

This process does not result in any reduction in the mass of the solids. In fact, the addition of a significant amount of lime increases the mass of the resulting biosolids. Due in part to the higher volume of solids produced, annual costs are typically higher for alkaline stabilization systems compared to anaerobic digestion, but less than for drying. The stabilized product can be used for a variety of end uses such as landscaping, agriculture, mine reclamation, and landfill cover. Depending on the soil to which the product is applied, the final product can be more favorable for some vegetation (particularly grasses which prefer a higher pH) as it can increase soil pH due to the added alkaline chemicals. However, extensive odor control may be required to treat ammonia and other off-gases.

Leading systems include the RDP Process and the "Class A FKC Process" Lime Stabilization followed by Simultaneous Pasteurization and Dewatering (FKC Co., Port Angeles, WA). The Cities of Sequim and Forks, and the Willapa Regional WWTP in Raymond, WA, use the FKC process, while the City of Centralia uses the RDP process. Staff from these facilities indicate that odors can be a significant issue for operations, as well as for the finished product.

TECHNOLOGY ALTERNATIVE 3 – COMPOSTING

Raw solids composting is a biological process to decompose organic material to produce humus. Active composting accelerates the natural process by controlling the carbon-to-nitrogen ratio, temperature, moisture content, and oxygen supply. After active composting, the material is cured and stored until ready for transport. The resulting product is rich in nutrients and suitable for promoting soil tilth and plant growth. Composting is typically applied to dewatered solids that have already been digested, but can be used on unstabilized (i.e., raw) solids as well. Solids are typically dewatered to between 14 and 30 percent total solids before mixing with a bulking agent such as wood chips, sawdust, or yard waste. Retention times of 10 to 30 days are required to sufficiently stabilize the material; additional time is often needed to air-dry the solids to allow for beneficial use.

There are three different compost methods typically available for wastewater solids: (1) aerated static pile; (2) windrow; and (3) in-vessel. All methods can produce Class A biosolids; the decomposition of organics matter is exothermic and if controlled properly can lead to the appropriate level of pathogen reduction. The major differences between the different methods are how the solids are aerated (e.g., either through forced aeration or by mixing).

Biosolids can be composted with waste or debris material to make excellent mulches and topsoils for horticultural and landscaping purposes. Some waste or debris material includes sawdust, wood chips, yard clippings, storm debris, food waste, manure or crop residues, or food processing wastes. While these materials have traditionally been viewed as waste, they can play a valuable role as soil amendments in urban and agricultural settings. Many professional landscapers and master gardeners use composted biosolids for landscaping new homes and businesses. Home gardeners also find composted biosolids to be an excellent addition to planting beds and gardens.

Similar to the process requirements described for the composting of unstabilized solids, composted biosolids must meet certain criteria, which include meeting pathogen reduction limits, complying with required sampling and analysis protocols, maintaining compost temperature and retention time records, and product labeling requirements. Compost products provide nutrients and organic matter and sequester carbon, thereby conserving resources, restoring soils, and combating climate change. Composting is a common method used to produce Class A biosolids, and many large and small communities in the Pacific Northwest (including the Cities of Westport, Port Townsend and Granite Falls in Washington State) have active composting operations.

Demand for compost often exceeds the available supply. Private composting companies in some areas receive biosolids from multiple communities and market their products to landscapers and home gardeners. Local delivery programs return a portion of the composted material to the communities from which they originated. However, private biosolids composters are very limited in the state of Washington.

Soil Blending

While Class B biosolids may be composted to produce Class A material with certain technologies, producing manufactured soils is a specialized class of biosolids product development. To be suitable for use by the public, the feedstock for this production is Class A biosolids cake. Class A biosolids are blended with a mixture of sawdust/bark and sand to produce a product that can be publicly distributed in bag or bulk form. The TAGRO product produced by the City of Tacoma is a manufactured compost soil comprising two parts Class A dewatered cake, two parts sawdust, and one part sand. Manufactured soils could potentially be custom-tailored to meet certain landscaping needs. As examples, TAGRO products include potting soil and a green roof blend in addition to the classic topsoil blend.

TECHNOLOGY ALTERNATIVE 4 – GASIFICATION

Gasification is a thermal oxidation process that oxidizes dried solids under high-temperature sub-stochiometric conditions. The resulting products are an inert ash (i.e., biochar) and a mixture of carbon monoxide (CO), methane, hydrogen, and other volatile components (i.e., syngas). To sustain the process, a portion of the syngas is used to dry the feed solids (required); the remaining syngas requires significant treatment before being used as a renewable fuel source. Gasification has a long history of being used with fossil fuels to convert coal to a gaseous fuel, but its use to stabilize wastewater solids is relatively new. Whereas several gasification projects have been developed in North America, most have been mothballed due to poor economics and operational issues. Only one small operating facility has been identified as currently operating in a wastewater treatment plant in North America. (However, additional facilities are in the planning or design stage of development, since it is a technology that can potentially remove PFAS through combustion, although higher temperatures may be necessary to remove all the compounds.) Gasification on biosolids requires an additional feedstock to properly process solids, such as wood waste or used tires.

TECHNOLOGY ALTERNATIVE 5 – PYROLYSIS

Pyrolysis is a thermal conversion process similar to gasification, but it is accomplished at a lower temperature and does not require the presence of oxygen. Similar to gasification, drying is required upstream of the pyrolysis system to sustain the process and produce a usable final product. There are varying by-products of pyrolysis depending on different heating rates. The products of the pyrolysis process are biochar and bio-oil (a condensed liquid fuel). The liquid nature of the bio-oil makes it more useful as a fuel, but this end product requires further processing to be used beneficially. Of the bio-oil produced, typically 40 percent can be recovered in this manner. In addition, a significant amount of energy is required to dry the feed solids prior to the pyrolysis process, reducing the overall net energy produced. Pyrolysis is a process widely used in the chemical industry that historically has not been successfully applied to manage wastewater solids. However, since it is a technology that can remove PFAS through combustion (although potentially requiring higher temperatures), there is increasing interest in this technology with several facilities in planning and design around the country. The City of Edmonds is planning to replace its incinerator with an integrated drying, pyrolysis and gasification process; the preliminary capital project cost estimate is $26 million.

TECHNOLOGY ALTERNATIVE 6 – INCINERATION

Sewage sludge incineration (full combustion of sludge with excess air) is a well-established technology that yields ash for disposal. The technology has largely fallen out of favor due the lack of resource recovery, permitting/siting challenges, and recent stringent regulations for pollutant emissions. No new sludge incinerators have been constructed in Washington State in the last 20 years; it is more popular in the northeast and parts of Europe due to population density, lack of biosolids land application sites, and

more recently, concerns over microconstituents in non-incinerated sludge. Sewage sludge incineration is currently employed by the Cities of Lynnwood, Edmonds, Vancouver and Bellingham in Washington State, but all of those municipalities are looking to replace their incinerators with other technologies in the near future (Bellingham with temperature phased anaerobic digestion and soil blending, at an estimated total capital cost exceeding $200 million, and Edmonds with the aforementioned integrated drying, pyrolysis and gasification process.

EVALUATION

Table 8-6 summarizes an evaluation of the available technologies. (10 is the highest rating, while 1 is the lowest rating.) The evaluation includes the following criteria:

1. **Regulatory Approval** – The expected ease of permitting and regulatory approval from Ecology, EPA, and local authorities including biosolids and air permitting.

2. **Proven as Reliable Treatment Technology** – "Track record" of technology including years of successful, reliable operation treating municipal biosolids.

3. **Reliable End Use Options** – Demonstrated level of success utilizing the product for beneficial purposes.

4. **Safe Working Environment** – Demonstrated level of safety for plant staff and neighbors, including protection from explosions, fires and odors. Availability of safety measures including system automation, alarms, monitoring, shut down and fire suppression systems.

5. **Environmental Benefits** – Sustainability of technology reflecting the impact of biosolids pollutants, greenhouse gas emissions, carbon sequestration, fertilizer benefits, and gas emissions.

6. **Footprint** – Relative area needed at the WWTP site for the technology and all associated technologies. Ability of equipment to fit within the footprint of existing structures.

7. **Ease of Operation** – Operation and maintenance needs for the technology, factoring both anticipated labor hours and operational complexity.

8. **Flexibility** – Ability of the technology to be expanded or modified for changing regulations or end uses.

9. **Capital Costs** – Anticipated relative initial total project capital cost.

10. **Life Cycle Costs** – Anticipated relative 20-year life cycle costs, including capital costs and net present value of operation and maintenance costs.

TABLE 8-6

Comparison of Class A Treatment Technologies

Technology Alternative	Biosolids Drying	Alkaline Stabilization	Composting	Gasification	Pyrolysis	Incineration
Regulatory Approval	10	10	10	4	4	1
Proven as Successful Technology	10	8	8	2	2	8
Reliable End Use Options	10	3	10	5	5	1
Safe Working Environment	7	5	10	3	3	5
Environmental Benefits	6	5	7	5	5	1
Footprint	8	8	1	7	7	6
Ease of Operation	6	7	5	2	2	1
Flexibility	8	4	6	6	6	1
Capital Costs	6	7	7	3	3	1
Life Cycle Costs	6	8	5	4	4	5
Total	**77**	**65**	**69**	**41**	**41**	**30**

(1) 10 is the highest rating, while 1 is the lowest rating.

For Class A treatment technologies, thermal drying is recommended. The other technologies have the following major issues, reflected in Table 8-6:

- Alkaline stabilization: Requires handling of additional chemicals (lime, an alkaline, toxic chemical, and would result in significant additional odors for the treatment process and the final product.

- Composting: Requires significant additional land footprint and labor, import of additional organic matter, and has odor emissions

- Gasification: Is not well-established technology in the US with sufficient similar installations, requires additional feedstock to maintain consistent operation, and does not recover the nutrients in the biosolids.

- Pyrolysis: Is not well-established technology in the US with sufficient similar installations, requires additional feedstock to maintain consistent

operation, and does not recover the nutrients in the biosolids. Does have the capability of removing PFAS.

- Incineration: Does not yield a useful production. Would be very difficult to permit, both for Ecology approval and air permitting. Is not consistent with Washington State resource recovery policies, so would not receive funding or support from the State.

Besides the alternative of continuing to produce the Class A biosolids through drying technology, the City would also like to explore the potential alternative of Class B biosolids hauling by a third party for treatment/disposal.

SLUDGE FLOW AND LOADING PROJECTIONS

The method by which flow and load projections were determined from population projections was discussed in Chapter 5, Wastewater Flow and Loading Projections. In general, flows and loads were calculated by applying projected populations to the City's historical per capita flows and loads. Projected 20-year influent flows and loads to the WWTP are presented in Table 8-7.

TABLE 8-7

Influent Flow and Loading Projections

Influent Parameter		2040
Flow, mgd	Average Annual	1.98
	Maximum Month	2.78
	Peak Day	3.39
	Peak Hour	5.94
BOD_5 Load, lb/day	Average Annual	4,520
	Maximum Month	6,130
TSS Load, lb/day	Average Annual	5,300
	Maximum Month	6,650

SLUDGE QUANTITY PROJECTIONS

Table 8-8 summarizes future sludge projections, based on the existing primary clarification and sludge gravity thickening performance (removal percentages), increased flows and loads, and proposed treatment modifications discussed in Chapter 7, Wastewater Treatment Plant Analysis.

TABLE 8-8

Projected Primary Sludge Loads

Parameter		2040
Primary Clarifier TSS Removal, %	Average Annual	65%
	Maximum Month	62%
Primary Sludge Load, lb/d TSS	Average Annual	3,896
	Maximum Month	4,766
Thickened Primary Sludge Load, lb/d TSS	Average Annual	3,506
	Maximum Month	4,289
Thickened Primary Sludge Load, lb/d VSS(1)	Average Annual	3,120
	Maximum Month	3,817
Thickened Primary Sludge Flow, gpd(2)	Average Annual	14,013
	Maximum Month	17,143

(1) Based on historically observed average of 0.89 VSS/TSS for thickened primary sludge, 2016-2020.
(2) Flow calculated from load projections, assuming TPS concentration of 3.0 percent (average from 2016-2020).
(3) Loadings include calculated impact of recycle streams.

Future removal of BOD_5 by the primary clarifiers was similarly calculated to help establish the projected characteristics of primary effluent flowing into the secondary treatment system. The minimum solids capture rate from a rotary drum thickener (RDT) system could vary between about 90 percent to 95 percent (depending on WAS concentrations and other factors like polymer efficacy), while producing a TWAS concentration of approximately 4 percent. A minimum solid capture rate of 95 percent has been applied for TWAS load projections, which are presented in Table 8-9.

TABLE 8-9

Projected Waste Activated Sludge Loads

Parameter		2040
WAS Load, ppd	Average Annual	2,604
	Maximum Month	5,034
Thickened Waste Activated Sludge Load, lb/d TSS	Average Annual	2,474
	Maximum Month	4,783
Thickened Waste Activated Sludge Load, lb/d VSS(1)	Average Annual	2,078
	Maximum Month	4,017
Thickened Waste Activated Sludge Flow, gpd(2)	Average Annual	7,416
	Maximum Month	14,336

(1) Based on historically observed average of 0.84 VSS/TSS for waste activated sludge, 2016-2020.
(2) Flow calculated from load projections, assuming TWAS concentration of 4 percent.
(3) Loadings include calculated impact of recycle streams.

Waste load projections of TPS and TWAS were combined to project future digester feed sludge loadings. To estimate future digester performance, the 30th percentile value of observed volatile solids reduction (VSR) from 2016-2020 was applied to the volatile portion of the projected digester feed sludge. The observed 30th percentile VSR was 50 percent and is used as a conservative method of accounting for potential diminishing performance by the anaerobic digester system as a result of future higher organic loading rates and lower retention times. Calculated digested sludge projections are presented in Table 8-10.

Finally, dewatered solids values are necessary to estimate future loads to the dryer system. The belt filter press dewatering system is expected to produce 15 percent solids at a solids capture rate of at least 95 percent. Projections of dewatered solids are presented in Table 8-10 based on calculations using these belt filter press performance parameters. For the dryer system, the minimum evaporative demand was projected based on the dewatered solids projections and the minimum dried solids concentration of 90 percent.

The operation of the current dryer consists of running the dryer continuously for 17 days for 120 batches with about seven batches every 24 hours, to process the stock pile of 7 to 8 weeks amount of dewatered Class B biosolids. The dryer is most efficient when running continuously. The dryer operations are typically capable of drying solids to at least 95 percent solids. It is assumed that the new dryer will meet the capacity requirement if it is running continuously 4 weeks every 8 weeks.

TABLE 8-10

Projected Dewatering and Dryer System Loads

Parameter		2040
Digested Sludge Load, lb/d	Average Annual	3,468
	Maximum Month	6,169
Digested Sludge Flow, gpd	Average Annual	21,429
	Maximum Month	31,480
Dewatered Cake Load, lb/d dry	Average Annual	3,295
	Maximum Month	5,860
Dewatered Cake Load, lb/d wet	Average Annual	21,970
	Maximum Month	39,070

(1) Loadings include calculated impact of recycle streams.

DRYER COST COMPARISON

Equipment costs have been solicited from manufacturers of the above dryer technologies and are presented in Table 8-11.

TABLE 8-11

Dryer System Equipment Costs

Manufacturer and Model	Type	System Cost[1]
Centrisys DLT 620[2]	Direct Belt	$2,567,000
Bioforce Tech. Biodryers[2]	Biodryer	$4,634,000
Komline-Sanderson 9W-840	Indirect Paddle	$3,600,000
BCR Environmental IC 3600	Indirect Paddle	$2,960,000
Andritz 8W40	Indirect Paddle	$4,365,000

(1) These system costs are not comprehensive and do not include ancillary equipment, installation, or sitework.

(2) Including detwatering centrifuge with estimated cost of $385,000 to increase solids % of the feed sludge.

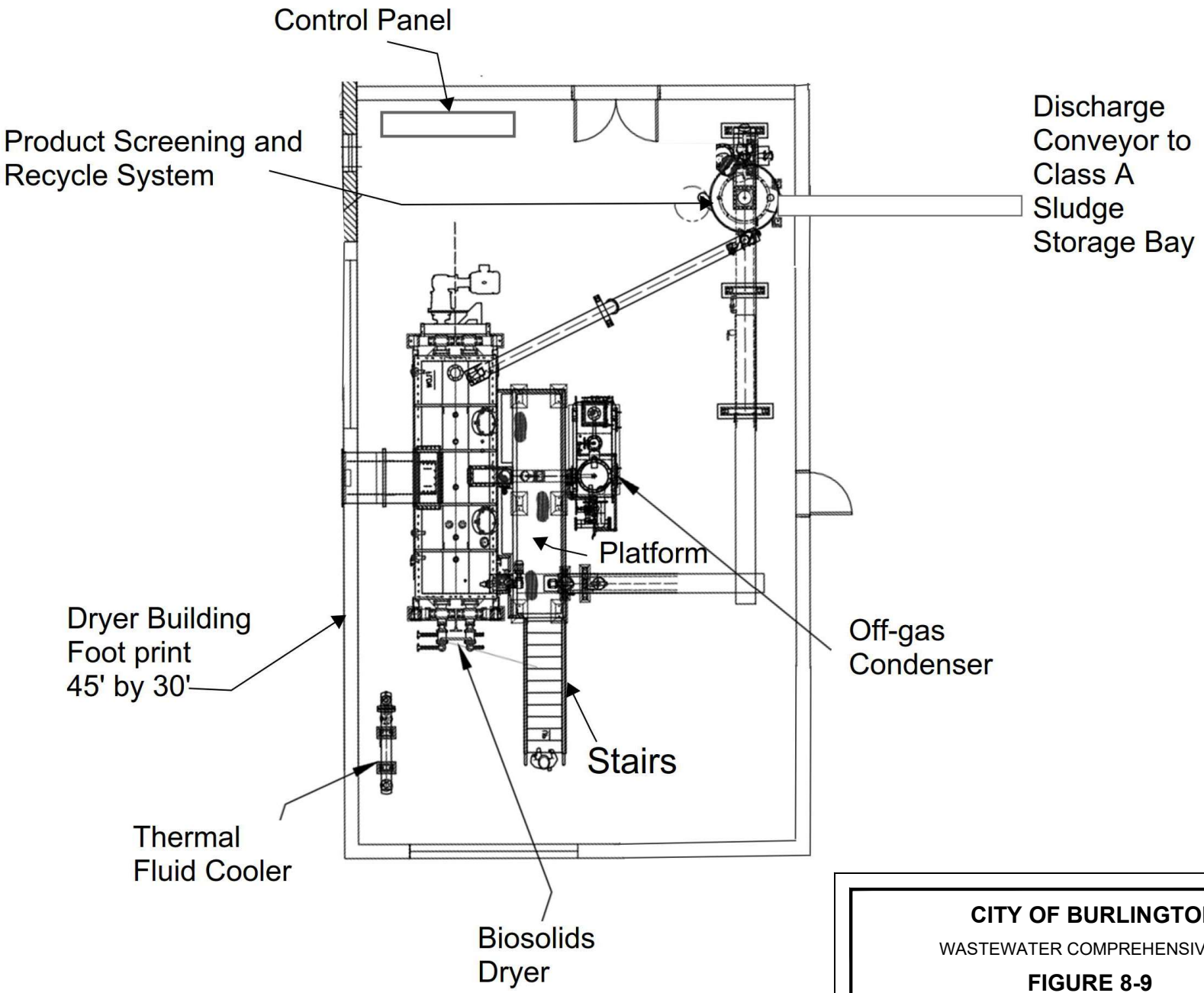
PREFERRED DRYER ALTERNATIVE

The indirect, continuous flow, paddle dryers are generally used for medium-sized wastewater treatment plants and typically have lower capital costs and a smaller footprint relative to direct dryers. Though projected flows, loads, and solids quantities are not expected to require major improvements that would require space, the direct dryer system would occupy space that may be needed for other potential future purposes, such as nutrient removal.

An indirect dryer applies heat to an oil, water, or steam medium that is passed in a closed loop through discs or paddles in a sludge heater. Heating the paddles requires a boiler to support the closed loop for the heated medium. At the scale of biosolids production at the Burlington WWTP, it would be reasonable to run the system continuously while it is periodically attended by an operator. Therefore, this analysis will assume the use of an indirect paddle or drum dryer system.

For the recommended dryer alternative, biosolids would be piped from the secondary anaerobic digester to the existing belt press, where the sludge would be dewatered to achieve a solids content of at least 15 percent. The existing progressing cavity cake pump would move the biosolids through a force main from the belt press outlet to the biosolids dryer inlet wet cake hopper. The dryer (assumed, for purposes of this discussion, to be a Komline-Sanderson paddle dryer) would provide a 380 degrees F heated environment, drying the dewatered solids to 90+ percent to meet Class A requirements. Both the dewatered and dried sludge are stockpiled under a canopy roof.

Two options for housing the dryer system were evaluated: (1) under the existing canopy housing the existing drying system, without a building; and (2) within a new building that is constructed under the canopy. Based on discussions with the dryer manufacturers, a building is not required; however, most of the operating drying systems are in buildings. A layout and site plan for the replacement drying system (assuming a building is constructed) are shown in Figures 8-9 and 8-10, respectively.



CITY OF BURLINGTON

WASTEWATER COMPREHENSIVE PLAN

FIGURE 8-9

PROPOSED LAYOUT FOR ALTERNATIVE 1: BIOSOLIDS DRYER

Gray & Osborne, Inc.
CONSULTING ENGINEERS

A paddle or drum dryer system typically includes the following components:

- Wet cake hopper;
- Drum/Paddle drying unit;
- Condenser;
- Final product cooler;
- Control panel;
- Class A Biosolids screw conveyor.

In addition, an odor control system, such as a biofilter is required.

The total project capital cost for Alternative 1 – Class A Solids Thermal Drying System (No Building Option) is $12.7 M. With a building, the estimate is $13.9 M.

Operation and maintenance costs for the Class A biosolids treatment alternative include power, natural gas, repair/maintenance, and labor. Based on the historical record of operation, the current power requirements consist of an annual electricity consumption of about 107,040 kWh and annual natural gas consumption of about 4,198,000 cf. The estimated capital cost, annual operational and maintenance cost, as well as the resultant 20-year net present worth have been calculated based on the system described above. A Komline-Sanderson dryer was included based on a longer track record and performance history. These costs are presented in Table 8-12. The estimated life span of a new dryer is 20 years.

TABLE 8-12

Alternative 1 – Class A Solids Thermal Drying System - Cost Estimates

Item	Estimated Value
Thermal Drying System Preliminary Capital Cost	$12,676,000
Thermal Drying System Preliminary Annual O&M Cost(1)	$180,800
Thermal Drying System 20-Year Net Present Worth(2)	$17,023,000

(1) All costs in 2022 dollars.
(2) Assumed 3 percent inflation rate and 3 percent discount rate.



FIGURE 8-10

Site Plan for Alternative 1 – Class A Solids Thermal Drying System

CLASS B BIOSOLIDS HAULING

Class B biosolids production would consist of hauling of dewatered anaerobically digested sludge. As this alternative would utilize existing infrastructure, there are relatively insignificant associated capital costs. Regarding operation and maintenance costs, the production of Class B biosolids would require the costs of contracted biosolids hauling, which a Class A alternative would not. The cost of hauling Class B biosolids is estimated to be $72 per wet ton if contracted with Tenelco Inc., a company specialized in biosolids transportation and land application, located about 40 miles away from the City of Burlington.

There are no additional costs for labor, power, and consumables. The estimated capital cost, annual operational and maintenance cost, as well as the resultant 20-year net present worth have been calculated based on the above. These costs are presented in Table 8-13.

TABLE 8-13

Alternative 2 – Class B Contracted Hauling - Cost Estimates

Item	Estimated Value
Capital Cost	$200,000
Contracted Hauling Annual O&M Cost(1)	$201,600
Contracted Hauling 20-Year Net Present Worth(2)	$7,031,000

(1) All costs in 2022 dollars.
(2) Assumed 3 percent inflation rate and 3 percent discount rate.

RECOMMENDED ALTERNATIVE

Estimates of the costs associated with the alternatives show that production of Class B biosolids would result in lower costs by a significant margin. For the Class B biosolids alternative, there are minimal additional capital costs associated with sludge loading improvements. As a result, the 20-year net present worth ($7,031,000) is significantly lower than the preferred Class A alternative ($17,023,000), due to the much higher capital cost for the replacement dryer, which is reflected in the 20-year net present worth comparison. However, there are additional non-monetary factors that might affect a decision on whether to continue with Class A biosolids or pursue Class B biosolids production.

The production of Class A biosolids would provide a benefit to the community. Thermally dried biosolids are considered desirable and welcomed by the residential, developer, and agricultural communities. In addition, the reduction in hauling would provide some benefit to the community directly neighboring the WWTP due to the lower traffic and noise from trucks. However, the costs associated with Class A biosolids production and higher sewer rates may diminish the net benefit to the community.

The production of Class A biosolids requires significant labor costs from WWTP staff, including operator attention, maintenance and periodic repair.

Another qualitative factor in this analysis is the long-term reliability of Class B biosolids application. Currently, a limited number of sites in this region will accept Class B biosolids for permitted land application. If fewer sites can accept Class B biosolids for land application or further treatment, contracted hauling costs would likely increase, particularly if permitted sites are only located in Eastern Washington. Thus, significant benefits would result from the continued use of Class A biosolids production, which would be relatively independent from the uncertainties of contracted hauling costs.

The above discussion is quantified through a decision matrix in Table 8-14, which shows that the combined benefits of continued Class A biosolids treatment outweigh the benefits of Class B biosolids hauling. (10 is the highest rating, while 1 is the lowest rating.) Thus, it is recommended to continue Class A biosolids treatment, with a new drying system.

TABLE 8-14

Biosolids Classification Decision Matrix

	Class A Thermal Drying	**Class B Hauling**
Regulatory Approval	10	8
Proven as Successful Technology	10	6
Reliable End Use Options	10	1
Safe Working Environment	5	7
Environmental Benefits	9	3
Footprint	2	8
Ease of Operation	6	9
Flexibility	8	2
Capital Costs	3	10
Life Cycle Costs	3	10
Total	**66**	**64**

(1) 10 is the highest rating, while 1 is the lowest rating.

The evaluation of these two alternatives showed that they scored similarly overall. Although biosolids drying is the recommended alternative, it is noted that it may be advisable to wait to implement the replacement of the dryer. The issue of chemicals (most notably "PFAS", per- and polyfluoroalkyl substances) in biosolids has upended biosolids planning in many parts of the country, and EPA is fast tracking research regarding issue, with new regulations likely. The City could have third parties haul Class B biosolids until around 2030 (if and when operation of the existing dryer is no longer feasible) and then incorporate actual costs for hauling, and any new relevant regulations,

into biosolids management decision-making at that time. Accordingly, replacement of the biosolids dryer is not in the CIP, but will be evaluated again in the future.

REFERENCES

WEF, 2014.Water Environment Federation, Drying of Wastewater Solids Fact Sheet, 2014

Ecology, 2010. Control of Toxic Chemicals in Puget Sound Summary Technical Report for Phase 3: Loadings from POTW Discharge of Treated Wastewater, Washington State Department of Ecology

CHAPTER 9

CAPITAL IMPROVEMENT PLAN

INTRODUCTION

To implement the collection system improvements and wastewater treatment plant improvements discussed in Chapters 6, 7, and 8, it is recommended that the City implement the Capital Improvement Plan (CIP) presented in this chapter. The projects presented here will require City funds to construct.

The recommended capacities and schedules for the improvements are provided for planning purposes only. The actual design parameters should be evaluated at the design phase of the project. Updated population and flow data should be used when available to ensure that the proposed facilities are adequately sized to accommodate projected flows.

Additional projects that are not identified as part of the City's CIP may become necessary. Such projects may be required in order to remedy an emergency situation, to address unforeseen problems, or to accommodate improvements proposed or required by other agencies. Due to budgetary constraints, the completion of such projects may require alterations to the recommended CIP. The City retains the flexibility to reschedule, expand, or reduce the projects included in the CIP and to add new projects to the CIP, as best determined by the City Council, when new information becomes available for review and analysis.

BUDGETED CAPITAL IMPROVEMENTS PROJECTS

The City has prepared a preliminary Capital Improvement List for budgeting purposes. The CIP projects that are currently budgeted for construction within the next 6 years are shown in yellow in Table 9-1, along with additional recommended projects (shown in blue). The costs presented in Table 9-1 are in 2022 dollars and have been prepared for guidance in project evaluation from the information available at the time of preparation. Some changes to the schedules for the CIP projects shown in Chapters 6, 7, and 8 have been made in this chapter based on budget contraints. Cost esitmates are provided in Appendix I. The final costs of the project will depend on inflation, the actual labor and material costs, actual site conditions, competitive market conditions, final project scope, final project schedule, and other variable factors. As a result, the final project costs will vary from the costs presented in this chapter. Because of these factors, funding needs must be carefully reviewed prior to making specific financial decisions or establishing final budgets.

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TABLE 9-1

Capital Improvement Projects

No.	Estimated Completion Year	Improvements	Budgeted Cost	Unbudgeted Costs	2023	2024	2025	2026	2027	2028	2029-2032
PW-SS-10-2018	2023	Pump Station 8 Generator Replacement	$175,000		$175,000						
PW-SS-16-2018	2023	Pump Station Pump Replacement	$65,000		$65,000						
PW-SS-1-2018	2023	Wastewater Line I&I Mitigation	$125,000		$125,000						
PW-SS-2-2018	2023	WWTP Annual Equipment Replacement	$250,000		$250,000						
PW-SS-3-2018	2023	Wastewater Line Replacement Program	$300,000		$280,000						
PW-SS-16-2018	2023	Pump Station Pump Replacement	$65,000		$65,000						
PS-SS-2029	2029	Pump Station 14		$668,000							$668,000
PW-SS-1-2024	2024	Wastewater Line I&I Mitigation	$125,000			$150,000					
PW-SS-2-2024	2024	WWTP Annual Equipment Replacement	$250,000			$250,000					
PW-SS-3-2024	2024	Wastewater Line Replacement Program	$300,000			$320,000					
PW-SS-16-2024	2024	Pump Station Pump Replacement	$85,000			$85,000					
PW-SS-17-2024	2024	Primary Digester Design Report	$40,000			$40,000					
	2024	Miscellaneous and Emergency Projects				$145,000					
PW-SS-2026	2026	Pump Station 11 Flow Meter		$55,000				$55,000			
PW-SS-2026	2026	Pump Station 13 Flow Meter		$50,000				$50,000			
PW-SS-2026	2026	Smoke Testing		$80,000						$80,000	
PW-SS-1-2025	2025	Wastewater Line I&I Mitigation	$125,000				$150,000				
PW-SS-2-2025	2025	WWTP Annual Equipment Replacement	$250,000				$100,000				
PW-SS-3-2025	2025	Wastewater Line Replacement Program	$300,000				$100,000				
PW-SS-4-2025	2025	Pump Station Pump Replacement	$65,000				$65,000				
PW-SS-2030	2030	Force Main from Pump Station 6		$4,716,000							$4,716,000
PW-SS-2024	2024	Upgrades to Influent Pump Station		$1,974,000		$1,974,000					
PW-SS-2024	2024	Upgrades to Effluent Pump Station		$568,000		$568,000					
PW-SS-2025	2025	Upgrades to HVAC Systems		$500,000			$500,000				
PW-SS-2025	2028	pH Monitoring		$453,000					$453,000		
PW-SS-2025	2025	Blower Building Improvements		$2,690,000			$2,690,000				
PW-SS-2025	2028	Solids Building Improvements		$786,000					$786,000		
PW-SS-2025	2028	Control Building Improvements		$43,000					$43,000		
PW-SS-2028	2028	Secondary Clarifier 2 Access Platform		$205,000						$205,000	
PW-SS-2025	2025	Disinfection Building Upgrades		$350,000			$350,000				
PW-SS-2023	2023	Digester Struvite Mitigation		$50,000	$50,000						
PW-SS-1-2026	2026	Wastewater Line I&I Mitigation	$150,000					$150,000			
PW-SS-2-2026	2026	WWTP Annual Equipment Replacement	$250,000					$250,000			
PW-SS-3-2026	2026	Wastewater Line Replacement Program	$300,000					$300,000			
PW-SS-4-2026	2026	Pump Station Pump Replacement	$65,000					$65,000			

TABLE 9-1 – (continued)

Capital Improvement Projects

(1) No.	Estimated Completion Year	Improvements	Budgeted Cost	Unbudgeted Costs	2023	2024	2025	2026	2027	2028	2029-2032
PW-SS-1-2032	2032	New Gravity Sewer across the Umbarger Elementary School Property		$1,725,000							$1,725,000
PW-SS-1-2027	2027	Wastewater Line I&I Mitigation	$150,000						$150,000		
PW-SS-2-2027	2027	WWTP Annual Equipment Replacement	$250,000						$250,000		
PW-SS-3-2027	2027	Wastewater Line Replacement Program	$300,000						$300,000		
PW-SS-4-2027	2027	Pump Station Pump Replacement	$65,000						$65,000		
		Miscellaneous and Emergency Projects							$350,000		
PW-SS-1-2028	2028	Wastewater Line I&I Mitigation	$150,000							$150,000	
PW-SS-2-2028	2028	WWTP Annual Equipment Replacement	$250,000							$250,000	
PW-SS-4-2028	2028	Wastewater Line Replacement Program	$300,000							$300,000	
PW-SS-4-2028	2028	Pump Station Pump Replacement	$65,000							$65,000	
	2028	Miscellaneous and Emergency Projects								$1,725,000	
TOTAL			**$4,815,000**	**$14,913,000**	**$1,010,000**	**$3,532,000**	**$3,955,000**	**$870,000**	**$2,397,000**	**$2,775,000**	**$7,109,000**
TOTAL 6-YEAR CIP					**$14,539,000**						

(1) All costs are in 2022 dollars.

RECOMMENDED UNBUDGETED CAPITAL IMPROVEMENTS PROJECTS

Additional projects which are not currently budgeted are recommended within the 6-year planning period, as discussed in Chapters 6, 7, and 8. It is recommended that these projects be constructed in accordance with the schedule listed. A description of each recommended project and a budgetary project cost for each project are provided below. (As noted above, all costs are in 2022 dollars.)

ANAEROBIC DIGESTER STRUVITE MITIGATION

Project Details: This project includes an investigation into the struvite accumulation under the manway cover at the top of the primary digester cover. Specific solutions will be defined and implemented. The estimated project cost shown below is a placeholder. A project cost cannot be estimated until improvements have been defined based on the investigation.
Estimated Completion: 2023
Estimated Project Cost: $50,000

UPGRADES TO THE INFLUENT PUMP STATION

Project Details: This project includes the abandonment of the existing motor control center and canopy and the construction of a new building housing a new motor control center, including three new variable frequency drives (VFDs), a new programmable logic controller (PLC), input/output (I/O) cards, and communication terminations. Also, a cover will be installed over the existing wet well and a new ventilation and odor control system will be installed. The project will include the installation of a new standby generator dedicated to the Influent Pump Station, to be activated if the wastewater treatment plant standby generator fails during a power outage. All the piping and hardware inside the wet well would either be replaced or receive surface preparation and coating, if salvageable.
Estimated Completion: 2024
Estimated Project Cost: $1,974,000

UPGRADES TO THE EFFLUENT PUMP STATION

Project Details: This project will include the installation of a new standby generator dedicated to the Effluent Pump Station, to be activated if the wastewater treatment plant standby generator fails during a power outage. If feasible, the new standby generator for the Effluent Pump Station could be combined with the new standby generator for the Influent Pump Station. Obsolete electrical gear, including a PLC, I/O cards, and communication terminations, will be replaced.
Estimated Completion: 2024
Estimated Project Cost: $568,000

UPGRADES TO HVAC SYSTEMS

Project Details: Some of the HVAC systems at the WWTP are almost 50 years old and, although maintained, do not conform to the recent NFPA 820 requirements and are approaching the end of their useful lives. This project will include a detailed building code and NFPA 820 conformance evaluation on the Blower Building, Grit Classifier Structure, Disinfection Building, and Solids Handling Building (Anaerobic Digester and Sludge Thickening/Dewatering areas) to follow up on the preliminary evaluation conducted for this Condition Assessment. This detailed evaluation will be followed by the design and construction of the improvements recommended by the evaluation. These improvements need to be in place before any electrical improvements are made in these facilities. This work will include installing a permanent ductless split air conditioning system in the Solids Handling Building electrical room. The estimated project cost shown below is a placeholder. A project cost cannot be estimated until improvements have been defined based on building code and NFPA 820 conformance evaluations.
Estimated Completion: 2025
Estimated Project Cost: $500,000

BLOWER BUILDING IMPROVEMENTS

Project Details: This project will include the replacement of aging mechanical and electrical equipment, including the existing centrifugal blowers and VFDs; all other VFDs, the PLCs, I/O cards, and communication terminations in the Blower Building Control Panel, Aeration Control Panel, and Generator Building Control Panel; the communication terminations in the Blower Building motor control centers (MCCs); and the grit cyclone and classifier. This project will also include the installation of new isolation valves on the air supply pipes to Aeration Basin 2 and 3. Miscellaneous surface preparation and painting of piping and hardware will also be included.
Estimated Completion: 2025
Estimated Project Cost: $2,690,000

PUMP STATION 11 FLOW METER

Project Details: In order to obtain accurate flow records for the Pump Station 11 service area, it is recommended that a magnetic flow meter be installed on Pump Station 11 discharge piping. This pump station discharges to a force main also carrying flow from Pump Stations 8 and 13. Using the pump run time meter to estimate the flows pumped by this pump station is not accurate as the pumping rate will vary, depending on the amount of flow discharged by the other pump stations. It is understood that the City staff will complete this project.
Estimated Completion: 2026
Estimated Project Cost: $55,000

PUMP STATION 13 FLOW METER

Project Details: In order to obtain accurate flow records for the Pump Station 13 service area, it is recommended that a magnetic flow meter be installed on Pump Station 13 discharge piping. This pump station discharges to a force main also carrying flow from Pump Stations 8 and 11. Using the pump run time meter to estimate the flows pumped by this pump station is not accurate as the pumping rate will vary, depending on the amount of flow discharged by the other pump stations. It is understood that the City staff will complete this project.
Estimated Completion: 2026
Estimated Project Cost: $50,000

pH MONITORING

Project Details: The WWTP has experienced process upsets due to occasional low influent pH. The source of this low-pH discharge has not been identified. pH is regularly monitored in daily grab samples, but the frequency of this monitoring is not adequate to catch the low pH wastewater entering the WWTP so that process adjustments can be made. This project will install pH monitoring equipment at the Headworks; Aeration Basins 1A, 1B, 2, and 3; and the UV Disinfection Channel to collect continuous real-time pH data so that rapid process adjustment can be made in response to low-pH influent wastewater.
Estimated Completion: 2027
Estimated Project Cost: $453,000

SOLIDS BUILDING IMPROVEMENTS

Project Details: This project will include the replacement of aging mechanical and electrical equipment, including PLC, I/O cards and communications terminations in the MCCs and control panels, and the waste activated sludge thickening and digested sludge dewatering polymer feed systems.
Estimated Completion: 2027
Estimated Project Cost: $786,000

CONTROL BUILDING IMPROVEMENTS

Project Details: The replacement of aging communications terminations is included in this project.
Estimated Completion: 2027
Estimated Project Cost: $43,000

UPGRADES TO THE DISINFECTION BUILDING

Project Details: The City should plan for replacement of the sodium hydroxide and sodium hypochlorite feed equipment which appear to approach the end of their useful lives. Specific improvements will be defined after a detailed building code evaluation has been conducted. An evaluation to use magnesium hydroxide rather than sodium hydroxide for the control of pH will also be conducted. Magnesium hydroxide is considerably safer to use than sodium hydroxide.
Estimated Completion: 2025
Estimated Project Cost: $350,000

SMOKE TESTING OF AREAS WITH HIGH INFLOW AND IMPLEMENTATION OF INFLOW REDUCTION MEASURES

Project Details: High inflow rates have been noted in five areas: (1) Pump Station 1 drainage area; (2) Old Downtown (Basins 3, 4, and 5); (3) Pump Station 9 drainage area; and (4) Pump Station 10 drainage area, including Port of Skagit County. It is recommended that smoke testing of sewers be undertaken in these areas to identify sources of inflow. Also, implementation of corrective measures to minimize or eliminate the sources of inflow should be undertaken. Most of these corrective measures may merely consist of enforcing ordinances already in effect, such as disconnecting roof drains from the sanitary sewer system.
Estimated Completion: 2026
Estimated Project Cost: $80,000

INSTALL ACCESS PLATFORM AROUND SECONDARY CLARIFIER 2

Project Details: Cleaning the launder at Secondary Clarifier 2 may be a safety hazard as WWTP staff have to go inside the launder to be able to complete this task. A platform 42 inches below the top of the wall of this clarifier will provide a safe location for staff to stand while cleaning the launder.
Estimated Completion: 2028
Estimated Project Cost: $205,000

NEW GRAVITY SEWER ACROSS THE UMBARGER ELEMENTARY SCHOOL PROPERTY

Project Details: This project would construct a new 18-inch gravity sewer across the Umbarger Elementary School property to provide additional capacity for buildout flows.
Estimated Completion: 2032
Estimated Project Cost: $1,725,000

RECOMMENDED LONGER-TERM CAPITAL IMPROVEMENTS PROJECTS

The following projects are recommended to be completed after the 6-year Capital Improvement Plan.

PUMP STATION 14

Project Details: Analysis shows that current flows to this pump station may exceed its capacity. In addition, Pump Station 15, which is upstream of this pump station, pumps at a much higher rate. It is recommended that the pump station be upgraded to accept projected 20-year wastewater flows. The cost includes predesign and design of new pumps, piping, electrical equipment,and site work. If the predesign shows that the required increased capacity can be accomplished only by pump replacement, the cost will be lower.
Estimated Completion: 2029
Estimated Project Cost: $668,000

REPLACEMENT AND UPSIZING OF 12-INCH AND 14-INCH FORCE MAIN FROM PUMP STATION 6 TO SHARON AVENUE, INCLUDING UPSIZING OF FORCE MAIN FROM PUMP STATION 5

Project Details: The 12- and 14-inch asbestos cement (AC) force main from Pump Station 6 to Sharon Avenue has been subject to failure recently and is expected to be approaching the end of its useful life. This project will replace this pipe with ductile iron or HDPE and will offer an opportunity to increase the capacity and reduce the friction loss through this pipe, thus making the pump stations more energy efficient and providing sufficient capacity through buildout conditions. The 12-inch force main from Pump Station 6 to Pump Station 3 can remain a 12-inch pipe. The 12-inch pipe from Pump Station 3 to Pump Station 5 will be upsized to an 18-inch diameter force main. The 14-inch pipe from Pump Station 5 to the discharge point in Sharon Avenue will be upsized to a 20-inch force main. The 6-inch force main from the pumps to connection to the 14-inch force main at Pump Station 5 will be upsized to 8-inch. This project will also include the installation of a magnetic flow meter in the Pump Station 5 discharge piping.
Estimated Completion: 2029
Estimated Project Cost: $4,716.000

CHAPTER 10

FINANCIAL PROGRAM

This chapter presents the Financial Program to demonstrate the financial capacity of the City of Burlington (City) to recover the full cost to construct, operate, maintain, and manage the sewer system on an ongoing basis. The following sections present the financial status of the City's sewer utility, potential funding sources and a plan for funding the recommended 6-year capital improvement program (CIP), and a 6-year financial plan that evaluates revenues, expenses, reserve levels, and the impact on user rates to recover total costs. An evaluation of the affordability of the City's sewer rates is also provided. This chapter was prepared by KLJ Financial Consulting.

HISTORICAL FINANCIAL PERFORMANCE

Table 10-1 summarizes the financial history for the four years 2018 through 2021.

TABLE 10-1

Sewer System Financial History

	2018	2019	2020	2021
Beginning Cash & Investments				
Unreserved	$ 4,476,842	$ 4,503,106	$ 4,739,417	$ 5,778,004
Prior Period Adjustments, Net	$ (37,451)	$ -	$ -	$ -
Net Cash & Investments	**$ 4,439,391**	**$ 4,503,106**	**$ 4,739,417**	**$ 5,778,004**
Revenues				
License and Permits	$ 18,745	$ 28,187	$ 15,436	$ 11,754
Charges for Goods and Services	$ 3,667,554	$ 4,475,302	$ 4,328,634	$ 3,978,625
Fines and Penalties	$ 11,595	$ 16,494	$ 35,676	$ 5,165
Miscellaneous Revenues	$ 93,553	$ 109,334	$ 78,366	$ 65,924
Total Revenue	**$ 3,791,447**	**$ 4,629,317**	**$ 4,458,112**	**$ 4,061,468**
Expenditures				
Utilities	$ 2,062,606	$ 2,423,773	$ 2,330,586	$ 2,365,322
Total Expenditures	**$ 2,062,606**	**$ 2,423,773**	**$ 2,330,586**	**$ 2,365,322**
Other Increases in Fund Resources				
Other Resources	$ 286	$ 15,003	$ 3,608	$ 1,729
Total Other Increases in Fund Resources:	**$ 286**	**$ 15,003**	**$ 3,608**	**$ 1,729**
Other Decreases in Fund Resources				
Capital Expenditures	$ 1,665,414	$ 1,969,233	$ 1,090,688	$ 479,242
Other Uses	$ -	$ 15,003	$ 1,861	$ -
Total Other Decreases in Fund Resources:	$ 1,665,414	$ 1,984,236	$ 1,092,549	$ 479,242
Net Revenues: Annual Increase/(Use) of Reserves	$ 63,713	$ 236,311	$ 1,038,585	$ 1,218,633
Ending Cash & Investments	**$ 4,503,106**	**$ 4,739,417**	**$ 5,778,004**	**$ 6,996,633**

The sewer system's historical financial performance, as documented in the City's financial statements, is presented as a reference point for future projections. The City accounts for its revenues and expenditures in two main funds: Sewer Fund (401) and Sewer Capital Fund (402).

The sewer utility has been in balance for each of the four years with positive net revenues (revenues minus expenditures) ranging from $63,713 to $1.2 million a year. The net revenues translate into annual increases to reserves or (use) of reserves to meet expenditures. When revenues are greater than expenditures, the reserves are used to balance the budget for the given year. Total revenues over the 4 years have been sufficient to fund operating expenses and reserves, capital outlays, and contributions to the capital reserve for future capital spending. The City did not have outstanding debt over this period.

Sewer service charges are the primary source of ongoing revenue for the sewer utility. Charges for goods and services have increased over time due to a combination of rate increases and additional revenue from new customer connections. Other revenues include licenses and permits, fines and penalties, and other miscellaneous revenues. Operating expenditures ("utilities") have been fairly consistent from year to year, ranging from $2.1 million to $2.4 million with an average of about $2.3 million. Capital spending varies from year to year with an average of about $1.3 million.

The City has maintained cash reserves in accordance with best practices to address emergencies and other unanticipated fluctuations in revenues and/or expenditures without material impact on system sustainability or customer rates.

CURRENT RATES AND CHARGES

Sewer Rates

The City bills customers every two months (bimonthly) for sewer service based on average winter water usage records. Rates vary for customers inside and outside of City limits. The sewer rates include a minimum charge that includes the first 1,000 cubic feet of water usage in the two-month billing cycle, plus an overage charge for each additional 100 cubic feet of water usage. The minimum charge varies by the number of people per household for residential customers and by the wastewater strength classifications (Low, Medium, High) for commercial customers. The overage charge is the same for all residential customers and varies by strength category for commercial categories.

Table 10-2 summarizes historical sewer rates for the four years 2019 through 2022 and current sewer rates effective January 1, 2023.

TABLE 10-2

Sewer System Historical and Current Bimonthly Rates

CUSTOMER CLASS	Historical				Current
	2019	2020	2021	2022	2023
RESIDENTIAL INSIDE					
Minimum Charge - (per Bi-Monthly Billing)					
1-2 People	$ 64.18	$ 67.38	$ 69.84	$ 73.34	$ 77.00
3-4 People	$ 96.29	$ 101.10	$ 104.80	$ 110.04	$ 115.54
5+ People	$ 128.37	$ 134.80	$ 139.72	$ 146.70	$ 154.04
Overage - (per 100 cf over 1,000 cf)	$ 4.58	$ 4.81	$ 4.99	$ 5.24	$ 5.50
RESIDENTIAL OUTSIDE					
Minimum Charge - (per Bi-Monthly Billing)					
2 People	$ 80.22	$ 84.24	$ 87.32	$ 91.68	$ 96.26
3-4 People	$ 120.35	$ 126.38	$ 131.00	$ 137.56	$ 144.44
5+ People	$ 160.48	$ 168.48	$ 174.62	$ 183.36	$ 192.52
Overage - (per 100 cf over 1,000 bi-monthly)	$ 5.72	$ 6.01	$ 6.23	$ 6.54	$ 6.87
COMMERCIAL INSIDE					
Minimum Charge - (per Bi-Monthly Billing)					
Low Strength	$ 64.18	$ 67.38	$ 69.84	$ 73.34	$ 77.00
Medium Strength	$ 91.20	$ 95.76	$ 99.26	$ 104.22	$ 109.44
High Strength	$ 117.47	$ 123.36	$ 127.86	$ 134.26	$ 140.98
Per Toilet	$ 87.93	$ 92.32	$ 95.68	$ 100.46	$ 105.48
1/2 Normal Rate	$ 46.65	$ 47.94	$ 49.68	$ 52.16	$ 54.76
Overage - (per 100 cf over 1,000 bi-monthly)					
Low Strength	$ 4.58	$ 4.81	$ 4.99	$ 5.24	$ 5.50
Medium Strength	$ 7.30	$ 7.67	$ 7.95	$ 8.35	$ 8.77
High Strength	$ 9.90	$ 10.40	$ 10.78	$ 11.32	$ 11.89
Per Toilet	$ -	$ -	$ -	$ -	$ -
1/2 Normal Rate	$ 7.30	$ 7.67	$ 7.95	$ 8.35	$ 8.77
COMMERCIAL OUTSIDE					
Minimum Charge - (per Bi-Monthly Billing)					
Low Strength	$ 80.22	$ 84.24	$ 87.32	$ 91.68	$ 96.26
Medium Strength	$ 114.14	$ 119.84	$ 124.22	$ 130.44	$ 136.96
High Strength	$ 146.85	$ 154.20	$ 159.82	$ 167.82	$ 176.22
Per Toilet	$ 109.91	$ 115.42	$ 119.64	$ 125.62	$ 131.90
Advanced $H2^0$	$ 67.39	$ 70.74	$ 73.32	$ 76.98	$ 80.82
Overage - (per 100 cf over 1,000 bi-monthly)					
Low Strength	$ 5.72	$ 6.01	$ 6.23	$ 6.54	$ 6.87
Medium Strength	$ 9.12	$ 9.58	$ 9.93	$ 10.43	$ 10.95
High Strength	$ 12.38	$ 12.99	$ 13.46	$ 14.13	$ 14.84
Per Toilet	$ -	$ -	$ -	$ -	$ -
Advanced $H2^0$	$ 4.81	$ 5.05	$ 5.23	$ 5.49	$ 5.76

General Facilities Charges

A general facilities charge (GFC) is collected from new customer connections or redevelopment that results in increases in capacity. These charges are intended to recover a fair share of system infrastructure costs for customers placing new demands on the

system. Typical types of projects recovered from GFCs are wastewater treatment facilities, pump stations, interceptors, and other general improvements that benefit the entire system. GFCs do not include the costs for main taps and side sewer connections needed to connect to the City system. GFCs vary for customers inside and outside of City limits and by residential and commercial types of properties.

Table 10-3 presents the City's current structure of GFCs.

TABLE 10-3

Sewer System Current General Facilities Charges

LOCATION		GFC
Inside City Limits/Urban Growth Area		
Residential (per unit)		
1-3 Units		$ 3,130
Over 3 units (per unit)		$ 2,503
Light Commercial/Industrial (general retail)	(per fixture unit)	$ 156
Bulk Water - Low Strength	$ 3,130 = / 138 gal/day	$22.68/gallons/day
Outside City Limits/Western Service Area		
Residential (per unit)		
1-3 Units		$ 4,505
Over 3 units (per unit)		$ 3,604
Light Commercial/Industrial (general retail)	(per fixture unit)	$ 226
Bulk Water	$4,505 / 138 gal/day	$32.65/gallons/day

[1] Commercial/industrial (other than general retail) per formula.

Certain facilities, such as restaurants, are considered high-strength customers because of their high load production potential and are subject to a different GFC formula. These customers pay a GFC calculated by multiplying the number of seats in the facility by 2 pounds of BOD per day per seat, then multiplying that value by $2,057 per pound of BOD per day. Facilities with a well-maintained grease interceptor are eligible for a GFC discount of 25 percent.

A study of GFCs is currently underway to review the methodology used to derive the charges and to incorporate the recommended capital improvement projects identified in this Plan.

CAPITAL IMPROVEMENT FUNDING

The following programs are reviewed for potential capital funding sources for major improvements.

Funding Assistance Programs

With the Coronavirus Covid-19 pandemic, there have been several federal aid programs with funding available to support sewer infrastructure, such as the coronavirus state recovery fund, American Rescue Plan and Bipartisan Infrastructure Law (BIL). This federal aid is a 5-year infrastructure spending plan (2022-26) and is targeted to existing funding programs, such as the Clean Water State Revolving Fund managed by the Department of Ecology. The City is staying in communication with Skagit County, WA State Departments of Ecology and Commerce, and legislators on potential new federal infrastructure funds that may become available. The Association of WA Cities (AWC) is tracking opportunities for cities with the BIL. See www.wacities.org.

The primary capital improvement funding source for sewer includes grants and mostly loans from the State of Washington Department of Ecology (DOE) Combined Water Quality Programs: Centennial Clean Water Fund, Clean Water State Revolving Fund and Section 319 Non-point Pollution. These programs share a combined competitive process with annual applications due October of each year. Early planning is recommended as DOE requires certain approvals prior to application. These programs may include federal funding which may have federal requirements. This program will be the recipient of the new level of federal infrastructure funds from the BIL and will have larger than normal amounts in each of the years 2022-2026. Scheduling large capital projects during this period might increase the probability of funding from this competitive program.

The Public Works Board Traditional Program (formerly PWTF) offers competitive preconstruction, construction, and emergency loans with low interest rates. The preconstruction loans are offered year-round with a maximum of $1,000,000 per jurisdiction per biennium. The construction loans have a maximum of $10,000,000 per jurisdiction per biennium. This source has been available for capital improvement funding for sewer projects. The applications are due year-round when funds are available. This year applications are due September 9th. A good target would be June-July following the legislative session in odd years. Current availability, application dates, amounts and terms should be verified prior to seeking funding. See www.pwb.wa.gov.

Other funding sources include the Washington State Department of Commerce energy efficiency grants and the Community Economic Revitalization Board (CERB) program geared to infrastructure improvements for job creation.

On the federal assistance side, there is the US Department of Agriculture-Rural Development Program (USDA-RD) that provides low-interest loans with potential grant subsidy for water systems in communities up to 25,000. There is also a federal Economic Development Administration (USEDA) with a Public Works grant and loan program available. Community Development Block Grant (CDBG) is another federal program, managed at the State Department of Commerce, with limited grants for improvements that benefit low to moderate income customers.

Another source is the Skagit County Economic Development Public Facility grant program to support road and infrastructure improvements for public economic development benefits for up to $500,000.

There is an infrastructure funding program database that is provided by the Infrastructure Assistance Coordinating Council (IACC). This can be accessed on the web directly at www.infrafunding.com. This database is helpful in determining which funding assistance programs may be available at the time the City is considering a project and how to contact the agencies.

Local Funding Sources

Monthly or bimonthly sewer rates provide an on-going level of funds for planned capital repairs and rehabilitation. These funds are appropriate for repair and replacement of the sewer system to serve existing customers. Sewer general facilities charges from new connections are available to fund improvements to the sewer system. The City can borrow from the above-mentioned financial assistance programs and any loans will need to be repaid by rates. The City also has authority to sell revenue bonds to fund planned system improvements. Revenue bonds will be repaid by sewer rates.

Some of the projects will be the responsibility of developers to connect their property to the system. When developers complete approved infrastructure projects, the infrastructure is deeded over to the City. The developer can negotiate a latecomer agreement with the City to be reimbursed by new development making use of the facilities constructed by the developer for a specified period allowed by state law. In certain instances, on a case-by-case basis, such as when additional capacity is provided by a developer-funded project, the City may opt to participate in a cost sharing mechanism.

The City has the option to complete area-specific projects and be reimbursed as new development occurs in that area through a special connection charge. The City also has the option to establish a local improvement district (LID), where the properties specially benefiting from an infrastructure investment would pay their share through an assessment.

Affordability

The EPA requires Ecology to award subsidy, or principal forgiveness, of at least 20 percent of the EPA capitalization grant award. To determine how best to award the subsidy, communities are evaluated on affordability of sewer compared to the median household income (MHI). EPA defines affordable sewer rates as 2 percent of MHI for a community. This also reflects the test applied by Ecology to determine the level of hardship in a community when applying for grants (subsidy) and loans for sewer improvement projects. The level of hardship can influence the financial assistance offer. If the cost of sewer service is higher, the community will be considered in hardship and

could be eligible for some financial assistance in the offer, resulting in a grant (subsidy), a lower interest rate loan, or a combination of the two. To find current program details and interest rates, see www.ecology.wa.gov and search grants & loans for Water Quality Combined Funding Program.

Ecology includes an appendix each year in the Combined Water Quality Funding Assistance Program Guidelines with the median household income, population, and hardship eligibility (Appendix M for SFY2024, published August 2022). For the City of Burlington, the current MHI is $55,451. The threshold for hardship at 2.0 percent of monthly MHI would be sewer rates of $92.00 per month, or $184.00 per bi-monthly period. The current residential sewer rate is between $77.00 (2 persons) and $115.54 (4 persons) per bi-monthly period or $38.50 to $57.77 per month. As shown in Table 10-4, the current residential sewer rates are between 0.83 percent and 1.25 percent of median household income and would be designated non-hardship (less than 2.0 percent of MHI). This level is considered affordable and would not be eligible for subsidy. Note that the hardship calculation for any future loan would include the anticipated new debt payments.

TABLE 10-4

Sewer System Affordability Index

Mediam Household Income (MHI)	**Annual**	**Monthly**		
Burlington MHI	$ 55,451	$ 4,621		
Average Residential Cost	Bi-Monthly [1]	Monthly	% of MHI	Designation
Burlington (1-2 persons)	$ 77.00	$ 38.50	0.83%	Non-Hardship
Burlington (3-4 persons)	$ 115.54	$ 57.77	1.25%	Non-Hardship

[1] Assumes bi-monthly minimum of 1,000 cf (500 cf per month)

Ecology provides a separate determination of hardship for pre-construction activities. This is predetermined by Ecology based on population and MHI, and is also published in same Appendix M. The August 2022 funding guidelines show the City of Burlington as "eligible" for preconstruction hardship funding, with a potential for subsidy up to 50 percent of the preconstruction application subject to availability of funds.

Another measure of affordability is what residents in local jurisdictions are paying. Table 10-5 compares 2023 sewer rates for a sample single-family residence using 1,000 cubic feet of water per bimonthly billing period. The range of bimonthly sewer rates is from $77.00 to $220.00. Using this measure, Burlington is the lowest tier of sewer utilities shown from Skagit County.

While it is interesting to note what other jurisdictions are charging for sewer service, it is important to realize that each system must be self-supporting and there are many factors that affect the rates or charges, including size of the service area, customer base, age of infrastructure, type of supply, contracts, interlocal agreements, and so on.

TABLE 10-5

Residential Sewer Bill Comparison

Residential Sewer Service	Bi-Monthly [1]	Monthly
Concrete	$ 220.00	$ 110.00
Stanwood	$ 196.36	$ 98.18
Sedro-Wooley	$ 141.66	$ 70.83
La Conner	$ 137.36	$ 68.68
Anacortes	$ 124.53	$ 62.27
Mount Vernon	$ 106.90	$ 53.45
Burlington	**$ 77.00**	**$ 38.50**

[1] Compares 5/8-3/4-inch bimonthly minimum of 1,000 cf (500 cf/month) for 2023 rates per website information (Jan. 2023)

SEWER CAPITAL IMPROVEMENTS

6-Year Capital Improvements

Chapter 9 of this Plan identifies $14.5 million in recommended capital improvements for the sewer system during the six-year planning horizon (2023-2028). These cost estimates are provided in 2022 dollars.

It is reasonable to assume that the costs will be higher in the future when projects are scheduled for completion. The estimated costs are escalated for the Financial Program to make sure the funding is appropriate to match the anticipated costs. The financial projections include construction cost escalation of 3.50 percent per year.

The six-year capital projects and associated costs (2022$) are displayed by year over the planning period as shown in Table 10-6. The individual project estimated costs have been escalated from 2022 dollars to the scheduled year of construction as shown to the right in the table. The total estimated planning level cost for the 6-year CIP is $16.5 million including construction cost escalation. The average annual cost for the 6-year CIP is $2.7 million.

The City has identified additional potential capital improvements projects within the next 10 years but beyond the 6-year planning horizon included in this Plan. These projects are not reflected in the Financial Program chapter.

TABLE 10-6

Sewer System 6-Year Capital Improvement Program

Year	Total CIP Cost (2022 $)	Escalated Total
2023	$1,010,000	$1,045,000
2024	$3,532,000	$3,784,000
2025	$3,955,000	$4,385,000
2026	$870,000	$998,000
2027	$2,397,000	$2,847,000
2028	$2,775,000	$3,411,000
TOTAL	**$14,539,000**	**$16,470,000**

6-Year Capital Improvement Funding

The 6-year CIP projects have been reviewed for potential funding sources, such as grants and appropriations, developer funding, rates and GFCs, reserves and borrowing. The City plans to execute the projects as necessary to balance the sewer system improvement and replacement needs with the ability to fund the CIP without new borrowing in the next 6 years. Grants will always be reviewed and pursued when appropriate.

The capital funding capital analysis develops the strategy to fund the annual project costs identified for the base year 2022 plus the six-year CIP (2023-2028). The City identified a total of $1.3 million in capital spending for 2022. The total funding need over the planning period (including year 2022) is estimated at $17.8 million.

Table 10-7 summarizes the funding sources anticipated to support execution of the planned CIP projects.

TABLE 10-7

Sewer System 6-Year Capital Funding Plan

	Base-Year	Six-Year Projection					
Capital Fund	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**
Beginning Cash Balance	**$ 5,183,215**	**$ 6,958,780**	**$ 7,685,591**	**$ 5,870,218**	**$ 3,604,738**	**$ 4,885,547**	**$ 4,526,644**
Cash Resources							
Sewer Connection fees	$ 350,000	$ 350,000	$ 350,000	$ 350,000	$ 350,000	$ 350,000	$ 350,000
Interest Income	$ 18,009	$ 45,000	$ 76,856	$ 58,702	$ 36,047	$ 48,855	$ 45,266
Rate-Funded Capital	$ 2,711,905	$ 1,377,161	$ 1,541,337	$ 1,710,797	$ 1,893,107	$ 2,089,125	$ 2,299,764
Total Cash Resources	**$ 3,079,914**	**$ 1,772,161**	**$ 1,968,193**	**$ 2,119,499**	**$ 2,279,154**	**$ 2,487,981**	**$ 2,695,031**
Cash Uses							
Capital Expenditures	$ 1,304,349	$ 1,045,350	$ 3,783,567	$ 4,384,979	$ 998,345	$ 2,846,884	$ 3,411,184
Total Cash Uses	**$ 1,304,349**	**$ 1,045,350**	**$ 3,783,567**	**$ 4,384,979**	**$ 998,345**	**$ 2,846,884**	**$ 3,411,184**
Annual Additions to / (Use) of Reserves	**$ 1,775,565**	**$ 726,811**	**$ (1,815,374)**	**$ (2,265,480)**	**$ 1,280,809**	**$ (358,904)**	**$ (716,153)**
Ending Cash Balance	**$ 6,958,780**	**$ 7,685,591**	**$ 5,870,218**	**$ 3,604,738**	**$ 4,885,547**	**$ 4,526,644**	**$ 3,810,491**

The Financial Program includes a conservative estimate for customer growth of about 1.0 percent per year (assuming continued growth at historical levels). GFC collections are conservatively estimated at $350,000 per year. The remaining costs are planned to be funded with a combination of rates, interest earnings and cash reserves.

The capital funding plan incorporates the City's capital funding policy objectives as summarized below. Additional discussion of financial policies is included in the next section (6-Year Financial Plan):

- A minimum annual contribution from rate revenues of $1.2 million consistent with historical practice. In addition, any surplus of annual operating revenues above the minimum target balance of 45 days of O&M is assumed to be transferred to the capital fund to pay for current projects and/or build reserves for future spending.

- A minimum combined operating fund and capital fund balance of $3 million (roughly $2.6 million target for capital). This target is simply a minimum. Higher capital reserves are preferred to enable cash funding for known future capital projects as well as managing risks of potential emergency repairs.

6-YEAR FINANCIAL PLAN

The 6-year financial plan to support the capital improvements recommended in this Plan was developed and discussed with City staff. The 2022 budget is the base year for financial projections with future year projections identified for the 6-year period 2023 through 2028. Key objectives of the financial plan are to ensure that rates are sufficient to sustain ongoing operations and maintenance (O&M), pay debt service obligations (if any), fund prioritized capital projects, and maintain stable cash reserves and other financial policy objectives. The financial plan evaluates the sufficiency of current utility revenues in meeting the forecasted operating and capital-related expenses and designs a rate adjustment strategy to close any revenue shortfall over the planning period.

Table 10-8 summarizes the financial plan. The annual increase to/(use) of reserves line at the bottom of the table shows that the anticipated revenues and expenditures can be balanced with annual rate increases of 5.0 percent per year for the years 2024-2028. This level of increase is consistent with the City's historical level of increases, including the adopted 5.0 percent rate increase effective January 1, 2023.

TABLE 10-8

Sewer System 6-Year Financial Plan

Operating Fund	Base-Year 2022	Six-Year Projection 2023	2024	2025	2026	2027	2028
Projected Rate Increase			**5.00%**	**5.00%**	**5.00%**	**5.00%**	**5.00%**
Beginning Cash Balance	**$ 1,813,418**	**$ 330,262**	**$ 360,011**	**$ 370,811**	**$ 381,936**	**$ 393,394**	**$ 405,196**
Cash Resources							
Sewer Service Charge Revenues, with Adjusted Rates	$ 3,644,219	$ 4,000,000	$ 4,242,000	$ 4,498,641	$ 4,770,809	$ 5,059,443	$ 5,365,539
Other Revenue	$ 256,000	$ 311,000	$ 314,230	$ 317,496	$ 320,798	$ 324,137	$ 327,514
Interest Income	$ 7,324	$ 16,000	$ 3,600	$ 3,708	$ 3,819	$ 3,934	$ 4,052
Total Cash Resources	**$ 3,907,543**	**$ 4,327,000**	**$ 4,559,830**	**$ 4,819,845**	**$ 5,095,426**	**$ 5,387,514**	**$ 5,697,105**
Cash Uses							
Operating & Maintenance (O&M) Expense							
Salaries & Wages	$ 1,076,936	$ 1,248,645	$ 1,286,104	$ 1,324,687	$ 1,364,428	$ 1,405,361	$ 1,447,522
Personnel Benefits	$ 378,291	$ 433,250	$ 446,248	$ 459,635	$ 473,424	$ 487,627	$ 502,255
Supplies	$ 401,000	$ 422,000	$ 434,660	$ 447,700	$ 461,131	$ 474,965	$ 489,214
Services	$ 822,567	$ 816,195	$ 840,681	$ 865,901	$ 891,878	$ 918,635	$ 946,194
Subtotal O&M Expenses	**$ 2,678,794**	**$ 2,920,090**	**$ 3,007,693**	**$ 3,097,923**	**$ 3,190,861**	**$ 3,286,587**	**$ 3,385,185**
Other Expenditures							
Direct Rate-Funded Capital Contributions	$ 1,200,000	$ 1,200,000	$ 1,200,000	$ 1,200,000	$ 1,200,000	$ 1,200,000	$ 1,200,000
Transfer of Surplus Reserves to Capital Fund	$ 1,511,905	$ 177,161	$ 341,337	$ 510,797	$ 693,107	$ 889,125	$ 1,099,764
Subtotal Other Expenditures	**$ 2,711,905**	**$ 1,377,161**	**$ 1,541,337**	**$ 1,710,797**	**$ 1,893,107**	**$ 2,089,125**	**$ 2,299,764**
Total Cash Uses	**$ 5,390,699**	**$ 4,297,251**	**$ 4,549,030**	**$ 4,808,721**	**$ 5,083,968**	**$ 5,375,712**	**$ 5,684,949**
Annual Additions to / (Use) of Reserves	$ (1,483,156)	$ 29,749	$ 10,800	$ 11,124	$ 11,458	$ 11,802	$ 12,156
Ending Cash Balance	**$ 330,262**	**$ 360,011**	**$ 370,811**	**$ 381,936**	**$ 393,394**	**$ 405,196**	**$ 417,352**
Days of O&M Cash Reserve	45 days	45 days	45 days	45 days	45 days	45 days	45 days

The $1,483,156 use of operating reserves in 2022 represents a transfer of revenues above the minimum operating target to the capital fund to help pay for capital projects.

Key Forecasting Assumptions

The operating forecast relies on the City's adopted 2023 budget and estimated cost escalation for each year based on assumed economic factors. Key economic assumptions were based on a historical review of actual performance and discussion with City staff:

- General cost inflation: 3.0 percent per year
- Customer growth: 1.0 percent per year
- Funds earnings rate: 1.0 percent per year

Financial Policies

To establish adequate rates, it is essential that the City define its benchmarks for financial performance. The purpose of financial policies is to promote the financial integrity and stability of the utility and to provide for sustainability of essential utility services. The following financial policies are included in the financial plan:

<u>Operating Cash Reserves</u>

Operating reserves provide a liquidity cushion to protect the financial viability of the utility from the risk of short-term variation in revenues and expenses – primarily caused by seasonal fluctuations in billings, unanticipated operating expenses and/or lower than

expected revenue collections. Target funding levels are expressed in the number of days of O&M expense with the minimum requirement varying with the expected risk of unanticipated needs or revenue volatility. The City maintains an operating reserve of 45 days of O&M, consistent with industry best practices.

Rate-Funded Capital Contribution

To avoid excessive reliance on debt, it is prudent to have a policy that commits a certain amount of annual rate revenue to the replacement and upgrade of sewer system infrastructure. By establishing a steady funding mechanism through a regular and predictable rate provision, an infrastructure replacement program can be structured that considers the defined funding source, accumulation of funds when funding exceeds near term needs, and the use of debt when capital needs exceed available cash resources. The financial program incorporates a minimum annual contribution from rate revenues of $1.2 million consistent with the City's historical practice. The City might consider increasing this annual contribution to $2 million over time as the costs of capital continue to increase.

Capital Cash Reserves

In addition to protecting against variations in operating costs and revenues, it is prudent to maintain a capital reserve to meet unexpected emergency capital outlays. The financial program incorporates a minimum capital reserve of about $2.6 million.

Debt Service Coverage and Reserves

The City does not have outstanding debt obligations for the sewer utility but may consider issuing debt for larger projects in the future. Debt service coverage is required for revenue bonds and some other forms of debt. Under this requirement, the utility agrees to collect sufficient annual system revenues to meet all operating expenses, pay annual debt service, and collect an additional multiple of that debt service. Typical coverage requirements range from 1.25 to 2.0 times debt service. A restricted debt reserve is also a common requirement associated with the issue of revenue bonds, typically set equal to annual or maximum annual debt service.

6-YEAR OPERATING AND CAPITAL CASH FLOWS AND BALANCES

Table 10-9 summarizes total operating and capital annual cash flows and ending cash balances over the 6-year planning period.

TABLE 10-9

Sewer System 6-Year Combined Operating and Capital Cash Flow

Combined Operating Fund and Capital Fund	Base-Year 2022	Six-Year Projection 2023	2024	2025	2026	2027	2028
Beginning Cash Balance	**$ 6,996,633**	**$ 7,289,043**	**$ 8,045,603**	**$ 6,241,029**	**$ 3,986,674**	**$ 5,278,941**	**$ 4,931,839**
Cash Resources							
Total Operating Revenues	$ 3,900,219	$ 4,311,000	$ 4,556,230	$ 4,816,137	$ 5,091,607	$ 5,383,580	$ 5,693,053
Total Interest Income	$ 25,333	$ 61,000	$ 80,456	$ 62,410	$ 39,867	$ 52,789	$ 49,318
Sewer Connection Fees	$ 350,000	$ 350,000	$ 350,000	$ 350,000	$ 350,000	$ 350,000	$ 350,000
Total Cash Resources	**$ 4,275,552**	**$ 4,722,000**	**$ 4,986,686**	**$ 5,228,547**	**$ 5,481,474**	**$ 5,786,369**	**$ 6,092,371**
Cash Uses							
Operating & Maintenance Expense	$ 2,678,794	$ 2,920,090	$ 3,007,693	$ 3,097,923	$ 3,190,861	$ 3,286,587	$ 3,385,185
Capital Expenditures	$ 1,304,349	$ 1,045,350	$ 3,783,567	$ 4,384,979	$ 998,345	$ 2,846,884	$ 3,411,184
Total Cash Uses	**$ 3,983,143**	**$ 3,965,440**	**$ 6,791,259**	**$ 7,482,903**	**$ 4,189,206**	**$ 6,133,471**	**$ 6,796,368**
Annual Additions to / (Use) of Reserves	$ 292,409	$ 756,560	$ (1,804,573)	$ (2,254,355)	$ 1,292,267	$ (347,102)	$ (703,997)
Ending Cash Balance	**$ 7,289,043**	**$ 8,045,603**	**$ 6,241,029**	**$ 3,986,674**	**$ 5,278,941**	**$ 4,931,839**	**$ 4,227,842**

PROJECTED SEWER RATES AND CUSTOMER BILL IMPACT

Projected Sewer Rates

Table 10-10 summarizes the current sewer rate and projected rates for the 5 years 2024-2028.

TABLE 10-10

Sewer System Current and Projected Bimonthly Rates

CUSTOMER CLASS	Current	Projected				
	2023	2024	2025	2026	2027	2028
RESIDENTIAL INSIDE						
Minimum Charge - (per Bi-Monthly Billing)						
1-2 People	$ 77.00	$ 80.85	$ 84.89	$ 89.14	$ 93.59	$ 98.27
3-4 People	$ 115.54	$ 121.32	$ 127.38	$ 133.75	$ 140.44	$ 147.46
5+ People	$ 154.04	$ 161.74	$ 169.83	$ 178.32	$ 187.24	$ 196.60
Overage - (per 100 cf over 1,000 cf)	$ 5.50	$ 5.78	$ 6.06	$ 6.37	$ 6.69	$ 7.02
RESIDENTIAL OUTSIDE						
Minimum Charge - (per Bi-Monthly Billing)						
2 People	$ 96.26	$ 101.07	$ 106.13	$ 111.43	$ 117.00	$ 122.85
3-4 People	$ 144.44	$ 151.66	$ 159.25	$ 167.21	$ 175.57	$ 184.35
5+ People	$ 192.52	$ 202.15	$ 212.25	$ 222.87	$ 234.01	$ 245.71
Overage - (per 100 cf over 1,000 bi-monthly)	$ 6.87	$ 7.21	$ 7.57	$ 7.95	$ 8.35	$ 8.77
COMMERCIAL INSIDE						
Minimum Charge - (per Bi-Monthly Billing)						
Low Strength	$ 77.00	$ 80.85	$ 84.89	$ 89.14	$ 93.59	$ 98.27
Medium Strength	$ 109.44	$ 114.91	$ 120.66	$ 126.69	$ 133.03	$ 139.68
High Strength	$ 140.98	$ 148.03	$ 155.43	$ 163.20	$ 171.36	$ 179.93
Per Toilet	$ 105.48	$ 110.75	$ 116.29	$ 122.11	$ 128.21	$ 134.62
1/2 Normal Rate	$ 54.76	$ 57.50	$ 60.37	$ 63.39	$ 66.56	$ 69.89
Overage - (per 100 cf over 1,000 bi-monthly)						
Low Strength	$ 5.50	$ 5.78	$ 6.06	$ 6.37	$ 6.69	$ 7.02
Medium Strength	$ 8.77	$ 9.21	$ 9.67	$ 10.15	$ 10.66	$ 11.19
High Strength	$ 11.89	$ 12.48	$ 13.11	$ 13.76	$ 14.45	$ 15.17
Per Toilet	$ -	$ -	$ -	$ -	$ -	$ -
1/2 Normal Rate	$ 8.77	$ 9.21	$ 9.67	$ 10.15	$ 10.66	$ 11.19
COMMERCIAL OUTSIDE						
Minimum Charge - (per Bi-Monthly Billing)						
Low Strength	$ 96.26	$ 101.07	$ 106.13	$ 111.43	$ 117.00	$ 122.85
Medium Strength	$ 136.96	$ 143.81	$ 151.00	$ 158.55	$ 166.48	$ 174.80
High Strength	$ 176.22	$ 185.03	$ 194.28	$ 204.00	$ 214.20	$ 224.91
Per Toilet	$ 131.90	$ 138.50	$ 145.42	$ 152.69	$ 160.33	$ 168.34
Advanced $H2^0$	$ 80.82	$ 84.86	$ 89.10	$ 93.56	$ 98.24	$ 103.15
Overage - (per 100 cf over 1,000 bi-monthly)						
Low Strength	$ 6.87	$ 7.21	$ 7.57	$ 7.95	$ 8.35	$ 8.77
Medium Strength	$ 10.95	$ 11.50	$ 12.07	$ 12.68	$ 13.31	$ 13.98
High Strength	$ 14.84	$ 15.58	$ 16.36	$ 17.18	$ 18.04	$ 18.94
Per Toilet	$ -	$ -	$ -	$ -	$ -	$ -
Advanced $H2^0$	$ 5.76	$ 6.05	$ 6.35	$ 6.67	$ 7.00	$ 7.35

Sewer Customer Bill Impact

Table 10-11 presents the projected customer bill impact over the 6-year period for a sample residential customer.

TABLE 10-11

Sewer System Sample Customer Bimonthly Bill Impact

RESIDENTIAL INSIDE	2023	2024	2025	2026	2027	2028
Projected Rate Increase	**Adopted**	**5.00%**	**5.00%**	**5.00%**	**5.00%**	**5.00%**
Minimum Charge - (per Bi-Monthly Billing)						
1-2 People	$ 77.00	$ 80.85	$ 84.89	$ 89.14	$ 93.59	$ 98.27
Bi-Monthly Increase		$ 3.85	$ 4.04	$ 4.24	$ 4.46	$ 4.68

[1] Residential (1-2 people) customer using less than or equal to 1,000 cubic of water per 2-month billing period.

The current sewer bill for this sample customer is $77.00 per two-month billing cycle. This bill is projected to increase to $98.27 by 2028. This represents an increase of $21.27 per bi-monthly bill (or $10.64 per month) over the 6-year period. This is an average increase of approximately $4.25 per two-month bill (or $2.13 per month). After reviewing the affordability index described previously the projected rates continue to be affordable under the 2.0 percent of median household income metric.

CONCLUSION

The Financial Program demonstrates how the sewer operations and recommended 6-year capital improvements are planned to be funded and the impact on bimonthly sewer rates. The City prepares annual budgets and conducts periodic rate studies to be sure the City can continue to provide reliable sewer service at affordable rates.

APPENDIX A

SEPA CHECKLIST AND MDNS

SEPA ENVIRONMENTAL CHECKLIST

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*:**

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:

City of Burlington Wastewater Comprehensive Plan

2. Name of applicant: [help]

City of Burlington Public Works Department

3. Address and phone number of applicant and contact person:

Marv Pulst, P.E.
City of Burlington – Public Works Director
833 South Spruce Street, Burlington, WA 98233

4. Date checklist prepared: [help]

February 17, 2023

5. Agency requesting checklist: [help]

Washington Department of Ecology

6. Proposed timing or schedule (including phasing, if applicable): [help]

The Plan includes multiple phases of projects over the 20-year planning period.

The City of Burlington has developed the City of Burlington Wastewater Comprehensive Plan to evaluate proposed policies, future infrastructure projects, and operations and maintenance (O&M) activities for the City's sewer utility, for the 20-year planning period. Implementation of the proposed plan would be phased. Some elements of the plan may be implemented immediately, while others would be implemented in future years.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain. [help]

Yes

The General Sewer/Wastewater Facilities Plan identifies collection system and wastewater treatment facility improvements that are necessary to maintain the integrity of the system and provide adequate treatment capacity. The City will pursue funding for the design and construction of the improvements. The SEPA process will be followed for all non-exempt construction projects.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal. [help]

Prior Environmental Information

- **City of Burlington 2011 Sewer Comprehensive Plan, Gray and Osborne, Inc.**

Future Environmental Information for the Projects Recommended in this Plan:

- **Projects funded through a Washington Department of Ecology Loan or Grant would need to complete the State Environmental Review Process (SERP), consult with the Department of Archaeology and Historic Preservation (EO 05-05 process), and implement any mitigation associated with these permitting processes.**
- **Projects funded with federal monies would need to complete a NEPA Environmental Assessment to determine whether an EIS would be required. If project impacts can be mitigated, a NEPA Finding of No Significant Impact (FONSI) would be sufficient.**

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 known.

10. List any government approvals or permits that will be needed for your proposal, if known.

Plan approval will require

- **Department of Ecology Approval for Wastewater Comprehensive Plan**
- **SEPA Determination**

Construction activities would require the following permits (as applicable):

- **City of Burlington Conditional Use Permit**
- **Projects funded through a Washington Department of Ecology Loan or Grant would need to complete the State Environmental Review Process (SERP) including a project level SEPA Checklist and Determination, consult with the Department of Archaeology and Historic Preservation (EO 05-05 process), and implement any mitigation associated with these permitting processes.**
- **Projects funded with federal monies would need to complete a NEPA Environmental Assessment to determine whether an EIS would be required. If project impacts can be mitigated, a NEPA Finding of No Significant Impact (FONSI) would be sufficient.**
- **Northwest Clean Air Agency Notice of Construction**
- **Flood Plain Development Permit**

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 SEPA checklist evaluates impacts associated with implementation of the recommended improvements in the Plan.

The City of Burlington operates an existing collection system and wastewater treatment plant (WWTP). The WWTP uses an activated sludge process to treat wastewater from the majority of the City. The WWTP also generates Class A Biosolids for land application. The WWTP discharges treated wastewater effluent to the Skagit River.

The City of Burlington is proposing to upgrade its sewage collection and treatment

facilities in accordance with the proposed Wastewater Comprehensive Plan. The previous Sewer Plan was completed in 2011.

This planning document provides a list of pump station and sanitary sewer pipe repair and replacement projects that the City will implement. The replacement of the sewer pipe (less than 12-inch diameter) is exempt from SEPA per WAC 197-11-800(23)(b) – Categorical exemptions.

This planning document also provides proposed conceptual designs, cost estimates, schedule and financing plan for recommended collection system, lift station and WWTP improvements at their respective existing sites. Many of the proposed projects in the Capital Improvement Plan (CIP) would increase the capacity and reliability of the systems.

The projects described in the 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 surface water. SEPA checklists for construction projects other than exempt activities will be prepared.

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]

See attached maps.

Implementation of the Proposed Wastewater Treatment Plant Construction identified in the Plan, would require work to be completed on the site of the Burlington Wastewater Treatment Plant at 900 South Section Street, Burlington, WA 98233, Latitude: 48.467075 N, Longitude: 122.313141 W.

In addition, work will be completed throughout the City for the collection system.

B. ENVIRONMENTAL ELEMENTS [help]

1. Earth [help]

a. General description of the site: [help]

The Plan addresses recommended improvements associated with operation of the City of Burlington collection system and WWTP. As such, the sites where work will be accomplished are all over the City and vary from flat (especially downtown) to hilly.

Much of the service area where collection system projects will be completed is developed. Some areas are more natural.

Some of the wastewater treatment infrastructure on the WWTP Site is located within 200 feet of the Skagit River.

(circle one): Flat, rolling, hilly, steep slopes, mountainous, other _____

b. What is the steepest slope on the site (approximate percent slope)? [help]

The WWTP site slopes gradually (at < 5 %), with a moderately steep hill (10 to 15%) to the west (the dike) of the site and steep decline to the east offsite (to the Skagit River).

In addition, work will be completed throughout the City for the collection system, including hilly areas.

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.

The soil types in the Burlington area are primarily different types of loam.

Site-specific soils would be identified during future SEPA review when individual projects are proposed.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe. [help]

More specific information on unstable soils would be determined during project-level environmental review. The City would identify site-specific unstable soils and other geological hazards during SEPA review when individual projects are proposed. All future projects would comply with the applicable provisions of the local critical areas ordinances.

Unstable soils in the planning area primarily occur in areas of steep slopes. When future projects undergo design and environmental review, the City would review any available maps of sensitive areas prepared by applicable local jurisdictions.

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]

There will be significant excavation, filling and grading associated with implementation of the recommended Plan. Generally speaking none of the project involve significant changes to the existing topography or grade. The exact amount of excavation, backfill and grading will be established during the design of the improvements, but is likely to include thousands of cubic yards. A portion of the backfill will be with imported material. Specific estimates of excavation, filling and grading will be provided for each individual project SEPA.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe. [help]

Construction activities associated with specific projects would have the potential to cause erosion during construction. Repaving or replanting of areas disturbed by construction will likely stabilize the site within a few days to a few months. Use of best management practices (BMPs) will be exercised during construction to prevent erosion.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)? [help]

The existing Burlington WWTP Site is about 70% impervious. Implementation of the WWTP improvements in the Plan will primarily take place in areas that are currently impervious.

More specific information on the potential percentages of impervious surfaces would be determined during design and environmental review of individual projects. Some projects could require new impervious surfaces, although because most O&M projects would occur in urban areas or within roadway rights-of-way, they would result in a relatively minor amount of additional impervious surfaces.

The City would identify the amount of impervious surface during design and SEPA review when individual projects are proposed. All future projects would comply with the applicable storm water requirements of the local jurisdictions.

Collection system sites vary, and little to no increases in impervious surface area can be expected at the sites.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any: [help]

Construction BMPs for the Control of Sedimentation and Erosion will be implemented during any construction activities associated with the recommendations of the Plan.

2. Air [help]

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]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects including a discussion of potential air emission sources during and after construction and approximate quantities of air emissions. In general, however, vehicle exhaust emissions would be generated from construction employee and equipment traffic to and from the site. The number of workers at the project site at any one time would vary depending upon the nature and construction phase of the project.

Odor-causing substances that commonly occur in wastewater consist of both organic and inorganic compounds. The compounds usually arise from biological activity in the wastewater collection and treatment system. The odor-causing compounds generally associated with wastewater collection and treatment systems are hydrogen sulfide, ammonia, mercaptans, organosulfides, amines and small amounts of phenols, cresols,

and esters.

Solids handling is the process most likely to produce odors.

Upon completion of proposed upgrades, odor emissions that occur from the current WWTP is expected to remain approximately the same.

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe. [help]

None known.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects including a discussion of proposed measures to reduce or control air emission during and after construction.

A "Notice of Construction and Application for Approval to Construct, Install, Establish, or Modify an Air Contaminant Source" will be submitted, where applicable, to the Northwest Clean Air Agency (NWCAA) prior to construction to determine if a permit from NWCAA is required. All NWCAA requirements for operational or equipment-based odor control will be followed. The final completed projects are not expected to cause significant increases in emissions.

3. **Water** [help]

a. Surface Water:

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]

More specific information on surface water bodies near individual sites would be determined during project-level environmental review. In general, the planning area is characterized by a wide variety of surface water features, including rivers, lakes, artificial reservoirs, and creeks.

The WWTP site is adjacent to the Skagit River (to the east).

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]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects including a discussion of proposed work over, in or adjacent to the described waters. Construction of some of the WWTP projects may require work within 200 feet of the Skagit River.

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]

More specific information on the amount, location, and source of fill or dredge material would be determined during project-level environmental review. Fill and/or dredge activity that would be placed in or removed from surface water or wetlands are not anticipated to be required for future projects. All future projects would comply with the applicable local, state, and federal regulations and permitting concerning fill and dredge materials.

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known. [help]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects. It is not anticipated that future construction projects will require withdrawals or diversions of surface water.

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan. [help]

All anticipated capital projects are located above the 100-year floodplain. The potential for projects within the 100-year floodplain would be identified when individual projects are proposed and reviewed under SEPA. All future projects would comply with any floodplain regulations, where applicable.

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]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects, including those impacting the WWTP and the nature of its discharge. The WWTP discharges treated effluent to the Skagit River. Discharges to the inlet are permitted under the city's National Pollutant Discharge Elimination System (NPDES) permit. Risks to water quality in the river will be reduced through implementation of the projects identified in the Plan.

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]

None of the projects within the General Sewer /Wastewater Facility Plan would require permanent groundwater withdrawals. Temporary groundwater withdrawal during construction of facilities that may be below the groundwater table may take place

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 ani*mals or humans the system(s) are expected to serve.*

Waste materials will not be discharged to the ground as part of this Plan. Biosolids, a valuable resource generated at the WWTP will be applied to the ground. Pollutants in the Biosolids will need to be present at levels below the limits in State regulations.

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]

More specific information on the potential for runoff and identification of receiving waters, if present, would be determined during environmental review and permitting of individual projects. Construction activities could temporarily increase runoff, and associated erosion and sedimentation could affect water quality in the short term. Potential construction runoff and erosion would be controlled with site-specific BMPs and other mitigation measures. The design, construction, and operation of all future projects would comply with the applicable local and state storm water management requirements.

2) Could waste materials enter ground or surface waters? If so, generally describe. [help]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects. Treated effluent WWTP is discharged to the Skagit River. it is not anticipated that future construction projects will result in the discharge of waste material into the ground or surface waters. Construction activities could create dewatering flows, which would be controlled with site-specific BMPs and other mitigation measures.

3) Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site? If so, describe. [help]

Construction of any of the potential improvements might result in the alteration of flow patterns, as new infrastructure is constructed.

d. Proposed measures to reduce or control surface, ground, and runoff water, and drainage pattern impacts, if any: [help]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects. In general, during construction, BMPs will be employed to minimize the amount of erosion and sediment leaving the site during rainfall events. The BMPs will be consistent with the Washington State Department of Ecology Stormwater Management Manual for Western Washington, and may include a rock construction entrance, catch basin filters, interceptor swales, sediment traps, silt fences, straw bales, and geonetting. Exposed soil areas and stockpiles will be covered with plastic sheeting. Clearing will

occur only in areas of active construction. Following construction, the site will be revegetated promptly. Chemical handling and vehicle fueling will be conducted in contained areas on site. Any spills will be cleaned promptly to minimize the potential for runoff.

Major ground-disturbing construction activities for projects identified in the Plan, in general, would be planned for the drier spring, summer and early fall months as much as possible to minimize any stormwater discharges.

4. **Plants** [help]

In general, the presence of plants will be evaluated for each specific project SEPA. The following lists the general types of plants near the WWTP and collection system.

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
__X__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]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects. In general, there is minimal vegetation in the area of the proposed projects to be disturbed by construction of the new infrastructure identified in the Plan.

c. List threatened and endangered species known to be on or near the site. [help]

The City would evaluate potential impacts and mitigation for threatened and endangered species during environmental review and permitting of individual projects. The design, construction, and operation of all future projects would comply with federal and state requirements for threatened or endangered species.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any: [help]

Where feasible, future projects would be designed to minimize potential impacts on vegetation. Where necessary to remove or alter areas of vegetation, vegetation would be restored following construction, according to City of Burlington standard construction practices.

e. List all noxious weeds and invasive species known to be on or near the site. [help]

The City would evaluate noxious weeds and invasive species during environmental review and permitting of individual projects.

5. **Animals** [help]

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. [help]

In general, the presence of animals will be evaluated for each specific project SEPA. The following lists the general types of animals that have been observed near the WWTP and collection system.

Examples include:

birds: hawk, heron, eagle, songbirds, other:
mammals: deer, bear, elk, beaver, otters, other:
fish: bass, salmon, trout, herring, shellfish, other _____

b. List any threatened and endangered species known to be on or near the site. [help]

In general, the presence of endangered species will be evaluated for each specific project SEPA.

c. Is the site part of a migration route? If so, explain. [help]

Areas in and around Burlington including the Burlington WWTP site are located within the Pacific Flyway for waterfowl and many species are known to be present in Hanmmersley Inlet , especially during the spring and fall migrations. Salmon spawn in these areas.

d. Proposed measures to preserve or enhance wildlife, if any:

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects. In general, standard construction best management practices (BMPs) will be implemented to avoid and minimize the potential for erosion from work areas and resulting impacts on fish and other aquatic species.

Once the improved facilities are operating, the project would benefit fish and wildlife by ensuring future water quality in the receiving waters, particularly during and after storm events.

e. List any invasive animal species known to be on or near the site. [help]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects, which will list any known invasive species adjacent to the project sites.

6. **Energy and Natural Resources** [help]

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]

The WWTP and pump stations use electricity (and diesel as a backup) to run pumps and other process equipment. These same energy sources would be used to run the upgraded facilities. Natural gas is used at the WWTP for heating of buildings, sludge digester, and sludge drying.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe. [help]

The proposal would not affect the potential use of solar energy by adjacent properties.

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]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects. In general, new and upgraded facilities will comply with City and State building requirements related to energy conservation. All buildings will be properly insulated to reduce heating and cooling requirements. The new treatment infrastructure identified in the Plan and constructed at the Burlington WWTP will be designed to operate by gravity to the extent practicable. New pumps at the WWTP and pump stations will be appropriately designed and sized to maximize efficiency and minimize electrical requirements.

7. **Environmental Health** [help]

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]

In general, no new environmental health hazards are expected to occur as a result of the projects in the Plan. Operators at the treatment plant have the potential to contact untreated wastewater and chemicals as part of the daily jobs. The operators are trained and experienced as to safety measures to minimize the potential for contact. Secondary containment, double-walled piping and other safety measures are used for the sodium hypochlorite (bleach) system.

Operation of individual sewer system projects anticipated under the proposed plan generally would not increase environmental health hazards in the long term. In general, sewer infrastructure projects typically would not require large amounts of hazardous materials, and any potential future releases would be minimal. Environmental health hazards could be encountered during construction, but any potential adverse impacts on environmental health would be short term and would be controlled by project-specific mitigation measures.

Ventialtion and electrical system will be designed to be in compliance with NFPA 820 guidelined to minimize the risk of fire or explosions.

1) Describe any known or possible contamination at the site from present or past uses. [help]

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. [help]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects, and will address any hazardous chemicals and conditions at that time. No hazardous liquid pipelines are on the WWTP sites; however, there is natural gas provided to the WWTP site, digester gas is distributed to the o the waste gas flare, and there is an underground diesel tank on site.

Liquid sodium hypochlorite is stored and used at the WWTP site; storage tanks, chemical conveyance piping and pumping systems are provided with secondary containment and monitoring systems. In addition, oils, lubricants, polymers, Bioxide (predominantly calcium nitrate) and other chemicals are stored at the WWTP and some pump station sites.

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. [help]

Liquid sodium hypochlorite is stored and used at the WWTP site; storage tanks, chemical conveyance piping and pumping systems are provided with secondary containment and monitoring systems. In addition, oils, lubricants, polymers, Bioxide (predominantly calcium nitrate), and other chemicals are stored at the WWTP and some pump station sites.

4) Describe special emergency services that might be required. [help]

As with any other WWTP or industrial facility, fire and ambulance may be required in rare circumstances. Safety showers and eyewashes are provided where needed on the sites.

5) Proposed measures to reduce or control environmental health hazards, if any:

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects that discuss measures to reduce or control environmental health hazards that may be associated with the particular project. In general, chemical storage tanks, chemical conveyance piping and pumping systems are provided with secondary containment and monitoring systems, when appropriate. Safety showers and eyewashes are provided on-site, where appropriate. Construction vehicles and equipment will be fitted with hazardous materials spill kits and operators will be trained in their use.

b. Noise [help]

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)? [help]

No noise exists that is likely to disrupt operations at the Burlington WWTP, or affect construction of WWTP or pump station improvements identified in the Plan.

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]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects that discuss the noise levels, duration and occurrence associated with the construction and operation of the WWTP and pump stations. In general, construction of the WWTP and pump station facilities identified and recommended in the Plan would require operation of gas or diesel powered equipment during business hours. Construction activities at the WWTP may be quite loud. The nature and extent of construction noise will vary with the projects and will be limited to daytime hours. Some of the collection system improvements will involve bypass pumping with engine-driven pumps during construction. Noise abatement will be required for pumping systems where appropriate.

Operation of the facilities recommended in the Plan would not generate noise levels above that associated with the existing facilities once construction is complete.

3) Proposed measures to reduce or control noise impacts, if any: [help]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects that discuss measure to reduce or control noise generated during construction and operation of the lift stations and WWTP. In general, noise abatement equipment on construction equipment will be properly operated and maintained.

8. **Land and Shoreline Use** [help]

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]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. The study area includes properties used for recreational, residential, commercial, institutional, and industrial uses. SEPA checklists will be prepared for specific non-exempt construction projects that discuss the land use in the vicinity of the proposed project.

Construction of any new facilities at the WWTP and existing pump station sites will support the existing land use on the sites The project site for the WWTP projects is the current Burlington WWTP.

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]

No. The WWTP and most of the existing pump station project sites have been dedicated to Burlington Sewer Department for decades. The improvements identified in the Plan will not convert any farm lands or working forest lands to non-forest or non-agricultural uses.

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: [help]

No.

c. Describe any structures on the site. [Help]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects. The SEPA checklists will discuss the structures on the sites.

The Burlington WWTP consists of a Control Building, headworks structure, three primary clarifiers, two aeration basins, three secondary clarifiers a blower building, a UV disinfection structure, anaerobic digesters, biosolids dryer and a covered biosolids storage area.

The pump station sites consist of wet (and in some cases dry) wells below ground and small buildings or canopy structures.

d. Will any structures be demolished? If so, what? [Help]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects that describe demolition of existing structures on the site.

e. What is the current zoning classification of the site? [Help]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects. The SEPA checklists will discuss the zoning of the sites. Project areas identified in the Plan primarily occur in residential, commercial, industrial, and residential areas. Zoning classifications of potential sites would be identified when individual projects undergo future SEPA and local land use reviews.

f. What is the current comprehensive plan designation of the site? [Help]

Comprehensive plan designations within the planning area are diverse. The designations of potential sites would be identified when individual projects undergo future SEPA and local land use reviews.

g. If applicable, what is the current shoreline master program designation of the site? [Help]

The planning area contains freshwater shorelines. Some of the future sewer system projects at the WWTP may be located in the shoreline zone, and would therefore be subject to the local shoreline master program (SMP). Shoreline designations in the applicable SMPs would be identified when individual projects are reviewed under SEPA and shoreline regulations. If a future project were sited within regulated shorelines, a shoreline substantial development permit, variance, or conditional use permit could be required.

h. Has any part of the site been classified as a critical area by the city or county? If so, specify. [help]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects. The SEPA checklists will discuss critical areas.

i. Approximately how many people would reside or work in the completed project? [help]

The WWTP staff consists of six certified operators at various levels. Implementation of the projects identified in the Plan is not expected to result in a significant increase in the operation and maintenance staffing requirements for the WWTP.

j. Approximately how many people would the completed project displace? [help]

None.

k. Proposed measures to avoid or reduce displacement impacts, if any:

None required.

L. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any: [help]

Implementation of the WWTP improvements identified in the Plan will improve and support use of the site for wastewater treatment through the planning period and beyond.

m. Proposed measures to reduce or control impacts to agricultural and forest lands of long-term commercial significance, if any: [help]

None, as no impacts are anticipated.

9. **Housing** [help]

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 required.

10. **Aesthetics** [help]

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed? [help]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects that describe that the height and exterior building material of lift station or WWTP structures. In general, the height of new structures on the WWTP and pump station sites are anticipated to be similar to existing structures on the sites. Structures at the sites will generally be reinforced concrete, reinforced concrete masonry or metal buildings.

b. What views in the immediate vicinity would be altered or obstructed? [help]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects that describe if any views in the immediate vicinity would be altered or obstructed. In general, impacts to views are expected to be minimal.

c. Proposed measures to reduce or control aesthetic impacts, if any: [help]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects that describe measures to reduce or control aesthetic impacts.

11. **Light and Glare** [help]

a. What type of light or glare will the proposal produce? What time of day would it mainly occur? [help]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects that describe what type of light or glare would be produced, which is anticipated to be minimal.

b. Could light or glare from the finished project be a safety hazard or interfere with views? [help]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects. It is not anticipated that light or glare would be a safety hazard or interfere with views.

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 required.

12. **Recreation** [help]

a. What designated and informal recreational opportunities are in the immediate vicinity? [help]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects. The Skagit River is adjacent to the WWTP site, and boating and fishing are common.

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 required, as the WWTP and pump station projects identified in the Plan will not impact recreational facilities or opportunities. It should be noted that providing adequate wastewater treatment will reduce the risks to people involved in recreation activities in the vicinity of the WWTP and reduce risks of negative impacts to water quality and recreational shellfish harvesting opportunities downstream of the WWTP.

13. **Historic and cultural preservation** [help]

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 ? If so, specifically describe. [help]

No.

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]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects that will identify any landmarks, features, or other evidence of native American or historic use or occupation that are located on or near the proposed project sites. In addition, cultural resource reviews will be completed where appropriate. Based on current information, there are no known landmark features or evidence of native American or historic use or occupation on the Burlington WWTP or pump station sites.

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]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects. Local tribes and the Department of Archeological and Historic Preservation will be notified of the proposed projects.

When future projects are proposed, the City would review preservation registers and contact organizations with jurisdiction over historic and cultural resources.

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. [help]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects. If it is determined that historic sites are located on or in close proximity to the project are identified a cultural resources survey will be conducted. The construction specifications will include an Inadvertent Discovery Plan that will be implemented in the event cultural resources are uncovered.

14. **Transportation** [help]

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 Burlington WWTP can be accessed from South Section Street in Burlington.

The pump station sites are accessed through City of Burlington streets or private property.

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]

No, although there are transit stops within 1 mile of the WWTP and pump stations.

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. The WWTP and pump station improvements reviewed in the Plan are not likely to impact parking on the sites.

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]

The Burlington WWTP is located adjacent to the Skagit River.

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]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects will describe the number of vehicle trips generated by the proposed project.

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. [help]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects. It is not anticipated that the projects will interfere with the movement of agricultural and forest products.

h. Proposed measures to reduce or control transportation impacts, if any: [help]

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects that will discuss proposed measures to reduce or control transportation impacts, which are expected to be temporary and minor. Improvements to the WWTP will be designed in compliance with regulations and codes applicable for facilities near airports.

15. **Public Services** [help]

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. Implementation of the proposed plan would not result in a long-term increase in the need for public services, as this is a non-project action. Occasional spills during construction and operation of sewer facilities could require responses from emergency service providers. Construction activities could affect local traffic circulation and access on public streets, which could temporarily affect emergency service vehicles.

b. Proposed measures to reduce or control direct impacts on public services, if any. [help]

None required.

16. **Utilities** [help]

a. Circle utilities currently available at the site: [help]
electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other _Communication_____

g. 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.

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects which will discuss the utilities that will be required for the proposed sites.

In general, implementation of the proposed plan would directly affect the sewer utility services provided by the City of Burlington. The other utility most likely to be affected by long-term operation of future projects is electricity. Sewer facilities like those contemplated under the proposed plan typically use electricity. Aeration, disinfection, sludge drying and pumping facilities typically consume the most energy. In general, energy use would increase in the long term with growth in flows, but would be minor compared to regional demand. Electrical power would be supplied though the existing power lines; and the electrical infrastructure within the vicinity of the pump stations would be adequate to handle future loads. Long-term demands on water, refuse, telephone, and other utilities would be negligible.

Repairing or replacing sewer lines and force mains could temporarily disrupt other utilities, such as water, drainage, power, and communication utilities. Potential impacts during construction would be short term and site specific, and would be determined when individual projects are proposed. To reduce construction impacts, individual projects would include site-specific mitigation measures to minimize disruptions to utilities, where applicable. The City would work cooperatively with the various utilities and service providers to locate utilities prior to construction and ensure continued service during construction.

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?

The Wastewater Comprehensive Plan, the subject of this checklist is a planning document. Future projects that will address the upgrade or replacement of sewer conveyance and treatment facilities will address the needs identified in the plan will be addressed in SEPA checklists prior to construction. The future projects will provide wastewater conveyance and treatment capacity to meet the demands of the community. It is not anticipated there will be releases of toxic or hazardous substances.

Proposed measures to avoid or reduce such increases are:

The Wastewater Comprehensive Plan, the subject of this checklist is a planning document. Future projects that will address the upgrade or replacement of sewer conveyance and treatment facilities will address the needs identified in the plan will be addressed in SEPA checklists prior to construction. The checklists will address measures that will be included in the project to avoid or reduce emissions to air and use/production/release/storage of toxic or hazardous substances.

2. How would the proposal be likely to affect plants, animals, fish, or marine life?

The Wastewater Comprehensive Plan, the subject of this checklist is a planning document. Future projects identified in the Plan that will address the upgrade or replacement of sewer conveyance and treatment facilities are not expected to negatively impact wildlife (and instead will enhance wildlife through improvements to water quality and improved stream flows). The projects will comply with environmental regulations regarding water quality, erosion/sediment control, and stormwater control.

Proposed measures to protect or conserve plants, animals, fish, or marine life are:

The proposed projects in the Plan are not expected to negatively impact wildlife (and instead will enhance wildlife through improvements to water quality). The projects will comply with environmental regulations regarding water quality, erosion/sediment control, and stormwater control.

3. How would the proposal be likely to deplete energy or natural resources?

The Wastewater Comprehensive Plan, the subject of this checklist, is a planning document. Future projects that will address the upgrade or replacement of sewer conveyance and treatment facilities will address the needs identified in the plan will include pump stations and WWTP with mechanical equipment. The pump stations and wastewater treatment facilities will rely on electricity for power and diesel fuel for standby power.

Proposed measures to protect or conserve energy and natural resources are:

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects and will address conservation of energy and natural resources. In general, all improvements will be designed with energy efficiency in mind. Energy efficient motors, pumps and mechanical equipment will be utilized in future projects to conserve energy and natural resources. Gravity conveyance will be designed where feasible and appropriate.

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?

Future projects identified in the Plan that will address the upgrade or replacement of sewer conveyance WWTP facilities are not expected to negatively impact wildlife (and instead will ensure the minimization of risks to wildlife and threatened or endangered species habitat through improvements in water quality in the Skagit River. The projects are also not expected to impact parks, wilderness, wild and scenic rivers, historic or cultural sites, wetlands, floodplains, or prime farmlands will comply with environmental regulations regarding water quality, erosion/sediment control, and stormwater control.

Proposed measures to protect such resources or to avoid or reduce impacts are:

Future projects identified in the Plan are not expected to impact parks, wilderness, wild and scenic rivers, historic or cultural sites, wetlands, floodplains, or prime farmlands will comply with environmental regulations regarding water quality, erosion/sediment control, and stormwater control. Construction BMPs and other measures will be followed. The projects will enhance wildlife and threatened or endangered species habitat through improvements to water quality in the Skagit River.

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?

The proposed projects identified in the Plan are not anticipated to affect land and shoreline use. All WWTP and pump station work is anticipated to occur within or adjacent to existing sites and/or in public rights of way.

Proposed measures to avoid or reduce shoreline and land use impacts are:

All WWTP and pump station work is anticipated to occur within or adjacent to existing sites and public rights of way.

6. How would the proposal be likely to increase demands on transportation or public services and utilities?

Future projects that will address the upgrade or replacement of sewer conveyance and treatment facilities identified in the plan are unlikely to increase demands on transportation, public services and utilities. There will be temporary localized increases in traffic due to construction activities but the impact will not be very significant.

There will be an increase in energy consumption as wastewater flows and loadings increase due to growth.

Proposed measures to reduce or respond to such demand(s) are:

This SEPA checklist discusses the Wastewater Comprehensive Plan, a planning document. SEPA checklists will be prepared for specific non-exempt construction projects, addressing transportation, pubic services and utilities. In general, traffic impacts will be addressed through traffic control plans and flaggers, where appropriate. Energy efficient pumps, motors and mechanical equipment will be incorporated into the pump station and WWTP upgrades to minimize the increase in electrical energy needed to operate the facilities.

7. Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.

Future projects that will address the upgrade or replacement of sewer conveyance and WWTP facilities identified in the plan will not conflict with local, state or federal laws for protection of the environment. Future projects will meet local, state and federal laws for wastewater conveyance and treatment and protection of the environment. The driving force behind upgrades to the existing conveyance and treatment facilities is to be in compliance with the federal Clean Water Act and the State of Washington Department of Ecology 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.

APPENDIX B

NPDES PERMIT

Issuance Date: January 12, 2018
Effective Date: February 1, 2018
Expiration Date: January 31, 2023

National Pollutant Discharge Elimination System
Waste Discharge Permit No. WA0020150

State of Washington
DEPARTMENT OF ECOLOGY
Northwest Regional Office
3190 160th Avenue SE
Bellevue, WA 98008-5452

In compliance with the provisions of
The State of Washington Water Pollution Control Law
Chapter 90.48 Revised Code of Washington
and
The Federal Water Pollution Control Act
(The Clean Water Act)
Title 33 United States Code, Section 1342 et seq.

CITY OF BURLINGTON
833 South Spruce Street
Burlington, Washington 98233

is authorized to discharge in accordance with the Special and General Conditions that follow.

Plant Location: 900 South Section Street Burlington, WA 98233	Receiving Water: Skagit River
Treatment Type: Activated Sludge - Aeration Basins	

Rachel McCrea
Water Quality Section Manager
Northwest Regional Office
Washington State Department of Ecology

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Appendix A ***37***

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 (DMR)	Monthly	March 15, 2018
S3.A	DMR - Priority Pollutant Data - Single Sample Data	Annual	January 15, 2019
S3.F	Reporting Permit Violations	As necessary	
S4.B	Plans for Maintaining Adequate Capacity	As necessary	
S4.D	Notification of New or Altered Sources	As necessary	
S5.F	Bypass Notification	As necessary	
S5.G	Operations and Maintenance Manual Update	As necessary	
S6.E	Industrial User Survey Submittal	1/permit cycle	July 25, 2022
S8	Application for Permit Renewal	1/permit cycle	July 25, 2022
S9.A	Effluent Mixing Plan of Study	1/permit cycle	February 1, 2020
S9.B	Effluent Mixing Report	1/permit cycle	October 1, 2020
S10	Outfall Evaluation	1/permit cycle	July 25, 2022
S11.C	Acute Toxicity: Compliance Monitoring Reports	Quarterly	July 31, 2018
S11.D	Acute Toxicity: Response to noncompliance reporting	As necessary	
S11.D	Acute Toxicity: TI/TRE Plan	As necessary	
S12.A	Chronic Toxicity Effluent Test Results with Permit Renewal Application	2/permit cycle (see S12.A for sampling dates)	July 25, 2022
G1	Notice of Change in Authorization	As necessary	
G4	Reporting Planned Changes	As necessary	
G5	Engineering Report for Construction or Modification Activities	As necessary	
G7	Notice of Permit Transfer	As necessary	
G10	Duty to Provide Information	As necessary	
G20	Compliance Schedules	As necessary	
G21	Contract Submittal	As necessary	

Special Conditions

S1. Discharge limits

All discharges and activities authorized by this permit must comply with the terms and conditions of this permit. The discharge of any of the following pollutants more frequently than, or at a level in excess of, that identified and authorized by this permit violates the terms and conditions of this permit.

Beginning on the effective date of this permit, the Permittee may discharge treated domestic wastewater to the Skagit River at the permitted location subject to compliance with the following limits:

Effluent Limits: Outfall 001 **Latitude: 48.467 Longitude: -122.310**		
Parameter	**Average Monthly [a]**	**Average Weekly [b]**
Biochemical Oxygen Demand (5-day) (BOD_5)	30 milligrams/liter (mg/L) 948 pounds/day (lbs/day) 85% removal of influent BOD_5	45 mg/L 1,422 lbs/day
Total Suspended Solids (TSS)	30 milligrams/liter (mg/L) 948 pounds/day (lbs/day) 85% removal of influent BOD_5	45 mg/L 1,422 lbs/day
Parameter	**Minimum**	**Maximum**
pH	6.2 standard units	9.0 standard units
Parameter	**Monthly Geometric Mean [c]**	**Weekly Geometric Mean**
Fecal Coliform Bacteria	200/100 milliliter (mL)	400/100 mL
Wet Limit		
The effluent limit for acute toxicity is: **No acute toxicity detected in a test concentration representing the acute critical effluent concentration (ACEC).** The ACEC means the maximum concentration of effluent during critical conditions at the boundary of the acute mixing zone, defined in Section 1.B of this permit. The ACEC equals 6.6% effluent. See S11 for more information.		
a	Average monthly effluent limit means the highest allowable average of daily discharges over a calendar month. To calculate the discharge value to compare to the limit, you add the value of each daily discharge measured during a calendar month and divide this sum by the total number of daily discharges measured. See footnote c for fecal coliform calculations.	
b	Average weekly discharge limit means the highest allowable average of daily discharges over a calendar week, calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges' measured during that week. See footnote c for fecal coliform calculations.	
c	Ecology provides directions to calculate the monthly and the weekly geometric mean in publication No. 04-10-020, Information Manual for Treatment Plant Operators available at: http://www.ecy.wa.gov/pubs/0410020.pdf	

S1.B. Mixing zone authorization

Mixing zone for Outfall 001

The paragraphs below defines the maximum boundaries of the mixing zones.

Chronic mixing zone

The length of the chronic mixing zone extends 100 feet (30 meters) upstream and 308 feet (94 meters) downstream of the outfall. The mixing zone extends from the discharge ports to the top of the water surface. The concentration of pollutants at the edge of the chronic zone must meet chronic aquatic life criteria and human health criteria.

Acute mixing zone

The length of the acute mixing zone extends 10 feet (3 meters) upstream and 31 feet (9 meters) downstream of the outfall. The mixing zone extends from the discharge ports to the top of the water surface. The concentration of pollutants at the edge of the acute zone must meet acute aquatic life criteria.

Available Dilution (dilution factor)	
Acute Aquatic Life Criteria	15.2
Chronic Aquatic Life Criteria	41.6
Human Health Criteria - Carcinogen	41.6
Human Health Criteria - Non-carcinogen	41.6

S2. Monitoring requirements

S2.A. Monitoring schedule

The Permittee must monitor in accordance with the following schedule and the requirements specified in Appendix A.

Parameter	Units & Speciation	Minimum Sampling Frequency	Sample Type
(1) Wastewater influent			
Wastewater Influent means the raw sewage flow from the collection system into the treatment facility. Sample the wastewater entering the headworks of the treatment plant excluding any side-stream returns from inside the plant.			
Flow	MGD	Continuous [1]	Metered
Biochemical Oxygen Demand (BOD_5)	mg/L	3/week [2]	24-hr composite [3]
Biochemical Oxygen Demand (BOD_5)	lbs/day	3/week	Calculated [4]
Total Suspended Solids (TSS)	mg/L	3/week	24-hr composite
Total Suspended Solids (TSS)	lbs/day	3/week	Calculated
(2) Final wastewater effluent			
Final Wastewater Effluent means wastewater exiting the last treatment process or operation. Typically, this is after or at the exit from the chlorine contact chamber or other disinfection process. The Permittee may take effluent samples for the BOD_5 analysis before or after the disinfection process. If taken after, the Permittee must dechlorinate and reseed the sample.			
BOD_5	mg/L	3/week	24-hr composite
BOD_5	lbs/day	3/week	Calculated
BOD_5	% removal [5]	1/month	Calculated
TSS	mg/L	3/week	24-hr composite
TSS	lbs/day	3/week	Calculated
TSS	% removal	1/month	Calculated
Fecal Coliform [6]	# /100 ml	5/week	Grab [7]
pH [8]	Standard Units	Daily	Grab

Parameter	Units & Speciation	Minimum Sampling Frequency	Sample Type
Temperature[9]	Degrees centigrade (°C)	3/week (during June/July/August only)	Grab
(3) Whole effluent toxicity testing – final wastewater effluent			
Acute Toxicity Testing	See Condition S11 for testing requirements.	4/year	24-hr composite
Chronic Toxicity Testing	See Condition S12 for testing requirements.	2/permit cycle	24-hr composite
(4) Effluent characterization – final wastewater effluent			
Total Phosphorus	mg/L as P	Monthly [10]	24-hr composite
Soluble Reactive Phosphorus	mg/L as P	Monthly	24-hr composite
Total Ammonia	mg/L as N	Monthly	24-hr composite
Nitrate plus Nitrite Nitrogen	mg/L as N	Monthly	24-hr composite
Total Kjeldahl Nitrogen (TKN)	mg/L as N	Monthly	24-hr composite
(5) Permit renewal application requirements – final wastewater effluent			
The Permittee must record and report the wastewater treatment plant flow discharged on the day it collects the sample for priority pollutant testing with the discharge monitoring report.			
Dissolved Oxygen	mg/L	Once per year	Grab
Oil and Grease	mg/L	Once per year	Grab
Total Dissolved Solids	mg/L	Once per year	24-hr composite
Total Hardness	mg/L	Once per year	24-hr composite
Cyanide	micrograms/liter (µg/L)	Once per year	Grab
Total Phenolic Compounds	µg/L	Once per year	Grab
Priority Pollutants (PP) – Total Metals	µg/L; nanograms(ng/L) for mercury	Once per year	24-hr composite Grab for mercury
PP – Volatile Organic Compounds	µg/L	Once per year	Grab
PP – Acid-extractable Compounds	µg/L	Once per year	24-hr composite
PP – Base-neutral Compounds	µg/L	Once per year	24-hr composite

1	Continuous means uninterrupted except for brief lengths of time for calibration, power failure, or unanticipated equipment repair or maintenance.
2	3/week means three (3) times during each calendar week and on a rotational basis throughout the days of the week, except weekends and holidays.
3	24-hour composite means a series of individual samples collected over a 24-hour period into a single container, and analyzed as one sample.
4	Calculated means figured concurrently with the respective sample, using the following formula: Concentration (in mg/L) X Flow (in MGD) X Conversion Factor (8.34) = lbs/day
5	% removal = $\frac{\text{Influent concentration (mg/L)} - \text{Effluent concentration (mg/L)}}{\text{Influent concentration (mg/L)}} \times 100$ Calculate the percent (%) removal of BOD_5 and TSS using the above equation.
6	Report a numerical value for fecal coliforms following the procedures in Ecology's *Information Manual for Wastewater Treatment Plant Operators*, Publication Number 04-10-020 available at: http://www.ecy.wa.gov/programs/wq/permits/guidance.html . Do not report a result as too numerous to count (TNTC).
7	Grab means an individual sample collected over a fifteen (15) minute, or less, period.
8	The Permittee must report the instantaneous maximum and minimum pH daily. Do not average pH values.
9	Temperature grab sampling must occur when the effluent is at or near its daily maximum temperature, which usually occurs in the late afternoon.
10	Monthly means once every calendar month.

S2.B. Sampling and analytical procedures

Samples and measurements taken to meet the requirements of this permit must represent the volume and nature of the monitored parameters. The Permittee must conduct representative sampling of any unusual discharge or discharge condition, including bypasses, upsets, and maintenance-related conditions that may affect effluent quality.

Sampling and analytical methods used to meet the monitoring requirements specified in this permit must conform to the latest revision of the *Guidelines Establishing Test Procedures for the Analysis of Pollutants* contained in 40 CFR Part 136 (or as applicable in 40 CFR subchapters N [Parts 400–471] or O [Parts 501-503]) unless otherwise specified in this permit . Ecology may only specify alternative methods for parameters without permit limits and for those parameters without an EPA approved test method in 40 CFR Part 136.

S2.C. Flow measurement and continuous monitoring devices

The Permittee must:

1. Select and use appropriate flow measurement and continuous monitoring devices and methods consistent with accepted scientific practices.
2. Install, calibrate, and maintain these devices to ensure the accuracy of the measurements is consistent with the accepted industry standard, the manufacturer's recommendation, and approved O&M manual procedures for the device and the wastestream.
3. Calibrate flow-monitoring devices at a minimum frequency of at least one calibration per year.
4. Maintain calibration records for at least three years.

S2.D. Laboratory accreditation

The Permittee must ensure that all monitoring data required by Ecology for permit specified parameters is prepared by a laboratory registered or accredited under the provisions of chapter 173-50 WAC, *Accreditation of Environmental Laboratories*. Flow, temperature, settleable solids, conductivity, pH, and internal process control parameters are exempt from this requirement. The Permittee must obtain accreditation for conductivity and pH if it must receive accreditation or registration for other parameters.

S3. Reporting and recording requirements

The Permittee must monitor and report in accordance with the following conditions. Falsification of information submitted to Ecology is a violation of the terms and conditions of this permit.

S3.A. Discharge monitoring reports

The first monitoring period begins on the effective date of the permit (unless otherwise specified). The Permittee must:

1. Summarize, report, and submit monitoring data obtained during each monitoring period on the electronic discharge monitoring report (DMR) form provided by Ecology within the Water Quality Permitting Portal. Include data for each of the parameters tabulated in Special Condition S2 and as required by the form. Report a value for each day sampling occurred (unless specifically exempted in the permit) and for the summary values (when applicable) included on the electronic form.
2. Ensure that DMRs are electronically submitted no later than the dates specified below.
3. The Permittee must also submit an electronic copy of the laboratory report as an attachment using WQWebDMR. The contract laboratory reports must also include information on the chain of custody, QA/QC results, and documentation of accreditation for the parameter.
4. Submit DMRs for parameters with the monitoring frequencies specified in S2 (monthly, annual, etc.) at the reporting schedule identified below. The Permittee must:
    a. Submit **monthly** DMRs by the 15th day of the following month.
    b. Submit **annual DMRs**, unless otherwise specified in the permit, by January 15 for the previous calendar year. The annual sampling period is the calendar year. The first due date for submitting annual monitoring data is January 15, 2019.
5. Enter the "No Discharge" reporting code for an entire DMR, for a specific monitoring point, or for a specific parameter as appropriate, if the Permittee did not discharge wastewater or a specific pollutant during a given monitoring period.
6. Report single analytical values below detection as "less than the detection level (DL)" by entering < followed by the numeric value of the detection level (e.g. < 2.0) on the DMR. If the method used did not meet the minimum DL and quantitation level (QL) identified in the permit, report the actual QL and DL in the comments or in the location provided.
7. Report single analytical values between the detection level (DL) and the quantitation level (QL) by entering the estimated value, the code for estimated value/below quantitation limit (j) and any additional information in the comments. Submit a copy of the laboratory report as an attachment using WQWebDMR.
8. Not report zero for bacteria monitoring. Report as required by the laboratory method.
9. Calculate and report an arithmetic average value for each day for bacteria if multiple samples were taken in one day.
10. Calculate the geometric mean values for bacteria (unless otherwise specified in the permit) using:

a. The reported numeric value for all bacteria samples measured above the detection value except when it took multiple samples in one day. If the Permittee takes multiple samples in one day it must use the arithmetic average for the day in the geometric mean calculation.

b. The detection value for those samples measured below detection.

11. Report the test method used for analysis in the comments if the laboratory used an alternative method not specified in the permit and as allowed in Appendix A.

12. Calculate average values and calculated total values (unless otherwise specified in the permit) using:

    a. The reported numeric value for all parameters measured between the detection value and the quantitation value for the sample analysis.

    b. One-half the detection value (for values reported below detection) if the lab detected the parameter in another sample from the same monitoring point for the reporting period.

    c. Zero (for values reported below detection) if the lab did not detect the parameter in another sample for the reporting period.

13. Report single-sample grouped parameters (for example: priority pollutants, PAHs, pulp and paper chlorophenolics, TTOs) on the WQWebDMR form and include: sample date, concentration detected, detection limit (DL) (as necessary), and laboratory quantitation level (QL) (as necessary).

S3.B. Permit submittals and schedules

The Permittee must use the Water Quality Permitting Portal – Permit Submittals application (unless otherwise specified in the permit) to submit all other written permit-required reports by the date specified in the permit.

When another permit condition requires submittal of a paper (hard-copy) report, the Permittee must ensure that it is postmarked or received by Ecology no later than the dates specified by this permit. Send these paper reports to Ecology at:

Water Quality Permit Coordinator
Department of Ecology
Northwest Regional Office
3190 160th Avenue SE
Bellevue, WA 98008-5452

S3.C. Records retention

The Permittee must retain records of all monitoring information for a minimum of three (3) years. Such information must 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. The Permittee must extend this period of retention during the course of any unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by Ecology.

S3.D. Recording of results

For each measurement or sample taken, the Permittee must record the following information:

1. The date, exact place, method, and time of sampling or measurement.
2. The individual who performed the sampling or measurement.
3. The dates the analyses were performed.
4. The individual who performed the analyses.
5. The analytical techniques or methods used.
6. The results of all analyses.

S3.E. Additional monitoring by the Permittee

If the Permittee monitors any pollutant more frequently than required by Special Condition S2 of this permit, then the Permittee must include the results of such monitoring in the calculation and reporting of the data submitted in the Permittee's DMR unless otherwise specified by Special Condition S2.

S3.F. Reporting permit violations

The Permittee must take the following actions when it violates or is unable to comply with any permit condition:

1. Immediately take action to stop, contain, and cleanup unauthorized discharges or otherwise stop the noncompliance and correct the problem.
2. If applicable, immediately repeat sampling and analysis. Submit the results of any repeat sampling to Ecology within thirty (30) days of sampling.

a. Immediate reporting

The Permittee must **immediately** report to Ecology, the Department of Health, Drinking Water Program, and the Local Health Jurisdiction (at the numbers listed below), all:

- Failures of the disinfection system.
- Collection system overflows discharging to a water body that may be used for drinking water.
- Plant bypasses discharging to a water body used as a source of drinking water.
- Any other failures of the sewage system (pipe breaks, etc)

Northwest Regional Office	425-649-7000
Department of Health, Drinking Water Program	800-521-0323 (business hours) 877-481-4901 (after business hours)
Skagit County Health Department	360-336-9474 (business hours) 360-840-9906 (after business hours)

Additionally, for any sanitary sewer overflow (SSO) that discharges to a municipal separate storm sewer system (MS4), the Permittee must notify the appropriate MS4 owner or operator.

b. Twenty-four-hour reporting

The Permittee must report the following occurrences of noncompliance by telephone, to Ecology at the telephone numbers listed above, within 24 hours from the time the Permittee becomes aware of any of the following circumstances:

1. Any noncompliance that may endanger health or the environment, unless previously reported under immediate reporting requirements.
2. Any unanticipated bypass that causes an exceedance of an effluent limit in the permit (See Part S5.F, “Bypass Procedures”).
3. Any upset that causes an exceedance of an effluent limit in the permit (See G.15, “Upset”).
4. Any violation of a maximum daily or instantaneous maximum discharge limit for any of the pollutants in Section S1.A of this permit.
5. Any overflow prior to the treatment works, whether or not such overflow endangers health or the environment or exceeds any effluent limit in the permit.

c. Report within five days

The Permittee must also submit a written report within five days of the time that the Permittee becomes aware of any reportable event under subparts a or b, above. The report must contain:

1. A description of the noncompliance and its cause.
2. The period of noncompliance, including exact dates and times.
3. The estimated time the Permittee expects the noncompliance to continue if not yet corrected.
4. Steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.
5. If the noncompliance involves an overflow prior to the treatment works, an estimate of the quantity (in gallons) of untreated overflow.

d. Waiver of written reports

Ecology may waive the written report required in subpart c, above, on a case-by-case basis upon request if the Permittee has submitted a timely oral report.

e. All other permit violation reporting

The Permittee must report all permit violations, which do not require immediate or within 24 hours reporting, when it submits monitoring reports for S3.A ("Reporting"). The reports must contain the information

listed in subpart c, above. 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.

S3.G. Other reporting

a. Spills of oil or hazardous materials

The Permittee must report a spill of oil or hazardous materials in accordance with the requirements of RCW 90.56.280 and chapter 173-303-145. You can obtain further instructions at the following website: http://www.ecy.wa.gov/programs/spills/other/reportaspill.htm .

b. Failure to submit relevant or correct facts

Where the Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application, or in any report to Ecology, it must submit such facts or information promptly.

S3.H. Maintaining a copy of this permit

The Permittee must keep a copy of this permit at the facility and make it available upon request to Ecology inspectors.

S4. Facility loading

S4.A. Design criteria

The flows or waste loads for the permitted facility must not exceed the following design criteria:

Average Flow for the Maximum Month	3.79 MGD
BOD_5 Influent Loading for Maximum Month	7,356 lb/day
TSS Influent Loading for Maximum Month	7,660 lb/day

S4.B. Plans for maintaining adequate capacity

a. Conditions triggering plan submittal

The Permittee must submit a plan and a schedule for continuing to maintain capacity to Ecology when:

1. The actual flow or waste load reaches 85 percent of any one of the design criteria in S4.A for three consecutive months.
2. The projected plant flow or loading would reach design capacity within five years.

b. Plan and schedule content

The plan and schedule must identify the actions necessary to maintain adequate capacity for the expected population growth and to meet the

limits and requirements of the permit. The Permittee must consider the following topics and actions in its plan.

1. Analysis of the present design and proposed process modifications
2. Reduction or elimination of excessive infiltration and inflow of uncontaminated ground and surface water into the sewer system
3. Limits on future sewer extensions or connections or additional waste loads
4. Modification or expansion of facilities
5. Reduction of industrial or commercial flows or waste loads

Engineering documents associated with the plan must meet the requirements of WAC 173-240-060, "Engineering Report," and be approved by Ecology prior to any construction.

S4.C. Duty to mitigate

The Permittee must take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment.

S4.D. Notification of new or altered sources

1. The Permittee must submit written notice to Ecology whenever any new discharge or a substantial change in volume or character of an existing discharge into the wastewater treatment plant is proposed which:
   a. Would interfere with the operation of, or exceed the design capacity of, any portion of the wastewater treatment plant.
   b. Is not part of an approved general sewer plan or approved plans and specifications.
   c. Is subject to pretreatment standards under 40 CFR Part 403 and Section 307(b) of the Clean Water Act.
2. This notice must include an evaluation of the wastewater treatment plant's ability to adequately transport and treat the added flow and/or waste load, the quality and volume of effluent to be discharged to the treatment plant, and the anticipated impact on the Permittee's effluent [40 CFR 122.42(b)].

S5. Operation and maintenance

The Permittee must at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances), which are installed to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance also includes keeping a daily operation logbook (paper or electronic), adequate laboratory controls, and appropriate quality assurance procedures. This provision of the permit requires the Permittee to operate backup or auxiliary facilities or similar systems only when the operation is necessary to achieve compliance with the conditions of this permit.

S5.A. Certified operator

This permitted facility must be operated by an operator certified by the state of Washington for at least a Class III plant. This operator must be in responsible charge of the day-to-day operation of the wastewater treatment plant. An operator certified for at least a Class II plant must be in charge during all regularly scheduled shifts. The Permittee must notify Ecology when the operator in charge at the facility changes. It must provide the new operator's name and certification level and provide the name of the operator leaving the facility.

S5.B. Operation and maintenance program

The Permittee must:

1. Institute an adequate operation and maintenance program for the entire sewage system.
2. Keep maintenance records on all major electrical and mechanical components of the treatment plant, as well as the sewage system and pumping stations. Such records must clearly specify the frequency and type of maintenance recommended by the manufacturer and must show the frequency and type of maintenance performed.
3. Make maintenance records available for inspection at all times.

S5.C. Short-term reduction

The Permittee must schedule any facility maintenance, which might require interruption of wastewater treatment and degrade effluent quality, during non-critical water quality periods and carry this maintenance out according to the approved O&M manual or as otherwise approved by Ecology.

If a Permittee contemplates a reduction in the level of treatment that would cause a violation of permit discharge limits on a short-term basis for any reason, and such reduction cannot be avoided, the Permittee must:

1. Give written notification to Ecology, if possible, thirty (30) days prior to such activities.
2. Detail 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 its obligations under this permit.

S5.D. Electrical power failure

The Permittee must ensure that adequate safeguards 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. Adequate safeguards include, but are not limited to, alternate power sources, standby generator(s), or retention of inadequately treated wastes.

The Permittee must maintain Reliability Class I (EPA 430-99-74-001) at the wastewater treatment plant. Reliability Class I requires a backup power source sufficient to operate all vital components and critical lighting and ventilation during peak wastewater flow conditions.

S5.E. Prevent connection of inflow

The Permittee must strictly enforce its sewer ordinances and not allow the connection of inflow (roof drains, foundation drains, etc.) to the sanitary sewer system.

S5.F. Bypass procedures

A bypass is the intentional diversion of waste streams from any portion of a treatment facility. This permit prohibits all bypasses except when the bypass is for essential maintenance, as authorized in special condition S5.F.1, or is approved by Ecology as an anticipated bypass following the procedures in S5.F.2.

1. Bypass for essential maintenance without the potential to cause violation of permit limits or conditions.

   This permit allows bypasses for essential maintenance of the treatment system when necessary to ensure efficient operation of the system. The Permittee may bypass the treatment system for essential maintenance only if doing so does not cause violations of effluent limits. The Permittee is not required to notify Ecology when bypassing for essential maintenance. However the Permittee must comply with the monitoring requirements specified in special condition S2.B.

2. Anticipated bypasses for non-essential maintenance

   Ecology may approve an anticipated bypass under the conditions listed below. This permit prohibits any anticipated bypass that is not approved through the following process.

   a. If a bypass is for non-essential maintenance, the Permittee must notify Ecology, if possible, at least ten (10) days before the planned date of bypass. The notice must contain:

      - A description of the bypass and the reason the bypass is necessary.
      - An analysis of all known alternatives which would eliminate, reduce, or mitigate the potential impacts from the proposed bypass.
      - A cost-effectiveness analysis of alternatives.
      - The minimum and maximum duration of bypass under each alternative.
      - A recommendation as to the preferred alternative for conducting the bypass.
      - The projected date of bypass initiation.
      - A statement of compliance with SEPA.

- A request for modification of water quality standards as provided for in WAC 173-201A-410, if an exceedance of any water quality standard is anticipated.
- Details of the steps taken or planned to reduce, eliminate, and prevent recurrence of the bypass.

b. For probable construction bypasses, the Permittee must notify Ecology of the need to bypass as early in the planning process as possible. The Permittee must consider the analysis required above during the project planning and design process. The project-specific engineering report as well as the plans and specifications must include details of probable construction bypasses to the extent practical. In cases where the Permittee determines the probable need to bypass early, the Permittee must continue to analyze conditions up to and including the construction period in an effort to minimize or eliminate the bypass.

c. Ecology will determine if the Permittee has met the conditions of special condition S5.F.2 a and b and consider the following prior to issuing a determination letter, an administrative order, or a permit modification as appropriate for an anticipated bypass:

- If the Permittee planned and scheduled the bypass to minimize adverse effects on the public and the environment.
- If the 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 feasible alternatives to the bypass exist, such as:
  - The use of auxiliary treatment facilities.
  - Retention of untreated wastes.
  - Stopping production.
  - Maintenance during normal periods of equipment downtime, but not if the Permittee should have installed adequate backup equipment in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventative maintenance.
  - Transport of untreated wastes to another treatment facility.

S5.G. Operations and maintenance (O&M) manual

a. O&M manual submittal and requirements

The Permittee must:

1. Ensure that the Operations and Maintenance (O&M) Manual meets the requirements of 173-240-080 WAC.
2. Review the O&M Manual at least annually.
3. Submit to Ecology for review and approval substantial changes or updates to the O&M Manual whenever it incorporates them into the manual.
4. Keep the approved O&M Manual at the permitted facility.
5. Follow the instructions and procedures of this manual.

b. O&M manual components

In addition to the requirements of WAC 173-240-080(1) through (5), the O&M Manual must be consistent with the guidance in Table G1-3 in the *Criteria for Sewage Works Design* (Orange Book), 2008. The O&M Manual must include:

1. Emergency procedures for cleanup in the event of wastewater system upset or failure.
2. A review of system components which if failed could pollute surface water or could impact human health. Provide a procedure for a routine schedule of checking the function of these components.
3. Wastewater system maintenance procedures that contribute to the generation of process wastewater.
4. Reporting protocols for submitting reports to Ecology to comply with the reporting requirements in the discharge permit.
5. Any directions to maintenance staff when cleaning or maintaining other equipment or performing other tasks which are necessary to protect the operation of the wastewater system (for example, defining maximum allowable discharge rate for draining a tank, blocking all floor drains before beginning the overhaul of a stationary engine).
6. The treatment plant process control monitoring schedule.
7. Minimum staffing adequate to operate and maintain the treatment processes and carry out compliance monitoring required by the permit.

S6. Pretreatment

S6.A. General requirements

The Permittee must work with Ecology to ensure that all commercial and industrial users of the publicly owned treatment works (POTW) comply with the pretreatment regulations in 40 CFR Part 403 and any additional regulations that the Environmental Protection Agency (U.S. EPA) may promulgate under Section 307(b) (pretreatment) and 308 (reporting) of the Federal Clean Water Act.

S6.B. Duty to enforce discharge prohibitions

1. Under federal regulations (40 CFR 403.5(a) and (b)), the Permittee must not authorize or knowingly allow the discharge of any pollutants into its POTW which may be reasonably expected to cause pass through or interference, or which otherwise violate general or specific discharge prohibitions contained in 40 CFR Part 403.5 or WAC 173-216-060.
2. The Permittee must not authorize or knowingly allow the introduction of any of the following into their treatment works:
    a. Pollutants which create a fire or explosion hazard in the POTW (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).
    b. Pollutants which will cause corrosive structural damage to the POTW, but in no case discharges with pH lower than 5.0, or greater than 11.0 standard units, unless the works are specifically designed to accommodate such discharges.
    c. Solid or viscous pollutants in amounts that could cause obstruction to the flow in sewers or otherwise interfere with the operation of the POTW.
    d. Any pollutant, including oxygen-demanding pollutants, (BOD_5, etc.) released in a discharge at a flow rate and/or pollutant concentration which will cause interference with the POTW.
    e. Petroleum oil, non-biodegradable cutting oil, or products of mineral origin in amounts that will cause interference or pass through.
    f. 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.
    g. 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 headworks exceeds 40 degrees Centigrade (104 degrees Fahrenheit) unless Ecology, upon request of the Permittee, approves, in writing, alternate temperature limits.
    h. Any trucked or hauled pollutants, except at discharge points designated by the Permittee.
    i. Wastewaters prohibited to be discharged to the POTW by the Dangerous Waste Regulations (chapter 173-303 WAC), unless authorized under the Domestic Sewage Exclusion (WAC 173-303-071).
3. The Permittee must also not allow the following discharges to the POTW unless approved in writing by Ecology:
    a. Noncontact cooling water in significant volumes.
    b. Stormwater and other direct inflow sources.

c. Wastewaters significantly affecting system hydraulic loading, which do not require treatment, or would not be afforded a significant degree of treatment by the system.

4. The Permittee must notify Ecology if any industrial user violates the prohibitions listed in this section (S6.B), and initiate enforcement action to promptly curtail any such discharge.

S6.C. Wastewater discharge permit required

The Permittee must:

1. Establish a process for authorizing non-domestic wastewater discharges that ensures all SIUs in all tributary areas meet the applicable state waste discharge permit (SWDP) requirements in accordance with chapter 90.48 RCW and chapter 173-216 WAC.
2. Immediately notify Ecology of any proposed discharge of wastewater from a source, which may be a significant industrial user (SIU) [see fact sheet definitions or refer to 40 CFR 403.3(v)(i)(ii)].
3. Require all SIUs to obtain a SWDP from Ecology prior to accepting their non-domestic wastewater, or require proof that Ecology has determined they do not require a permit.
4. Require the documentation as described in S6.C.3 at the earliest practicable date as a condition of continuing to accept non-domestic wastewater discharges from a previously undiscovered, currently discharging and unpermitted SIU.
5. Require sources of non-domestic wastewater, which do not qualify as SIUs but merit a degree of oversight, to apply for a SWDP and provide it a copy of the application and any Ecology responses.
6. Keep all records documenting that its users have met the requirements of S6.C.

S6.D. Identification and reporting of existing, new, and proposed industrial users

1. The Permittee must take continuous, routine measures to identify all existing, new, and proposed SIUs and potential significant industrial users (PSIUs) discharging or proposing to discharge to the Permittee's sewer system (see **Appendix C** of the fact sheet for definitions).
2. Within 30 days of becoming aware of an unpermitted existing, new, or proposed industrial user who may be a significant industrial user (SIU), the Permittee must notify such user by registered mail that, if classified as an SIU, they must apply to Ecology and obtain a State Waste Discharge Permit. The Permittee must send a copy of this notification letter to Ecology within this same 30-day period.
3. The Permittee must also notify all Potential SIUs (PSIUs), as they are identified, that if their classification should change to an SIU, they must apply to Ecology for a State Waste Discharge Permit within 30 days of such change.

S6.E. Industrial user survey

The Permittee must complete an industrial user survey listing all SIUs and potential significant industrial users (PSIUs) discharging to the POTW. The Permittee must submit the survey to Ecology by July 25, 2022. At a minimum, the Permittee must develop the list of SIUs and PSIUs by means of a telephone book search, a water utility billing records search, and a physical reconnaissance of the service area.

Information on PSIUs must include, at a minimum, the business name, telephone number, address, description of the industrial process(s), and the known wastewater volumes and characteristics. The list must include SIUs and PSIUs located in all areas that contribute flow to the facility covered under this permit, including users connected to collection systems owned and operated by sewer districts or municipalities that have treatment service agreements with the Permittee.

S7. Solid wastes

S7.A. Solid waste handling

The Permittee must handle and dispose of all solid waste material in such a manner as to prevent its entry into state ground or surface water.

S7.B. Leachate

The Permittee must not allow leachate from its solid waste material to enter state waters without providing all known, available, and reasonable methods of treatment, nor allow such leachate to cause violations of the State Surface Water Quality Standards, Chapter 173-201A WAC, or the State Ground Water Quality Standards, Chapter 173-200 WAC. The Permittee must apply for a permit or permit modification as may be required for such discharges to state ground or surface waters.

S8. Application for permit renewal or modification for facility changes

The Permittee must submit an application for renewal of this permit by July 25, 2022.

The Permittee must also submit a new application or addendum at least one hundred eighty (180) days prior to commencement of discharges, resulting from the activities listed below, which may result in permit violations. These activities include any facility expansions, production increases, or other planned changes, such as process modifications, in the permitted facility.

S9. Mixing study

S9.A. General requirements

The Permittee must:

1. Update the Outfall Evaluation and Mixing Zone Study (Beak, 1998). Submit a Plan of Study to Ecology for review by February 1, 2020, prior to initiation of the effluent mixing study.

2. Use the Guidance for Conducting Mixing Zone Analyses (Appendix C of Ecology's *Permit Writer's Manual*, 2015) and the protocols identified in S9.C.
3. Include the results of the effluent mixing study in the Effluent Mixing Report and submit it to Ecology for approval by October 1, 2020.
4. If the results of the mixing study, toxicity tests, and chemical analysis indicate that the concentration of any pollutant(s) exceeds or has a reasonable potential to exceed the state water quality standards, chapter 173-201A WAC, Ecology may modify this permit to impose effluent limits to meet the water quality standards.

S9.B. Reporting requirements

The mixing zone study must include:

1. A statement confirming that AKART has been applied to the discharge.
2. A description of the size of the mixing zone allowed under WAC 173-201A.
3. An analysis showing how mixing zones have been minimized based on using the lowest dilution from hydraulic limitation, width limitations, distance limitation and that predicted by the model.
4. A clear description of the critical conditions used for dilution factors:
    a. For ambient freshwater (unidirectional flow) use 7Q10 flows for acute, chronic and non-carcinogen pollutants, and harmonic flow for carcinogens.
    b. Generally, use depth of outfall at 7Q10 flows for river discharges. For assessing human health in freshwater, depths of outfall should be established at the applicable flow (e.g. harmonic mean flow or 30Q5 flows). For tidally influenced rivers a combination of MLLW and critical river flows should be used to establish depth of outfall.
    c. For unidirectional flow use centerline dilution factor for acute and chronic conditions, while flux average for human health dilution factors.
5. Diffuser information:
    a. Location, orientation, description and dimension of diffusers and ports.
    b. Port elevation above bottom and the depth of the diffuser/port below water surface based on the 7Q10 flow for river discharges.
    c. Plan view maps showing the mixing zone size and dimensions in relation to the diffuser.
    d. Schematic of waterbody cross-section, showing channel width, depth, and diffuser location in relation to shoreline and bottom.
    e. Report on the integrity of the diffuser and the ports being modeled.
6. Discharge characteristics:
    a. Existing and projected maximum daily, maximum monthly average, and annual average flows.
    b. Discharge density (function of temperature and salinity).

7. Ambient water characteristics:
   a. Critical stream flow statistics (7Q10, 30Q5, harmonic flow).
   b. Velocity profile in the vicinity of the diffuser.
   c. Manning's roughness coefficient, if used.
   d. Available information regarding background concentrations of chemical substances in the receiving water (for which there are criteria in chapter 173-201A WAC.
8. Model selection and results:
   a. Model selection and application discussion. Consider model applicability to single or multiport diffuser, opposing port configuration, submerged, surface or above-surface discharge, buoyant or non-buoyant discharge, and potential plume attachment to boundaries.
   b. Description of mixing and plume dynamics (nearfield, farfield, tidal buildup/reflux).
   c. Sensitivity analysis.
   d. Calibration to empirical data (tracer studies), if applicable.
   e. Provide model output and summary table of results.

S9.C. Protocols

The Permittee must determine the dilution ratio using protocols outlined in the following references, approved modifications thereof, or by another method approved by Ecology:

1. Doneker, R.L. and G.H. Jirka, *CORMIX User Manual: A Hydrodynamic Mixing Zone Model and Decision Support System for Pollutant Discharges into Surface Waters*, EPA-823-K-07-001, Dec. 2007. http://www.mixzon.com/downloads/.

   A complete list of general reference for CORMIX is at: http://www.cormix.info/references.php
2. Frick, W.E., Roberts, P.J.W., Davis, L.R., Keyes, D.J., Baumgartner, George, K.P. 2003. *Dilution Models for Effluent Discharges, 4th Edition (Visual Plumes).* Ecosystems Research Div., USEPA, Athens, GA, USA.
3. Ecology, Water Quality Program, *Permit Writer's Manual*. 2015. Washington State Department of Ecology. Publication No. 92-109, Revised January 2015. https://fortress.wa.gov/ecy/publications/documents/92109.pdf.
4. Ecology, Guidance for conducting mixing zone analysis (Appendix C, Water Quality Program *Permit Writer's Manual*. 2015). https://fortress.wa.gov/ecy/publications/parts/92109part1.pdf#page=27.
5. Kilpatrick, F.A., and E.D. Cobb, *Measurement of Discharge Using Tracers, Chapter A16, Techniques of Water-Resources Investigations of the USGS,*

Book 3, Application of Hydraulics, USGS, U.S. Department of the Interior, Reston, VA, 1985.

6. Wilson, J.F., E.D. Cobb, and F.A. Kilpatrick, *Fluorometric Procedures for Dye Tracing, Chapter A12. Techniques of Water-Resources Investigations of the USGS*, Book 3, Application of Hydraulics, USGS, U.S. Department of the Interior, Reston, VA, 1986.

S10. Outfall evaluation

The Permittee must inspect, once per permit term, the submerged portion of the outfall line and diffuser to document its integrity and continued function. If conditions allow for a photographic verification, the Permittee must include such verification in the report. By July 25, 2022, the Permittee must submit the inspection report to Ecology through the Water Quality Permitting Portal – Permit Submittals application. The Permittee must submit hard-copies of any video files to Ecology as required by Permit Condition S3.B. The Portal does not support submittal of video files.

The inspector must at a minimum:

- Assess the physical condition of the outfall pipe, diffuser, and associated couplings.
- Determine the extent of sediment accumulation in the vicinity of the diffuser.
- Ensure diffuser ports are free of obstructions and are allowing uniform flow.
- Confirm physical location (latitude/longitude) and depth (at MLLW) of the diffuser section of the outfall.

S11. Acute toxicity

S11.A. Effluent limit for acute toxicity

The effluent limit for acute toxicity is:

No acute toxicity detected in a test concentration representing the acute critical effluent concentration (ACEC).

The ACEC means the maximum concentration of effluent during critical conditions at the boundary of the acute mixing zone, defined in Section S1.B of this permit. The ACEC equals 6.6% effluent.

S11.B. Compliance with the effluent limit for acute toxicity

Compliance with the effluent limit for acute toxicity means the results of the testing specified in Section C show no statistically significant difference in survival between the control and the ACEC.

If the test results show a statistically significant difference in survival between the control and the ACEC, and Ecology had not determined the test result to be anomalous under Section D, and the test is otherwise valid, the result is a violation of the effluent limit for acute toxicity. The Permittee must immediately conduct the additional testing described in Section D.

The Permittee must determine the statistical significance by conducting a hypothesis test at the 0.05 level of significance (Appendix H, EPA/600/4-89/001). If the difference in survival between the control and the ACEC is less than 10%, the Permittee must conduct the hypothesis test at the 0.01 level of significance.

S11.C. Compliance testing for acute toxicity

The Permittee must:

1. Perform the acute toxicity tests with 100% effluent, the ACEC, and a control, or with a full dilution series.
2. Conduct quarterly acute toxicity testing on the final effluent. Testing must begin during the second quarter of 2018, occurring no later than June 30, 2018. Quarters means January through March, April through June, July through September, and October through December.
3. Submit a quarterly written report to Ecology no later than July 31, 2018. Each subsequent report is due on October 30th, January 30th, April 30th, and July 31st of each year. Further instructions on testing conditions and test report content are in Section E below.
4. The Permittee must perform compliance tests using each of the species and protocols listed below on a rotating basis:

Acute Toxicity Tests	Species	Method
Fathead minnow 96-hour static-renewal test	*Pimephales promelas*	EPA-821-R-02-012
Daphnid 48-hour static test	*Ceriodaphnia dubia, Daphnia pulex,* or *Daphnia magna*	EPA-821-R-02-012

S11.D. Response to noncompliance with the effluent limit for acute toxicity

If a toxicity test conducted under Section C determines a statistically significant difference in response between the ACEC and the control, using the statistical test described in Section B, the Permittee must begin additional testing within one week from the time of receiving the test results. The Permittee must:

1. Conduct one additional test each week for four consecutive weeks, using the same test and species as the failed compliance test.
2. Test at least five effluent concentrations and a control to determine appropriate point estimates. One of these effluent concentrations must equal the ACEC. The results of the test at the ACEC will determine compliance with the effluent limit for acute toxicity as described in Section B.
3. Return to the original monitoring frequency in Section C after completion of the additional compliance monitoring.

Anomalous test results: If a toxicity test conducted under Section C indicates noncompliance with the acute toxicity limit and the Permittee believes that the test result is anomalous, the Permittee may notify Ecology that the compliance test result may be anomalous. The Permittee may take one additional sample for

toxicity testing and wait for notification from Ecology before completing the additional testing. The Permittee must submit the notification with the report of the compliance test result and identify the reason for considering the compliance test result to be anomalous.

If Ecology determines that the test result was not anomalous, the Permittee must complete all of the additional monitoring required in this section. Or,

If the one additional sample fails to comply with the effluent limit for acute toxicity, then the Permittee must complete all of the additional monitoring required in this section. Or,

If Ecology determines that the test result was anomalous, the one additional test result will replace the anomalous test result for the purpose of determining compliance with the acute toxicity limit.

If all of the additional testing in S10.D.1 complies with the permit limit, the Permittee must submit a report to Ecology on possible causes and preventive measures for the transient toxicity event, which triggered the additional compliance monitoring. This report must include a search of all pertinent and recent facility records, including:

- Operating records
- Monitoring results
- Inspection records
- Spill reports
- Weather records
- Production records
- Raw material purchases
- Pretreatment records, etc.

If the additional testing in this section shows another violation of the acute toxicity limit, the Permittee must submit a Toxicity Identification/Reduction Evaluation (TI/RE) plan to Ecology within sixty (60) days after the sample date (WAC 173-205-100(2)).

S11.E. Sampling and reporting requirements

1. The Permittee must submit all reports for toxicity testing in accordance with the most recent version of Ecology Publication No. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*. Reports must contain toxicity data, bench sheets, and reference toxicant results for test methods. In addition, the Permittee must submit toxicity test data in electronic format (CETIS export file preferred) for entry into Ecology's database.

2. The Permittee must collect 24-hour composite effluent samples for toxicity testing. The Permittee must cool the samples to 0 - 6 degrees Celsius during collection and send them to the lab immediately upon completion. The lab must begin the toxicity testing as soon as possible but no later than 36 hours after sampling was completed.

3. The laboratory must conduct water quality measurements on all samples and test solutions for toxicity testing, as specified in the most recent version of Ecology Publication No. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*.
4. All toxicity tests must meet quality assurance criteria and test conditions specified in the most recent versions of the EPA methods listed in Subsection C and the Ecology Publication No. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*. If Ecology determines any test results to be invalid or anomalous, the Permittee must repeat the testing with freshly collected effluent.
5. The laboratory must use control water and dilution water meeting the requirements of the EPA methods listed in Section C or pristine natural water of sufficient quality for good control performance.
6. The Permittee must conduct whole effluent toxicity tests on an unmodified sample of final effluent.
7. The Permittee may choose to conduct a full dilution series test during compliance testing in order to determine dose response. In this case, the series must have a minimum of five effluent concentrations and a control. The series of concentrations must include the acute critical effluent concentration (ACEC). The ACEC equals 6.6% effluent.
8. All whole effluent toxicity tests, effluent screening tests, and rapid screening tests that involve hypothesis testing must comply with the acute statistical power standard of 29% as defined in WAC 173-205-020. If the test does not meet the power standard, the Permittee must repeat the test on a fresh sample with an increased number of replicates to increase the power.

S12. Chronic toxicity

S12.A. Testing when there is no permit limit for chronic toxicity

The Permittee must:

1. Conduct chronic toxicity testing on final effluent once in the last full summer (sampling should occur during June 2021-August 2021) and once in the last winter (sampling should occur during December 2021-February 2022) prior to submission of the application for permit renewal.
2. Conduct chronic toxicity testing on a series of at least five concentrations of effluent and a control. This series of dilutions must include the acute critical effluent concentration (ACEC). The ACEC equals 6.6% effluent. The series of dilutions should also contain the CCEC of 2.4% effluent.
3. Compare the ACEC to the control using hypothesis testing at the 0.05 level of significance as described in Appendix H, EPA/600/4-89/001.
4. Submit the results to Ecology by July 25, 2022.

5. Perform chronic toxicity tests with all of the following species and the most recent version of the following protocols:

Freshwater Chronic Test	Species	Method
Fathead minnow survival and growth	*Pimephales promelas*	EPA-821-R-02-013
Water flea survival and reproduction	*Ceriodaphnia dubia*	EPA-821-R-02-013

S12.B. Sampling and reporting requirements

1. The Permittee must submit all reports for toxicity testing in accordance with the most recent version of Ecology Publication No. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*. Reports must contain toxicity data, bench sheets, and reference toxicant results for test methods. In addition, the Permittee must submit toxicity test data in electronic format (CETIS export file preferred) for entry into Ecology's database.
2. The Permittee must collect 24-hour composite effluent samples for toxicity testing. The Permittee must cool the samples to 0 - 6 degrees Celsius during collection and send them to the lab immediately upon completion. The lab must begin the toxicity testing as soon as possible but no later than 36 hours after sampling was completed.
3. The laboratory must conduct water quality measurements on all samples and test solutions for toxicity testing, as specified in the most recent version of Ecology Publication No. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*.
4. All toxicity tests must meet quality assurance criteria and test conditions specified in the most recent versions of the EPA methods listed in Section A. and the Ecology Publication no. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*. If Ecology determines any test results to be invalid or anomalous, the Permittee must repeat the testing with freshly collected effluent.
5. The laboratory must use control water and dilution water meeting the requirements of the EPA methods listed in Subsection A or pristine natural water of sufficient quality for good control performance.
6. The Permittee must conduct whole effluent toxicity tests on an unmodified sample of final effluent.
7. The Permittee may choose to conduct a full dilution series test during compliance testing in order to determine dose response. In this case, the series must have a minimum of five effluent concentrations and a control. The series of concentrations must include the CCEC and the ACEC. The CCEC and the ACEC may either substitute for the effluent concentrations that are closest to them in the dilution series or be extra effluent concentrations. The CCEC equals 2.4% effluent. The ACEC equals 6.6% effluent.

8. All whole effluent toxicity tests that involve hypothesis testing must comply with the chronic statistical power standard of 39% as defined in WAC 173-205-020. If the test does not meet the power standard, the Permittee must repeat the test on a fresh sample with an increased number of replicates to increase the power.

General Conditions

G1. Signatory requirements

1. All applications submitted to Ecology must be signed and certified.

   a. In the case of corporations, by a responsible corporate officer. For the purpose of this section, a responsible corporate officer means:

      - A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions for the corporation, or
      - The manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long-term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

   b. In the case of a partnership, by a general partner.

   c. In the case of sole proprietorship, by the proprietor.

   d. In the case of a municipal, state, or other public facility, by either a principal executive officer or ranking elected official.

   Applications for permits for domestic wastewater facilities that are either owned or operated by, or under contract to, a public entity shall be submitted by the public entity.

2. All reports required by this permit and other information requested by Ecology must 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:

   a. The authorization is made in writing by a person described above and submitted to Ecology.

   b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)

3. Changes to authorization. If an authorization under paragraph G1.2, above, is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph G1.2, above, must be submitted to Ecology prior to or together with any reports, information, or applications to be signed by an authorized representative.

4. Certification. Any person signing a document under this section must 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 inspection and entry

The Permittee must allow an authorized representative of Ecology, upon the presentation of credentials and such other documents as may be required by law:

1. To enter upon the premises where a discharge is located or where any records must be kept under the terms and conditions of this permit.
2. To have access to and copy, at reasonable times and at reasonable cost, any records required to be kept under the terms and conditions of this permit.
3. To inspect, at reasonable times, any facilities, equipment (including monitoring and control equipment), practices, methods, or operations regulated or required under this permit.
4. To sample or monitor, at reasonable times, any substances or parameters at any location for purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act.

G3. Permit actions

This permit may be modified, revoked and reissued, or terminated either at the request of any interested person (including the Permittee) or upon Ecology's initiative. However, the permit may only be modified, revoked and reissued, or terminated for the reasons specified in 40 CFR 122.62, 40 CFR 122.64 or WAC 173-220-150 according to the procedures of 40 CFR 124.5.

1. The following are causes for terminating this permit during its term, or for denying a permit renewal application:
   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 determination that the permitted activity endangers human health or the environment, or contributes to water quality standards violations and can only be regulated to acceptable levels by permit modification or termination.

e. A change in any condition that requires either a temporary or permanent reduction, or elimination of any discharge or sludge use or disposal practice controlled by the permit.

f. Nonpayment of fees assessed pursuant to RCW 90.48.465.

g. Failure or refusal of the Permittee to allow entry as required in RCW 90.48.090.

2. The following are causes for modification but not revocation and reissuance except when the Permittee requests or agrees:

a. A material change in the condition of the waters of the state.

b. New information not available at the time of permit issuance that would have justified the application of different permit conditions.

c. Material and substantial alterations or additions to the permitted facility or activities which occurred after this permit issuance.

d. Promulgation of new or amended standards or regulations having a direct bearing upon permit conditions, or requiring permit revision.

e. The Permittee has requested a modification based on other rationale meeting the criteria of 40 CFR Part 122.62.

f. Ecology has determined that good cause exists for modification of a compliance schedule, and the modification will not violate statutory deadlines.

g. Incorporation of an approved local pretreatment program into a municipality's permit.

3. The following are causes for modification or alternatively revocation and reissuance:

a. When cause exists for termination for reasons listed in 1.a through 1,g of this section, and Ecology determines that modification or revocation and reissuance is appropriate.

b. When Ecology has received notification of a proposed transfer of the permit. A permit may also be modified to reflect a transfer after the effective date of an automatic transfer (General Condition G7) but will not be revoked and reissued after the effective date of the transfer except upon the request of the new Permittee.

G4. Reporting planned changes

The Permittee must, as soon as possible, but no later than one hundred eighty (180) days prior to the proposed changes, give notice to Ecology of planned physical alterations or additions to the permitted facility, production increases, or process modification which will result in:

1. The permitted facility being determined to be a new source pursuant to 40 CFR 122.29(b).

2. A significant change in the nature or an increase in quantity of pollutants discharged.

3. A significant change in the Permittee's sludge use or disposal practices. Following such notice, and the submittal of a new application or supplement to the existing application, along with required engineering plans and reports, this permit may be modified, or revoked and reissued pursuant to 40 CFR 122.62(a) to specify and limit any pollutants not previously limited. Until such modification is effective, any new or increased discharge in excess of permit limits or not specifically authorized by this permit constitutes a violation.

G5. Plan review required

Prior to constructing or modifying any wastewater control facilities, an engineering report and detailed plans and specifications must be submitted to Ecology for approval in accordance with chapter 173-240 WAC. Engineering reports, plans, and specifications must be submitted at least one hundred eighty (180) days prior to the planned start of construction unless a shorter time is approved by Ecology. Facilities must be constructed and operated in accordance with the approved plans.

G6. Compliance with other laws and statutes

Nothing in this permit excuses the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

G7. Transfer of this permit

In the event of any change in control or ownership of facilities from which the authorized discharge emanate, the Permittee must notify the succeeding owner or controller of the existence of this permit by letter, a copy of which must be forwarded to Ecology.

1. Transfers by Modification

   Except as provided in paragraph (2) below, this permit may be transferred by the Permittee to a new owner or operator only if this permit has been modified or revoked and reissued under 40 CFR 122.62(b)(2), or a minor modification made under 40 CFR 122.63(d), to identify the new Permittee and incorporate such other requirements as may be necessary under the Clean Water Act.

2. Automatic Transfers

   This permit may be automatically transferred to a new Permittee if:

   a. The Permittee notifies Ecology at least thirty (30) days in advance of the proposed transfer date.

   b. The notice includes a written agreement between the existing and new Permittees containing a specific date transfer of permit responsibility, coverage, and liability between them.

   c. Ecology does not notify the existing Permittee and the proposed new Permittee of its intent to modify or revoke and reissue this permit. A modification under this subparagraph may also be minor modification under 40 CFR 122.63. If this notice is not received, the transfer is effective on the date specified in the written agreement.

G8. Reduced production for compliance

The Permittee, in order to maintain compliance with its permit, must control production and/or all discharges upon reduction, loss, failure, or bypass of the treatment facility until the facility is restored or an alternative method of treatment is provided. This requirement applies in the situation where, among other things, the primary source of power of the treatment facility is reduced, lost, or fails.

G9. Removed substances

Collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters must not be resuspended or reintroduced to the final effluent stream for discharge to state waters.

G10. Duty to provide information

The Permittee must submit to Ecology, within a reasonable time, all information which Ecology may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Permittee must also submit to Ecology upon request, copies of records required to be kept by this permit.

G11. Other requirements of 40 CFR

All other requirements of 40 CFR 122.41 and 122.42 are incorporated in this permit by reference.

G12. Additional monitoring

Ecology may establish specific monitoring requirements in addition to those contained in this permit by administrative order or permit modification.

G13. Payment of fees

The Permittee must submit payment of fees associated with this permit as assessed by Ecology.

G14. Penalties for violating permit conditions

Any person who is found guilty of willfully violating the terms and conditions of this permit is deemed guilty of a crime, and upon conviction thereof shall be punished by a fine of up to ten thousand dollars ($10,000) 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 may incur, in addition to any other penalty as provided by law, a civil penalty in the amount of up to ten thousand dollars ($10,000) for every such violation. Each and every such violation is a separate and distinct offense, and in case of a continuing violation, every day's continuance is deemed to be a separate and distinct violation.

G15. Upset

Definition – "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limits because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limits if the requirements of the following paragraph are met.

A Permittee who wishes to establish the affirmative defense of upset must demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

1. An upset occurred and that the Permittee can identify the cause(s) of the upset.
2. The permitted facility was being properly operated at the time of the upset.
3. The Permittee submitted notice of the upset as required in Special Condition S3.F.
4. The Permittee complied with any remedial measures required under S3.F of this permit.

In any enforcement action the Permittee seeking to establish the occurrence of an upset has the burden of proof.

G16. Property rights

This permit does not convey any property rights of any sort, or any exclusive privilege.

G17. Duty to comply

The Permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

G18. Toxic pollutants

The Permittee must comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if this permit has not yet been modified to incorporate the requirement.

G19. Penalties for tampering

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than two (2) years per violation, or by both. If a conviction of a person is for a violation committed after a first conviction of such

person under this condition, punishment shall be a fine of not more than $20,000 per day of violation, or by imprisonment of not more than four (4) years, or by both.

G20. Compliance schedules

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit must be submitted no later than fourteen (14) days following each schedule date.

G21. Service agreement review

The Permittee must submit to Ecology any proposed service agreements and proposed revisions or updates to existing agreements for the operation of any wastewater treatment facility covered by this permit. The review is to ensure consistency with chapters 90.46 and 90.48 RCW as required by RCW 70.150.040(9). In the event that Ecology does not comment within a thirty-day (30) period, the Permittee may assume consistency and proceed with the service agreement or the revised/updated service agreement.

Appendix A

LIST OF POLLUTANTS WITH ANALYTICAL METHODS, DETECTION LIMITS AND QUANTITATION LEVELS

The Permittee must use the specified analytical methods, detection limits (DLs) and quantitation levels (QLs) in the following table for permit and application required monitoring unless:

- Another permit condition specifies other methods, detection levels, or quantitation levels.
- The method used produces measurable results in the sample and EPA has listed it as an EPA-approved method in 40 CFR Part 136.

If the Permittee uses an alternative method, not specified in the permit and as allowed above, it must report the test method, DL, and QL on the discharge monitoring report or in the required report.

If the Permittee is unable to obtain the required DL and QL in its effluent due to matrix effects, the Permittee must submit a matrix-specific detection limit (MDL) and a quantitation limit (QL) to Ecology with appropriate laboratory documentation.

When the permit requires the Permittee to measure the base neutral compounds in the list of priority pollutants, it must measure all of the base neutral pollutants listed in the table below. The list includes EPA required base neutral priority pollutants and several additional polynuclear aromatic hydrocarbons (PAHs). The Water Quality Program added several PAHs to the list of base neutrals below from Ecology's Persistent Bioaccumulative Toxics (PBT) List. It only added those PBT parameters of interest to Appendix A that did not increase the overall cost of analysis unreasonably.

Ecology added this appendix to the permit in order to reduce the number of analytical "non-detects" in permit-required monitoring and to measure effluent concentrations near or below criteria values where possible at a reasonable cost.

The lists below include conventional pollutants (as defined in CWA section 502(6) and 40 CFR Part 122.), toxic or priority pollutants as defined in CWA section 307(a)(1) and listed in 40 CFR Part 122 Appendix D, 40 CFR Part 401.15 and 40 CFR Part 423 Appendix A), and nonconventionals. 40 CFR Part 122 Appendix D (Table V) also identifies toxic pollutants and hazardous substances which are required to be reported by dischargers if expected to be present. This permit appendix A list does not include those parameters.

CONVENTIONAL POLLUTANTS

Pollutant	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL) [2] *µg/L unless specified*
Biochemical Oxygen Demand		SM5210-B		2 mg/L
Biochemical Oxygen Demand, Soluble		SM5210-B [3]		2 mg/L
Fecal Coliform		SM 9221E,9222	N/A	Specified in method - sample aliquot dependent
Oil and Grease (HEM) (Hexane Extractable Material)		1664 A or B	1,400	5,000
pH		SM4500-H^+ B	N/A	N/A
Total Suspended Solids		SM2540-D		5 mg/L

NONCONVENTIONAL POLLUTANTS

Pollutant & CAS No. (if available)	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL)[1] µg/L unless specified	Quantitation Level (QL)[2] µg/L unless specified
Alkalinity, Total		SM2320-B		5 mg/L as CaCO3
Aluminum, Total	7429-90-5	200.8	2.0	10
Ammonia, Total (as N)		SM4500-NH3-B and C/D/E/G/H		20
Barium Total	7440-39-3	200.8	0.5	2.0
BTEX (benzene +toluene + ethylbenzene + m,o,p xylenes)		EPA SW 846 8021/8260	1	2
Boron, Total	7440-42-8	200.8	2.0	10.0
Chemical Oxygen Demand		SM5220-D		10 mg/L
Chloride		SM4500-Cl B/C/D/E and SM4110 B		Sample and limit dependent
Chlorine, Total Residual		SM4500 Cl G		50.0
Cobalt, Total	7440-48-4	200.8	0.05	0.25
Color		SM2120 B/C/E		10 color units
Dissolved oxygen		SM4500-OC/OG		0.2 mg/L
Flow		Calibrated device		
Fluoride	16984-48-8	SM4500-F E	25	100
Hardness, Total		SM2340B		200 as CaCO3
Iron, Total	7439-89-6	200.7	12.5	50
Magnesium, Total	7439-95-4	200.7	10	50
Manganese, Total	7439-96-5	200.8	0.1	0.5
Molybdenum, Total	7439-98-7	200.8	0.1	0.5
Nitrate + Nitrite Nitrogen (as N)		SM4500-NO3- E/F/H		100
Nitrogen, Total Kjeldahl (as N)		SM4500-N_{org}B/C and SM4500NH_3-B/C/D/EF/G/H		300
NWTPH Dx [4]		Ecology NWTPH Dx	250	250
NWTPH Gx [5]		Ecology NWTPH Gx	250	250

NONCONVENTIONAL POLLUTANTS

Pollutant & CAS No. (if available)	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL)[1] µg/L unless specified	Quantitation Level (QL)[2] µg/L unless specified
Phosphorus, Total (as P)		SM 4500 PB followed by SM4500-PE/PF	3	10
Salinity		SM2520-B		3 practical salinity units or scale (PSU or PSS)
Settleable Solids		SM2540 -F		Sample and limit dependent
Soluble Reactive Phosphorus (as P)		SM4500-P E/F/G	3	10
Sulfate (as mg/L SO_4)		SM4110-B		0.2 mg/L
Sulfide (as mg/L S)		SM4500-S^2F/D/E/G		0.2 mg/L
Sulfite (as mg/L SO_3)		SM4500-SO3B		2 mg/L
Temperature (max. 7-day avg.)		Analog recorder or Use micro-recording devices known as thermistors		0.2º C
Tin, Total	7440-31-5	200.8	0.3	1.5
Titanium, Total	7440-32-6	200.8	0.5	2.5
Total Coliform		SM 9221B, 9222B, 9223B	N/A	Specified in method - sample aliquot dependent
Total Organic Carbon		SM5310-B/C/D		1 mg/L
Total dissolved solids		SM2540 C		20 mg/L

PRIORITY POLLUTANTS	PP #	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
METALS, CYANIDE & TOTAL PHENOLS					
Antimony, Total	114	7440-36-0	200.8	0.3	1.0
Arsenic, Total	115	7440-38-2	200.8	0.1	0.5
Beryllium, Total	117	7440-41-7	200.8	0.1	0.5
Cadmium, Total	118	7440-43-9	200.8	0.05	0.25
Chromium (hex) dissolved	119	18540-29-9	SM3500-Cr C	0.3	1.2
Chromium, Total	119	7440-47-3	200.8	0.2	1.0
Copper, Total	120	7440-50-8	200.8	0.4	2.0
Lead, Total	122	7439-92-1	200.8	0.1	0.5
Mercury, Total	123	7439-97-6	1631E	0.0002	0.0005
Nickel, Total	124	7440-02-0	200.8	0.1	0.5
Selenium, Total	125	7782-49-2	200.8	1.0	1.0
Silver, Total	126	7440-22-4	200.8	0.04	0.2
Thallium, Total	127	7440-28-0	200.8	0.09	0.36
Zinc, Total	128	7440-66-6	200.8	0.5	2.5
Cyanide, Total	121	57-12-5	335.4	5	10
Cyanide, Weak Acid Dissociable	121		SM4500-CN I	5	10
Cyanide, Free Amenable to Chlorination (Available Cyanide)	121		SM4500-CN G	5	10
Phenols, Total	65		EPA 420.1		50

PRIORITY POLLUTANTS	PP #	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
ACID COMPOUNDS					
2-Chlorophenol	24	95-57-8	625.1	3.3	9.9
2,4-Dichlorophenol	31	120-83-2	625.1	2.7	8.1
2,4-Dimethylphenol	34	105-67-9	625.1	2.7	8.1
4,6-dinitro-o-cresol (2-methyl-4,6,-dinitrophenol)	60	534-52-1	625.1/1625B	24	72
2,4 dinitrophenol	59	51-28-5	625.1	42	126
2-Nitrophenol	57	88-75-5	625.1	3.6	10.8
4-Nitrophenol	58	100-02-7	625.1	2.4	7.2
Parachlorometa cresol (4-chloro-3-methylphenol)	22	59-50-7	625.1	3.0	9.0
Pentachlorophenol	64	87-86-5	625.1	3.6	10.8
Phenol	65	108-95-2	625.1	1.5	4.5
2,4,6-Trichlorophenol	21	88-06-2	625.1	2.7	8.1

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL) [2] *µg/L unless specified***
VOLATILE COMPOUNDS					
Acrolein	2	107-02-8	624	5	10
Acrylonitrile	3	107-13-1	624	1.0	2.0
Benzene	4	71-43-2	624.1	4.4	13.2
Bromoform	47	75-25-2	624.1	4.7	14.1
Carbon tetrachloride	6	56-23-5	624.1/601 or SM6230B	2.8	8.4
Chlorobenzene	7	108-90-7	624.1	6.0	18.0
Chloroethane	16	75-00-3	624/601	1.0	2.0
2-Chloroethylvinyl Ether	19	110-75-8	624	1.0	2.0
Chloroform	23	67-66-3	624.1 or SM6210B	1.6	4.8
Dibromochloromethane (chlordibromomethane)	51	124-48-1	624.1	3.1	9.3
1,2-Dichlorobenzene	25	95-50-1	624	1.9	7.6
1,3-Dichlorobenzene	26	541-73-1	624	1.9	7.6
1,4-Dichlorobenzene	27	106-46-7	624	4.4	17.6
Dichlorobromomethane	48	75-27-4	624.1	2.2	6.6
1,1-Dichloroethane	13	75-34-3	624.1	4.7	14.1
1,2-Dichloroethane	10	107-06-2	624.1	2.8	8.4
1,1-Dichloroethylene	29	75-35-4	624.1	2.8	8.4
1,2-Dichloropropane	32	78-87-5	624.1	6.0	18.0
1,3-dichloropropene (mixed isomers) (1,2-dichloropropylene) [6]	33	542-75-6	624.1	5.0	15.0
Ethylbenzene	38	100-41-4	624.1	7.2	21.6
Methyl bromide (Bromomethane)	46	74-83-9	624/601	5.0	10.0
Methyl chloride (Chloromethane)	45	74-87-3	624	1.0	2.0
Methylene chloride	44	75-09-2	624.1	2.8	8.4
1,1,2,2-Tetrachloroethane	15	79-34-5	624.1	6.9	20.7
Tetrachloroethylene	85	127-18-4	624.1	4.1	12.3
Toluene	86	108-88-3	624.1	6.0	18.0
1,2-Trans-Dichloroethylene (Ethylene dichloride)	30	156-60-5	624.1	1.6	4.8
1,1,1-Trichloroethane	11	71-55-6	624.1	3.8	11.4
1,1,2-Trichloroethane	14	79-00-5	624.1	5.0	15.0
Trichloroethylene	87	79-01-6	624.1	1.9	5.7
Vinyl chloride	88	75-01-4	624/SM6200B	1.0	2.0

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL) [2] *µg/L unless specified***
BASE/NEUTRAL COMPOUNDS (compounds in bold are Ecology PBTs)					
Acenaphthene	1	83-32-9	625.1	1.9	5.7
Acenaphthylene	77	208-96-8	625.1	3.5	10.5
Anthracene	78	120-12-7	625.1	1.9	5.7
Benzidine	5	92-87-5	625.1	44	132
Benzyl butyl phthalate	67	85-68-7	625.1	2.5	7.5
Benzo(*a*)anthracene	72	56-55-3	625.1	7.8	23.4
Benzo(b)fluoranthene (3,4-benzofluoranthene) [7]	74	205-99-2	610/625.1	4.8	14.4
Benzo(j)fluoranthene [7]		**205-82-3**	625	0.5	1.0
Benzo(k)fluoranthene (11,12-benzofluoranthene) [7]	75	207-08-9	610/625.1	2.5	7.5
Benzo(r,s,t)pentaphene		**189-55-9**	625	1.3	5.0
Benzo(*a*)pyrene	73	50-32-8	610/625.1	2.5	7.5
Benzo(*ghi*)Perylene	79	191-24-2	610/625.1	4.1	12.3
Bis(*2-chloroethoxy)*methane	43	111-91-1	625.1	5.3	15.9
Bis(*2-chloroethyl*)ether	18	111-44-4	611/625.1	5.7	17.1
Bis(*2-chloroisopropyl*)ether	42	39638-32-9	625	0.5	1.0
Bis(*2-ethylhexyl*)phthalate	66	117-81-7	625.1	2.5	7.5
4-Bromophenyl phenyl ether	41	101-55-3	625.1	1.9	5.7
2-Chloronaphthalene	20	91-58-7	625.1	1.9	5.7
4-Chlorophenyl phenyl ether	40	7005-72-3	625.1	4.2	12.6
Chrysene	76	218-01-9	610/625.1	2.5	7.5
Dibenzo (a,h)acridine		**226-36-8**	610M/625M	2.5	10.0
Dibenzo (a,j)acridine		**224-42-0**	610M/625M	2.5	10.0
Dibenzo(a-*h*)anthracene (1,2,5,6-dibenzanthracene)	82	53-70-3	625.1	2.5	7.5
Dibenzo(a,e)pyrene		192-65-4	610M/625M	2.5	10.0
Dibenzo(a,h)pyrene		189-64-0	625M	2.5	10.0
3,3-Dichlorobenzidine	28	91-94-1	605/625.1	16.5	49.5
Diethyl phthalate	70	84-66-2	625.1	1.9	5.7
Dimethyl phthalate	71	131-11-3	625.1	1.6	4.8
Di-n-butyl phthalate	68	84-74-2	625.1	2.5	7.5
2,4-dinitrotoluene	35	121-14-2	609/625.1	5.7	17.1
2,6-dinitrotoluene	36	606-20-2	609/625.1	1.9	5.7
Di-n-octyl phthalate	69	117-84-0	625.1	2.5	7.5
1,2-Diphenylhydrazine (*as Azobenzene*)	37	122-66-7	1625B	5.0	20
Fluoranthene	39	206-44-0	625.1	2.2	6.6
Fluorene	80	86-73-7	625.1	1.9	5.7
Hexachlorobenzene	9	118-74-1	612/625.1	1.9	5.7
Hexachlorobutadiene	52	87-68-3	625.1	0.9	2.7
Hexachlorocyclopentadiene	53	77-47-4	1625B/625	2.0	4.0
Hexachloroethane	12	67-72-1	625.1	1.6	4.8
Indeno(*1,2,3-cd*)Pyrene	83	193-39-5	610/625.1	3.7	11.1
Isophorone	54	78-59-1	625.1	2.2	6.6
3-Methyl cholanthrene		**56-49-5**	625	2.0	8.0

PRIORITY POLLUTANTS	PP #	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL) [2] *µg/L unless specified*
BASE/NEUTRAL COMPOUNDS (compounds in bold are Ecology PBTs)					
Naphthalene	55	91-20-3	625.1	1.6	4.8
Nitrobenzene	56	98-95-3	625.1	1.9	5.7
N-Nitrosodimethylamine	61	62-75-9	607/625	2.0	4.0
N-Nitrosodi-n-propylamine	63	621-64-7	607/625	0.5	1.0
N-Nitrosodiphenylamine	62	86-30-6	625	1.0	2.0
Perylene		**198-55-0**	625	1.9	7.6
Phenanthrene	81	85-01-8	625.1	5.4	16.2
Pyrene	84	129-00-0	625.1	1.9	5.7
1,2,4-Trichlorobenzene	8	120-82-1	625.1	1.9	5.7

PRIORITY POLLUTANT	PP #	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL) [2] *µg/L unless specified*
DIOXIN					
2,3,7,8-Tetra-Chlorodibenzo-P-Dioxin (2,3,7,8 TCDD)	129	1746-01-6	1613B	1.3 pg/L	5 pg/L

PRIORITY POLLUTANTS	PP #	CAS Number (if available)	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL) [2] *µg/L unless specified*
PESTICIDES/PCBs					
Aldrin	89	309-00-2	608.3	4.0 ng/L	12 ng/L
alpha-BHC	102	319-84-6	608.3	3.0 ng/L	9.0 ng/L
beta-BHC	103	319-85-7	608.3	6.0 ng/L	18 ng/L
gamma-BHC (Lindane)	104	58-89-9	608.3	4.0 ng/L	12 ng/L
delta-BHC	105	319-86-8	608.3	9.0 ng/L	27 ng/L
Chlordane [8]	91	57-74-9	608.3	14 ng/L	42 ng/L
4,4'-DDT	92	50-29-3	608.3	12 ng/L	36 ng/L
4,4'-DDE	93	72-55-9	608.3	4.0 ng/L	12 ng/L
4,4' DDD	94	72-54-8	608.3	11ng/L	33 ng/L
Dieldrin	90	60-57-1	608.3	2.0 ng/L	6.0 ng/L
alpha-Endosulfan	95	959-98-8	608.3	14 ng/L	42 ng/L
beta-Endosulfan	96	33213-65-9	608.3	4.0 ng/L	12 ng/L
Endosulfan Sulfate	97	1031-07-8	608.3	66 ng/L	198 ng/L
Endrin	98	72-20-8	608.3	6.0 ng/L	18 ng/L
Endrin Aldehyde	99	7421-93-4	608.3	23 ng/L	70 ng/L
Heptachlor	100	76-44-8	608.3	3.0 ng/L	9.0 ng/L
Heptachlor Epoxide	101	1024-57-3	608.3	83 ng/L	249 ng/L
PCB-1242 [9]	106	53469-21-9	608.3	0.065	0.095
PCB-1254	107	11097-69-1	608.3	0.065	0.095
PCB-1221	108	11104-28-2	608.3	0.065	0.095
PCB-1232	109	11141-16-5	608.3	0.065	0.095
PCB-1248	110	12672-29-6	608.3	0.065	0.095
PCB-1260	111	11096-82-5	608.3	0.065	0.095

PRIORITY POLLUTANTS	**PP #**	**CAS Number (if available)**	**Recommended Analytical Protocol**	**Detection (DL)[1] *µg/L unless specified***	**Quantitation Level (QL) [2] *µg/L unless specified***
PESTICIDES/PCBs					
PCB-1016 [9]	112	12674-11-2	608.3	0.065	0.095
Toxaphene	113	8001-35-2	608.3	240 ng/L	720 ng/L

1. Detection level (DL) or detection limit means the minimum concentration of an analyte (substance) that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero as determined by the procedure given in 40 CFR part 136, Appendix B.

2. Quantitation Level (QL) also known as Minimum Level of Quantitation (ML) – The lowest level at which the entire analytical system must give a recognizable signal and acceptable calibration point for the analyte. It is equivalent to the concentration of the lowest calibration standard, assuming that the lab has used all method-specified sample weights, volumes, and cleanup procedures. The QL is calculated by multiplying the MDL by 3.18 and rounding the result to the number nearest to (1, 2, or 5) x 10^n, where n is an integer. (64 FR 30417).
   ALSO GIVEN AS:
   The smallest detectable concentration of analyte greater than the Detection Limit (DL) where the accuracy (precision & bias) achieves the objectives of the intended purpose. (Report of the Federal Advisory Committee on Detection and Quantitation Approaches and Uses in Clean Water Act Programs Submitted to the US Environmental Protection Agency December 2007).

3. Soluble Biochemical Oxygen Demand method note: First, filter the sample through a Millipore Nylon filter (or equivalent) - pore size of 0.45-0.50 um (prep all filters by filtering 250 ml of laboratory grade deionized water through the filter and discard). Then, analyze sample as per method 5210-B.

4. NWTPH Dx - Northwest Total Petroleum Hydrocarbons Diesel Extended Range – see http://www.ecy.wa.gov/biblio/97602.html

5. NWTPH Gx - Northwest Total Petroleum Hydrocarbons Gasoline Extended Range – see http://www.ecy.wa.gov/biblio/97602.html

6. 1, 3-dichloroproylene (mixed isomers) You may report this parameter as two separate parameters: cis-1, 3-dichlorpropropene (10061-01-5) and trans-1, 3-dichloropropene (10061-02-6).

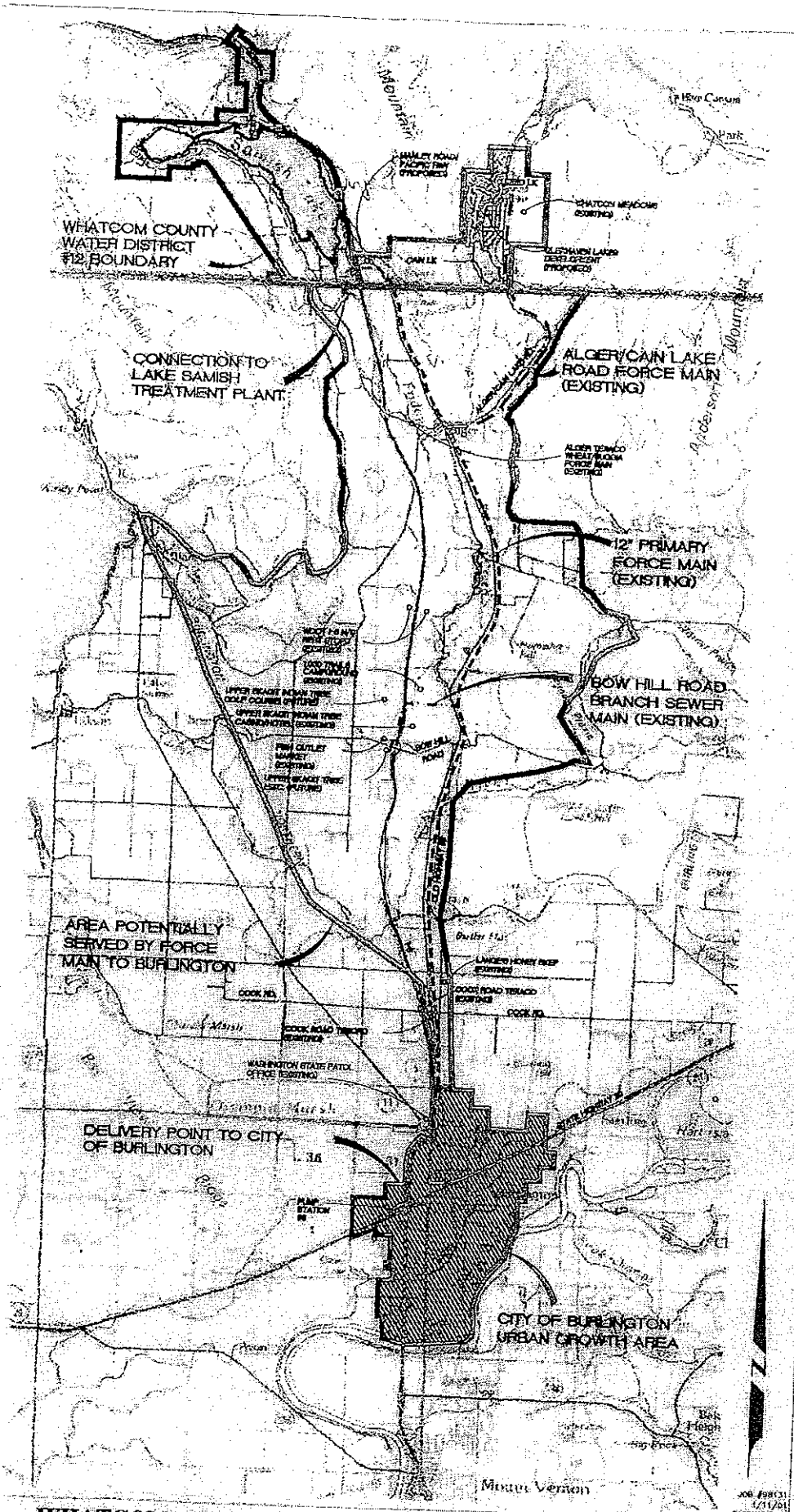
7. Total Benzofluoranthenes - Because Benzo(b)fluoranthene, Benzo(j)fluoranthene and Benzo(k)fluoranthene co-elute you may report these three isomers as total benzofluoranthenes.

8. Chlordane – You may report alpha-chlordane (5103-71-9) and gamma-chlordane (5103-74-2) in place of chlordane (57-74-9). If you report alpha and gamma-chlordane, the DL/PQLs that apply are 14/42 ng/L.

9. PCB 1016 & PCB 1242 – You may report these two PCB compounds as one parameter called PCB 1016/1242.

APPENDIX C

SAMISH WATER DISTRICT CUSTOMERS AND MAP



WHATCOM COUNTY WATER DISTRICT NO. 12

Sewer Force Main Map - Lake Samish to City of Burlington WWTP

EXHIBIT

SAMISH WATER DISTRICT
BURLINGTON FORCE MAIN

Prepared by: E.A. Sterling, Wilson Engineering LLC
Prepared on: 03/23/2010
Prepared for: City of Burlington, Gray and Osborne, Inc.
Supporting City of Burlington Rebuild of Burlington PS #6

SUMMARY OF WASTEWATER FLOWS

Burlington Force Main – Listing of Wastewater Sources	Rated Pump Station Capacity or Customer Flow Rate
• **Samish WD Treatment Lagoon PS #4**	700 gpm @ 53-ft TDH
• **Whatcom Meadows PS #9**	242 gpm @ 137-ft TDH
• **Alger PS #10**	84 gpm @ 78-ft TDH
• **Thousand Trails PS #11**	276 gpm @ 51-ft TDH
• **Skagit Speedway PS #16**	95 gpm @ 25-ft TDH
• **Upper Skagit Tribe PS #17**	495 gpm @ 29-ft TDH
• **Upper Skagit Tribe PS #18**	230 gpm @ 40-ft TDH
• **Burlington FM Customers (not covered by above pump stations)**	17 each Commercial & 80 each Residential Customers

Samish WD Treatment Lagoon PS #4

- Samish WD pumps daily from PS#4 during the off-peak hours of 10pm to 2am.
- Average daily flow currently varies from 0.80 to 1.20 Mgd.
- Per the current agreement with the City of Burlington, the District has a total contractual capacity reserve of 250,000 gpd.

Whatcom Meadows PS #9

- Whatcom Meadows PS #9 services Whatcom Meadows Campground, a residential campground facility in Whatcom County near Cain Lake and Reed Lake.
- Whatcom Meadows currently contracts with the District for 250 LUEs or 46,250 gpd of sewer service.

Alger PS #10

- Alger PS #10 services the Alger Shell (I-5 Exit 240) and the Alger Storage Facility.
- The facilities feeding into Alger PS #10 currently contract with the District for 9 LUEs or 1,665 gpd of sewer service.

Thousand Trails PS #11

- Thousand Trails PS #11 lifts wastewater from Thousand Trails Campground and the WSDOT I-5 Rest Areas north of Bow Hill Road to the Burlington Force Main via District's Bow Hill Gravity Main.
- Thousand Trails Campground currently contracts with the District for 47 LUEs or 8,695 gpd of sewer service.
- WSDOT currently contracts with the District for 2 LUEs or 370 gpd of sewer service.

Skagit Speedway PS #16

- The Skagit Speedway PS #16 services only Skagit Speedway flows which peak during race season (May to September) on Friday through Sunday nights.
- Skagit Speedway currently contracts with the District for 3 LUEs or 555 gpd of sewer service.

Upper Skagit Tribe PS #17 & #18

- Upper Skagit Tribe PS #17 lifts wastewater from the Skagit Casino to the Burlington Force Main via the District's Bow Hill Gravity Main.
- The Upper Skagit Tribe PS #18 lifts wastewater from the Tribe's installation south of Bow Hill Road to the Burlington Force Main via the District's Bow Hill Gravity Main.
- The Upper Skagit Tribe currently contracts with the District to transport a maximum flow of 60,000 gpd.

Burlington FM Customers (not covered by PS #9 – PS #18)

- There are 17 each commercial customers connected to the Burlington Force Main which are not covered by PS #9 through PS #18.

COMMERCIAL CUSTOMER NAME	ADDRESS
– Alger Food Mart	2180 Old Highway 99 N. Road, Burlington
– Samish Fish Hatchery	5585 Old Highway 99 N. Road, Burlington
– Washington State Patrol	10945 Chuckanut Drive, Burlington
– Fairfield Inn	9384 Old Highway 99 N. Road, Burlington
– Jack-in-the-Box, Inc.	9408 Old Highway 99 N. Road, Burlington
– Larson Cook Road LLC	9596 Old Highway 99 N. Road, Burlington
– Whispering Firs Alger LLC	1745 Old Highway 99 N. Road, Burlington
– Grant Springer	1693 Old Highway 99 N. Road, Burlington
– Alger Christian Reform Church	1475 Silver Run Lane, Bellingham
– Mike Roeter	9596 Old Highway 99 N. Road, Burlington
– Alger Bar & Grille	1758 Old Highway 99 N. Road, Burlington
– Cook Road Shell	9440 Old Highway 99 N. Road, Burlington
– Kesselring Gun Shop	4024 Old Highway 99 N. Road, Burlington
– Gas & Go 76	9572 Old Highway 99 N. Road, Burlington
– Lang's Honey Shop	18898 Dahlstedt Rd., Burlington
– Associated Petroleum Products	9552 Old Highway 99 N. Road, Burlington
– Robert Smith	Old Highway 99 N. Road, Burlington

- There are eighty (80) residential customers connected to the Burlington Force Main which are not covered by PS #9 through PS #18.

APPENDIX D

DISCHARGE MONTHLY REPORTS

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
1/1/2016	1.648			256	3519				9	124	96	2						6.8	
1/2/2016	1.546			184	2372				9	116	95							6.7	
1/3/2016	1.565			204	2663				8	104	96							6.7	
1/4/2016	1.573	217	2847	224	2939	7	92	97	6	79	97	2						6.9	
1/5/2016	1.517			284	3593				8	101	97	7						6.8	
1/6/2016	1.523	265	3366	216	2744	8	102	97	3	38	99	8						7	
1/7/2016	1.641			300	4106				5	68	98	42						6.8	
1/8/2016	1.468	350	4285	272	3330	12	147	97	4	49	99	6						6.8	
1/9/2016	1.449			576	6961				7	85	99							6.8	
1/10/2016	1.413			228	2687				6	71	97							6.7	
1/11/2016	1.411	358	4213	204	2401	9	106	97	6	71	97	13						6.6	
1/12/2016	1.407			292	3426				4	47	99	4	20.2	0.436	0.07	2.16	20.7	6.8	
1/13/2016	1.478	267	3291	236	2909	10	123	96	7	86	97	104						6.8	
1/14/2016	1.56			260	3383				8	104	97	112						7	
1/15/2016	1.247	339	3526	256	2662	9	94	97	4	42	98	8						7.1	
1/16/2016	1.294			332	3583				3	32	99							7	
1/17/2016	1.515			316	3993				2	25	99							6.9	
1/18/2016	1.325			220	2431				3	33	99	2						6.9	
1/19/2016	1.442	316	3800	252	3031	7	84	98	6	72	98	23						6.5	
1/20/2016	1.318	242	2660	232	2550	8	88	97	5	55	98	8						6.6	
1/21/2016	1.518			248	3140				7	89	97	3						6.9	
1/22/2016	1.419	210	2485	256	3030	5	59	98	8	95	97	21						7	
1/23/2016	1.710			376	5362				9	128	98							6.9	
1/24/2016	1.973			228	3752				12	197	95							6.9	
1/25/2016	1.641	173	2368	148	2026	6	82	97	5	68	97	4						6.7	
1/26/2016	1.538			200	2565				7	90	97	19						6.6	
1/27/2016	1.674	256	3574	276	3853	6	84	98	6	84	98	2						6.4	
1/28/2016	1.555			288	3735				5	65	98	12						6.5	
1/29/2016	1.562	260	3387	216	2814	7	91	97	8	104	96	11						6.9	
1/30/2016	1.773			256	3785				9	133	96							6.7	
1/31/2016	1.802			252	3787				8	120	97							6.6	
2/1/2016	1.763	249	3661	208	3058	6.1	90	98	5	74	98	8						6.6	
2/2/2016	1.715			240	3433				8	114	97	5						6.6	
2/3/2016	1.534	214	2738	232	2968	6	77	97	5	64	98	7						6.6	
2/4/2016	1.559			252	3277				7	91	97	9						6.5	
2/5/2016	1.62	263	3553	280	3783	8	108	97	8	108	97	4						6.7	
2/6/2016	1.633			308	4195				9	123	97							6.8	
2/7/2016	1.597			188	2504				7	93	96							6.8	
2/8/2016	1.563	184	2399	204	2659	7	91	96	8	104	96	1						6.7	
2/9/2016	1.531			168	2145				7	89	96	1						6.7	
2/10/2016	1.48	240	2962	300	3703	8	99	97	10	123	97	22						6.8	
2/11/2016	1.543			240	3088				9	116	96	18	23.4	0.494	0.08	1.32	26.9	6.8	
2/12/2016	1.652	289	3982	280	3858	12	165	96	13	179	95	10						6.8	
2/13/2016	2.000			276	4604				19	317	93							6.7	
2/14/2016	1.986			216	3578				16	265	93							6.6	
2/15/2016	2.18			176	3200				19	345	89	200						6.6	
2/16/2016	2.632	134	2941	160	3512	22	483	84	53	1163	67	77						6.5	
2/17/2016	2.456	151	3093	200	4097	7	143	95	9	184	96	7						6.5	
2/18/2016	2.396			216	4316				7	140	97	15						6.8	
2/19/2016	2.278	195	3705	180	3420	5	95	97	4	76	98	12						6.4	
2/20/2016	2.283			240	4570				7	133	97							6.8	
2/21/2016	2.189			188	3432				9	164	95							6.8	
2/22/2016	2.161			120	2163				7	126	94	11						6.6	
2/23/2016	2.059	233	4001	280	4808	4	69	98	6	103	98	2						6.7	
2/24/2016	1.999	246	4101	220	3668	5	83	98	5	83	98	2						6.5	
2/25/2016	1.921			292	4678				6	96	98	11						6.8	
2/26/2016	1.891	231	3643	252	3974	4	63	98	3	47	99	6						6.4	
2/27/2016	1.835			288	4408				3	46	99							6.6	
2/28/2016	1.809			228	3440				4	60	98							6.7	
2/29/2016	1.843	201	3089	188	2890	3	46	99	3	46	98	5						6.7	
3/1/2016	1.804			304	4574				3	45	99	11						6.3	
3/2/2016	1.820			200	3036				3	46	99	5						6.6	
3/3/2016	1.817	186	2819	264	4001	4	61	98	2	30	99	2						6.5	
3/4/2016	1.736	210	3040	232	3359	4	58	98	3	43	99	3						6.5	
3/5/2016	1.753			332	4854				4	58	99							6.6	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
3/6/2016	1.730			192	2770				3	43	98							6.6	
3/7/2016	1.735	195	2822	192	2778	2	29	99	3	43	98	5						6.5	
3/8/2016	1.935			280	4519				3	48	99	1						6.7	
3/9/2016	1.858	293	4540	200	3099	7	108	98	4	62	98	2						6.3	
3/10/2016	1.819			232	3520				2	30	99	2						6.3	
3/11/2016	1.705	277	3939	280	3982	4	57	99	4	57	99	3	26.5	2.98	2.09	3.04	26.9	6.6	
3/12/2016	1.717			336	4811				4	57	99							6.6	
3/13/2016	1.621			308	4164				4	54	99							6.5	
3/14/2016	1.720	173	2482	212	3041	8	115	95	6	86	97	7						6.4	
3/15/2016	1.837			272	4167				5	77	98	100						6.4	
3/16/2016	1.824	237	3605	484	7363	5	76	98	4	61	99	12						6.7	
3/17/2016	1.730			372	5367				5	72	99	1						6.6	
3/18/2016	1.709	231	3292	260	3706	5	71	98	5	71	98	3						6.5	
3/19/2016	1.636			276	3766				7	96	97							6.5	
3/20/2016	1.651			216	2974				4	55	98							6.6	
3/21/2016	1.657	220	3040	204	2819	4	55	98	4	55	98	4						6.3	
3/22/2016	1.601			256	3418				5	67	98	3						6.6	
3/23/2016	1.564	268	3496	300	3913	4	52	99	3	39	99	5						6.4	
3/24/2016	1.662			272	3770				6	83	98	9						6.6	
3/25/2016	1.698	274	3880	376	5325	11	156	96	19	269	95	8						6.8	
3/26/2016	1.603			296	3957				18	241	94							6.9	
3/27/2016	1.708			192	2735				19	271	90							6.7	
3/28/2016	1.725	152	2187	176	2532	8	115	95	9	129	95	2						6.6	
3/29/2016	1.665			272	3777				12	167	96	23						6.7	
3/30/2016	1.581	112	1477	208	2743	8	105	93	11	145	95	9						6.9	
3/31/2016	1.513			256	3230				15	189	94	5						6.7	
4/1/2016	1.499	258	3225	223	2788	14	175	95	13	163	94	1						6.7	
4/2/2016	1.451			200	2420				15	182	93							6.7	
4/3/2016	1.456			196	2380				9	109	95							6.7	
4/4/2016	1.596	266	3541	216	2875	7	93	97	184	2449	15	130						6.6	
4/5/2016	1.594			264	3510				11	146	96	184						7	
4/6/2016	1.537	271	3474	288	3692	7	90	97	10	128	97	4						6.7	
4/7/2016	1.466			284	3472				19	232	93	5	25.8	1.62	0.66	32	24.7	6.9	
4/8/2016	1.452	291	3524	236	2858	8	97	97	10	121	96	15						6.9	
4/9/2016	1.469			332	4067				11	135	97							7.2	
4/10/2016	1.416			272	3212				6	71	98							7.1	
4/11/2016	1.422	243	2882	236	2799	5	59	98	3	36	99	24						7	
4/12/2016	1.429			320	3814				5	60	98	7						7	
4/13/2016	1.500	320	4003	332	4153	5	63	98	4	50	99	2						7.1	
4/14/2016	1.430			336	4007				9	107	97	17						7	
4/15/2016	1.447	377	4550	336	4055	13	157	97	7	84	98	7						7.1	
4/16/2016	1.404			340	3981				5	59	99							7	
4/17/2016	1.346			252	2829				6	67	98							7	
4/18/2016	1.343			236	2643				6	67	97	23						6.9	
4/19/2016	1.346	296	3323	292	3278	8	90	97	7	79	98	17						7	
4/20/2016	1.319	339	3729	348	3828	7	77	98	4	44	99	71						6.9	
4/21/2016	1.292			308	3319				2	22	99	111						7.1	
4/22/2016	1.301	340	3689	312	3385	11	119	97	8	87	97	156						7	
4/23/2016	1.349			428	4815				9	101	98							7	
4/24/2016	1.484			260	3218				13	161	95							7	
4/25/2016	1.465	264	3226	288	3519	10	122	96	13	159	95	200						7	
4/26/2016	1.362			400	4544				11	125	97	1						7.2	
4/27/2016	1.360	318	3607	312	3539	11	125	97	7	79	98	7						6.9	
4/28/2016	1.340			296	3308				8	89	97	120						6.8	
4/29/2016	1.317	281	3086	256	2812	8	88	97	6	66	98	39						6.8	
4/30/2016	1.287			272	2920				9	97	97							7.2	
5/1/2016	1.302			288	3127				6	65	98							7	
5/2/2016	1.304	297	3230	432	4698	9	98	97	4	44	99	8						6.7	
5/3/2016	1.258			324	3399				5	52	98	8						7	
5/4/2016	1.264	302	3184	356	3753	5	53	98	3	32	99	44						6.8	
5/5/2016	1.295			308	3326				4	43	99	64						7	
5/6/2016	1.248	295	3070	376	3914	9	94	97	6	62	98	27						7.1	
5/7/2016	1.231			268	2751				6	62	98							7	
5/8/2016	1.220			276	2808				4	41	99							6.8	
5/9/2016	1.244	333	3455	256	2656	4	41	99	4	41	98	9						6.7	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
5/10/2016	1.218			260	2641				5	51	98	48						6.9	
5/11/2016	1.189	366	3629	480	4760	7	69	98	5	50	99	9						7.1	
5/12/2016	1.186			508	5025				5	49	99	13	41.6	1.47	0.46	0.92	40.7	7	
5/13/2016	1.204	322	3233	292	2932	9	90	97	3	30	99	27						7	
5/14/2016	1.152			468	4496				7	67	99							7.3	
5/15/2016	1.181			328	3231				7	69	98							7.1	
5/16/2016	1.210	328	3310	312	3149	8	81	98	6	61	98	3						6.8	
5/17/2016	1.183			424	4183				9	89	98	16						7	
5/18/2016	1.147	349	3339	360	3444	6	57	98	7	67	98	2						7.1	
5/19/2016	1.206			412	4144				10	101	98	128						7	
5/20/2016	1.239	285	2945	308	3183	9	93	97	9	93	97	24						7.2	
5/21/2016	1.165			376	3653				9	87	98							7.1	
5/22/2016	1.282			344	3678				6	64	98							6.9	
5/23/2016	1.242	311	3221	388	4019	7	73	98	7	73	98	20						6.9	
5/24/2016	1.209			364	3670				8	81	98	15						6.8	
5/25/2016	1.166	350	3404	408	3968	7	68	98	6	58	99	6						6.7	
5/26/2016	1.139			400	3800				5	47	99	20						6.8	
5/27/2016	1.112	388	3598	444	4118	10	93	97	8	74	98	13						7.1	
5/28/2016	1.118			372	3469				7	65	98							6.7	
5/29/2016	1.135			280	2650				8	76	97							6.7	
5/30/2016	1.110			276	2555				5	46	98	15						6.7	
5/31/2016	1.151	322	3091	288	2765	6	58	98	4	38	99	3						6.5	
6/1/2016	1.092	335	3051	312	2841	6	55	98	8	73	97	3						6.8	19.3
6/2/2016	1.140			368	3499				5	48	99	3						6.8	19
6/3/2016	1.150	339	3251	276	2647	7	67	97	7	67	97	5						6.7	19.2
6/4/2016	1.088			492	4464				6	54	99							6.8	
6/5/2016	1.056			348	3065				6	53	98							6.8	
6/6/2016	1.092	416	3789	400	3643	6	55	99	6	55	99	3						6.7	20
6/7/2016	1.100			392	3596				5	46	99	1						6.8	20
6/8/2016	1.104	355	3269	440	4051	9	83	98	9	83	98	3						6.7	
6/9/2016	1.097			300	2745				10	91	97	1						6.9	
6/10/2016	1.097	352	3220	388	3550	7	64	98	4	37	99	3	28.5	8.4	5.66	4.51	28.8	6.9	19.7
6/11/2016	1.088			364	3303				6	54	98							6.9	
6/12/2016	1.079			328	2952				7	63	98							6.7	
6/13/2016	1.121	387	3618	388	3627	8	75	98	13	122	97	10						6.8	19.1
6/14/2016	1.392			600	6966				7	81	99	150						6.7	
6/15/2016	1.238	330	3407	352	3634	7	72	98	7	72	98	8						6.6	18.7
6/16/2016	1.151			348	3341				9	86	97	35						6.8	
6/17/2016	1.119	321	2996	276	2576	8	75	97	7	65	97	3						6.8	19.4
6/18/2016	1.180			280	2756				7	69	98							6.9	
6/19/2016	1.293			252	2717				7	75	97							7	
6/20/2016	1.207	219	2205	304	3060	4	40	99	4	40	99	3						6.9	20.3
6/21/2016	1.144			504	4809				7	67	99	65						6.8	
6/22/2016	1.153	304	2923	332	3193	7	67	98	7	67	98	10						6.8	19.8
6/23/2016	1.147			380	3635				7	67	98	3						6.7	
6/24/2016	1.211	225	2272	316	3192	4	40	99	5	50	98	81						6.6	19.3
6/25/2016	1.182			408	4022				10	99	98							7	
6/26/2016	1.118			276	2573				7	65	97							7	
6/27/2016	1.092	277	2523	296	2696	7	64	98	6	55	98	7						6.6	20.2
6/28/2016	1.115			356	3310				8	74	98	2						6.8	
6/29/2016	1.086	274	2482	344	3116	8	72	98	9	82	97	2						6.7	21.8
6/30/2016	1.080			380	3423				8	72	98	1						6.8	
7/1/2016	1.079	362	3258	360	3240	7	63	99	6	54	98	7						7	22.1
7/2/2016	1.082			360	3249				11	99	97							7	
7/3/2016	1.070			260	2320				10	89	96							7	
7/4/2016	1.015			240	2032				7	59	97	28						7	22.3
7/5/2016	1.017	295	2502	284	2409	5	42	98	5	42	98	2						7	
7/6/2016	1.097	357	3266	260	2379	7	64	98	8	73	97	8						7	22.6
7/7/2016	1.052			316	2772				10	88	97	5						7	
7/8/2016	1.136	321	3041	260	2463	8	76	98	8	76	97	11						7.1	22.5
7/9/2016	1.066			256	2276				12	107	95							7	
7/10/2016	1.066			300	2667				4	36	99							7	
7/11/2016	1.073	327	2926	276	2470	7	63	98	8	72	97	42						7	22.7
7/12/2016	1.104			452	4162				9	83	98	2						6.9	
7/13/2016	1.027	322	2758	300	2570	6	51	98	7	60	98	2						7.1	21.6

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
7/14/2016	1.026	348	2978	392	3354	6	51	98	8	68	98	2	5.3	2.78	1.77	6.63	7.69	7	
7/15/2016	1.023			380	3242				7	60	98	15						6.9	21.4
7/16/2016	1.023			356	3037				6	51	98							6.9	
7/17/2016	1.016			272	2305				7	59	97							7	
7/18/2016	1.031	438	3766	288	2476	7	60	98	9	77	97	1						7	
7/19/2016	1.077			316	2838				9	81	97	4						7	22
7/20/2016	1.049	223	1951	352	3080	13	114	94	9	79	97	13						7.1	22.1
7/21/2016	1.037			332	2871				9	78	97	31						7.1	22.1
7/22/2016	1.075	217	1946	492	4411	7	63	97	10	90	98	52						7	
7/23/2016	1.148			308	2949				7	67	98							7	
7/24/2016	1.057			292	2574				6	53	98							6.9	
7/25/2016	1.062			276	2445				5	44	98	6						6.9	22.2
7/26/2016	1.069	327	2915	324	2889	5	45	99	7	62	98	25						7	
7/27/2016	1.081			380	3426				11	99	97	1						6.8	22.4
7/28/2016	1.071	348	3108	364	3251	9	80	93	16	143	96	27						7	
7/29/2016	1.087			256	2321				13	118	95	7						7	22.4
7/30/2016	1.091			320	2912				12	109	96							7.1	
7/31/2016	1.046			264	2303				11	96	96							7	
8/1/2016	1.046	302	2635	244	2129	6	52	98	7	61	97	10						6.8	22.4
8/2/2016	1.089			312	2834				13	118	96	18						6.8	
8/3/2016	1.048	352	3077	424	3706	8	70	98	13	114	97	240						7	22
8/4/2016	1.033			432	3722				16	138	96	20						7	
8/5/2016	1.068	335	2984	348	3100	10	89	97	11	98	97	17						6.8	22.5
8/6/2016	1.032			252	2169				9	77	96							6.8	
8/7/2016	1.02			220	1871				7	60	97							6.8	
8/8/2016	1.036	305	2635	268	2316	6	52	98	9	78	97	8						6.8	22.1
8/9/2016	1.035			320	2762				8	69	98	13						6.8	
8/10/2016	1.043	327	2844	296	2575	9	78	97	10	87	97	8						7	22.5
8/11/2016	1.054			400	3516				9	79	98	7	31.4	1.03	0.34	5.72	30.2	6.9	
8/12/2016	1.046	292	2547	464	4048	9	79	98	13	113	97	8						6.8	22.5
8/13/2016	1.038			700	6060				14	121	98							7.1	
8/14/2016	1.042			316	2746				13	113	96							6.9	
8/15/2016	1.043	312	2714	312	2714	9	78	97	13	113	96	8						6.8	22.3
8/16/2016	0.973			444	3603				10	81	98	1						7	
8/17/2016	0.95	381	3019	400	3169	10	79	98	13	103	97	0						7	25
8/18/2016	1.061			468	4141				15	133	97	3						7.2	
8/19/2016	1.052	209	1834	380	3334	6	53	98	17	149	96	7						7.4	24.8
8/20/2016	1.045			324	2824				9	78	97							7.1	
8/21/2016	1.039			284	2461				9	78	97							7	
8/22/2016	1.052	317	2781	316	2772	7	61	98	11	97	97	12						6.9	24.7
8/23/2016	1.027			336	2878				12	103	96	9						6.8	
8/24/2016	1.03	326	2800	368	3161	11	94	97	11	94	97	118						7.2	25
8/25/2016	1.041			396	3438				13	113	97	8						7	
8/26/2016	1.017	303	2570	496	4207	9	76	98	14	119	97	5						6.7	24.7
8/27/2016	1.003			508	4249				11	92	98							6.8	
8/28/2016	1.04			364	3157				14	121	96							6.9	
8/29/2016	1.007	297	2494	268	2251	7	59	97	9	76	97	88						6.9	22.7
8/30/2016	1.045			356	3103				9	78	97	10						7	
8/31/2016	1.087	503	4560	468	4243	10	91	98	7	63	99	70						6.9	22.5
9/1/2016	1.724		0	268	3853				18	259	93	168						6.6	
9/2/2016	1.484	285	3527	412	5099	10	124	96	15	186	96	44						6.7	
9/3/2016	1.257		0	376	3942				13	136	97							7	
9/4/2016	1.175		0	248	2430				10	98	96							7	
9/5/2016	1.131		0	348	3283				11	104	97	2						6.9	
9/6/2016	1.25		0	312	3253				10	104	97	5						6.9	
9/7/2016	1.129	287	2702	240	2260	8	75	97	9	85	96	12						6.9	
9/8/2016	1.185	353	3489	400	3953	6	59	98	8	79	98	42	26.3	0.611	0.05	3.36	26.9	6.9	
9/9/2016	1.119	361	3369	460	4293	6	56	98	8	75	98	124						6.7	
9/10/2016	1.028		0	468	4012				9	77	98							7.1	
9/11/2016	1.081		0	312	2813				10	90	97							6.9	
9/12/2016	1.077	321	2883	308	2767	6	54	98	5	45	98	6						6.8	
9/13/2016	1.044		0	432	3761				6	52	99	12						7	
9/14/2016	1.077	355	3189	436	3916	10	90	97	11	99	97	8						7	
9/15/2016	1.044		0	460	4005				13	113	97	27						7	
9/16/2016	1.051	313	2744	356	3120	12	105	96	8	70	98	11						6.7	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
9/17/2016	1.084		0	396	3580				8	72	98							7	
9/18/2016	1.243		0	300	3110				11	114	96							6.9	
9/19/2016	1.166	183	1780	264	2567	6	58	97	7	68	97	4						6.8	
9/20/2016	1.155		0	588	5664				7	67	99	5						6.8	
9/21/2016	1.121	261	2440	452	4226	8	75	97	5	47	99	2						6.7	
9/22/2016	1.135		0	420	3976				8	76	98	19						7	
9/23/2016	1.142	334	3181	340	3238	10	95	97	8	76	98	16						6.8	
9/24/2016	1.12		0	476	4446				8	75	98							6.8	
9/25/2016	1.096		0	412	3766				11	101	97							6.8	
9/26/2016	1.143	300	2860	296	2822	7	67	98	9	86	97	3						6.7	
9/27/2016	1.095		0	452	4128				9	82	98	3						6.7	
9/28/2016	1.098	397	3635	552	5055	8	73	98	9	82	98	8						6.7	
9/29/2016	1.096		0	400	3656				11	101	97	3						7	
9/30/2016	1.126	408	3831	420	3944	8	75	98	11	103	97	5						6.5	
10/1/2016	1.060			528	4668				10	88	98							6.7	
10/2/2016	1.166			364	3540				8	78	98							6.8	
10/3/2016	1.060	298	2634	328	2900	6	53	98	13	115	96	5						6.9	
10/4/2016	1.174			540	5287				17	166	97	7						6.9	
10/5/2016	1.105	475	4377	496	4571	12	111	97	14	129	97	13						6.9	13
10/6/2016	1.073			360	3222				17	152	95	38						6.9	
10/7/2016	1.157	346	3339	416	4014	10	96	97	13	125	97	20						6.9	
10/8/2016	1.156			304	2931				13	125	96							7	
10/9/2016	1.297			364	3937				13	141	96							6.9	
10/10/2016	1.186	318	3145	292	2888	11	109	97	9	89	97	24						6.9	
10/11/2016	1.163			372	3608				10	97	97	7	51.2	11.4	12.7	1.4	4.11	6.9	
10/12/2016	1.120	353	3297	444	4147	9	84	97	7	65	98	5						7	12
10/13/2016	1.180			324	3189				10	98	97	8						7	
10/14/2016	1.367	381	4344	468	5336	11	125	97	9	103	98	40						7	
10/15/2016	1.429			476	5673				12	143	97							6.8	
10/16/2016	1.378			272	3126				10	115	96							7	
10/17/2016	1.381	260	2995	252	2902	9	104	97	6	69	98	29						6.9	
10/18/2016	1.424			348	4133				8	95	98	48						7	15
10/19/2016	1.350	293	3299	348	3918	9	101	97	7	79	98	7						6.9	
10/20/2016	1.457			296	3597				10	122	97	21						7	
10/21/2016	1.541	295	3791	304	3907	12	154	96	11	141	96	4						7	
10/22/2016	1.380			340	3913				11	127	97							7	
10/23/2016	1.309			300	3275				10	109	97							7	
10/24/2016	1.304	267	2904	292	3176	10	109	96	6	65	98	4						7	
10/25/2016	1.295			336	3629				8	86	98	20						7	
10/26/2016	1.259	282	2961	268	2814	16	168	94	7	74	97	416						7	14
10/27/2016	1.400			272	3176				9	105	97	2						7	
10/28/2016	1.327	310	3431	388	4294	7	77	98	5	55	99	7						7	
10/29/2016	1.190			496	4923				9	89	98							7	
10/30/2016	1.216			460	4665				12	122	97							7	
10/31/2016	1.270	279	2955	260	2754	17	180	94	8	85	97	2						7	
11/1/2016	1.329			404	4478				7	78	98	4						6.7	
11/2/2016	1.341	338	3780	436	4876	15	168	96	13	145	97	1						6.7	
11/3/2016	1.529			308	3928				8	102	97	1	29.3	0.624	0.1	1.89	28.1	6.8	
11/4/2016	1.362	250	2840	248	2817	12	136	95	9	102	96	3						6.6	
11/5/2016	1.400			148	1728				9	105	94							6.8	
11/6/2016	1.918			284	4543				11	176	96							6.8	
11/7/2016	1.694	215	3038	204	2882	16	226	93	10	141	95	1						6.4	
11/8/2016	1.540	231	2967	236	3031	14	180	94	7	90	97	1						6.9	
11/9/2016	1.435	145	1735	292	3495	6	72	96	7	84	98	2						6.8	
11/10/2016	1.441			284	3413				13	156	95	4						6.8	
11/11/2016	1.363			220	2501				8	91	96	2						7	
11/12/2016	1.450			216	2612				9	109	96							6.9	
11/13/2016	1.442			288	3464				11	132	96							6.7	
11/14/2016	1.493	256	3188	252	3138	13	162	95	9	112	96	8						6.6	
11/15/2016	1.558			252	3274				15	195	94	8						6.9	
11/16/2016	1.660	279	3863	352	4873	24	332	91	21	291	94	13						6.8	
11/17/2016	1.573			340	4460				17	223	95	21						6.8	
11/18/2016	1.500	292	3653	352	4404	18	225	94	19	238	95	10						6.8	
11/19/2016	1.428			336	4002				19	226	94							6.9	
11/20/2016	1.428			228	2715				19	226	92							6.8	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
11/21/2016	1.391	219	2541	228	2645	14	162	94	19	220	92	12						6.7	
11/22/2016	1.368	249	2841	264	3012	18	205	93	17	194	94	5						7	
11/23/2016	1.502	286	3583	260	3257	20	251	93	17	213	93	15						6.8	
11/24/2016	1.477			268	3301				14	172	95	1						7	
11/25/2016	1.533			244	3120				16	205	93	3						6.8	
11/26/2016	1.534			268	3429				18	230	93							6.8	
11/27/2016	1.818			268	4063				20	303	93							6.8	
11/28/2016	1.757	200	2931	208	3048	15	220	93	20	293	90	8						6.6	
11/29/2016	1.669			204	2840				17	237	92	17						6.9	
11/30/2016	1.604	228	3050	280	3746	20	268	91	14	187	95	22						6.9	
12/1/2016	1.801			260	3905				17	255	93	33						6.8	
12/2/2016	1.680	228	3195	260	3643	13	182	94	18	252	93	3						6.9	
12/3/2016	1.671			224	3122				9	125	96							6.8	
12/4/2016	1.745			252	3667				16	233	94							6.8	
12/5/2016	1.724	205	2948	228	3278	12	173	94	16	230	93	7						6.9	
12/6/2016	1.653			268	3695				13	179	95	79						6.7	
12/7/2016	1.571	314	4114	344	4507	12	157	96	13	170	96	15						6.7	
12/8/2016	1.542			280	3601				11	141	96	32	16.7	0.775	0.09	2.38	6.83	6.8	
12/9/2016	1.523	279	3544	256	3252	12	152	96	11	140	96	21						7	
12/10/2016	1.479			308	3799				13	160	96							7.2	
12/11/2016	1.486			296	3668				11	136	96							7.1	
12/12/2016	1.524	219	2784	216	2745	14	178	94	11	140	95	16						6.9	
12/13/2016	1.464			324	3956				13	159	96	35						6.8	
12/14/2016	1.402	278	3251	268	3134	12	140	96	11	129	96	13						6.4	
12/15/2016	1.402			296	3461				17	199	94	31						6.9	
12/16/2016	1.402	237	2771	236	2759	13	152	95	14	164	94	16						7.1	
12/17/2016	1.357			352	3984				11	124	97							6.9	
12/18/2016	1.392			275	3193				14	163	95							7.2	
12/19/2016	1.418	262	3098	268	3169	16	189	94	8	95	97	21						7.1	
12/20/2016	1.534			332	4247				11	141	97	23						7	
12/21/2016	1.498	282	3523	376	4697	14	175	95	12	150	97	25						6.9	
12/22/2016	1.517	291	3682	288	3644	10	127	97	15	190	95	15						7	
12/23/2016	1.558			324	4210				10	130	97	13						7.2	
12/24/2016	1.753			260	3801				12	175	95							7	
12/25/2016	1.613			184	2475				15	202	92							6.9	
12/26/2016	1.405	269	3152	220	2578	14	164	95	11	129	95	8						6.9	
12/27/2016	1.574	253	3321	236	3098	16	210	94	12	158	95	21						7	
12/28/2016	1.618			277	3738				13	175	95	21						6.9	
12/29/2016	1.560	264	3435	260	3383	10	130	96	15	195	94	55						7	
12/30/2016	1.617			248	3344				13	175	95	28						7	
12/31/2016	1.543			244	3140				11	142	95							7.1	
1/1/2017	1.586			224	2963				8	106	96							7.1	
1/2/2017	1.532			280	3578				7	89	98	1						7	
1/3/2017	1.572	233	3055	220	2884	12	157	95	17	223	92	13						7	
1/4/2017	1.499	287	3588	320	4001	11	138	97	13	163	96	44						7	
1/5/2017	1.505			308	3866				13	163	96	60						7.1	
1/6/2017	1.447	324	3910	564	6806	11	133	98	13	157	98	30						7.1	
1/7/2017	1.416			264	3118				12	142	95							7.3	
1/8/2017	1.422			220	2609				12	142	95							7.3	
1/9/2017	1.471	263	3227	252	3092	10	123	96	11	135	96	48						7.1	
1/10/2017	1.471			328	4024				13	159	96	45						7	
1/11/2017	1.453	260	3151	316	3829	12	145	96	14	170	96	80						7.1	
1/12/2017	1.433			284	3394				20	239	93	43	40.2	4.73	3.25	0.32	42.8	7.1	
1/13/2017	1.361	338	3837	328	3723	14	159	96	17	193	95	50						7	
1/14/2017	1.339			332	3708				17	190	95							7.2	
1/15/2017	1.339			240	2680				17	190	93							7.1	
1/16/2017	1.293			232	2502				15	162	94	50						7.1	
1/17/2017	1.381	275	3167	256	2948	12	138	95	13	150	95	63						7.1	
1/18/2017	1.408	268	3147	372	4368	12	141	97	15	176	96	12						7	
1/19/2017	1.714			268	3831				20	286	93	50						7.3	
1/20/2017	1.67	260	3621	300	4178	18	251	94	25	348	92	83						7.1	
1/21/2017	1.573			304	3988				20	262	93							7.1	
1/22/2017	1.517			244	3087				17	215	93							7.1	
1/23/2017	1.52	193	2447	232	2941	14	177	94	24	304	90	70						7.1	
1/24/2017	1.442			268	3223				23	277	91	32						7	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
1/25/2017	1.448	228	2753	288	3478	14	169	95	23	278	92	13						7	
1/26/2017	1.412			408	4805				24	283	94	33						7.1	
1/27/2017	1.371	211	2413	264	3019	4	46	98	23	263	91	25						7.1	
1/28/2017	1.305			324	3526				21	229	94							7.2	
1/29/2017	1.32			308	3391				26	286	92							7.1	
1/30/2017	1.327	275	3043	344	3807	12	133	97	15	166	96	33						7.1	
1/31/2017	1.319			248	2728				21	231	92	13						7	
2/1/2017	1.185	272	2688	420	4151	12	119	96	23	227	95	7						7.3	
2/2/2017	1.165			348	3381				21	204	94	83						7.1	
2/3/2017	1.160	385	3725	296	2864	13	126	97	23	223	92	90						7	
2/4/2017	1.239			260	2687				17	176	93							7.1	
2/5/2017	1.453			244	2957				19	230	92							6.9	
2/6/2017	1.380	322	3706	192	2210	9	104	97	21	242	89	47						6.9	
2/7/2017	1.395			248	2885				14	163	94	35						6.9	
2/8/2017	1.370	197	2251	292	3336	8	91	96	13	149	96	22						6.8	
2/9/2017	1.483			260	3216				17	210	93	19						7.1	
2/10/2017	1.654	232	3200	244	3366	10	138	96	13	179	95	30						7	
2/11/2017	1.486			360	4462				10	124	97							7	
2/12/2017	1.478			292	3599				8	99	97							7	
2/13/2017	1.475	267	3285	232	2854	7	86	97	7	86	97	25						6.9	
2/14/2017	1.376			308	3535				13	149	96	13						6.9	
2/15/2017	1.379	190	2185	332	3818	11	127	94	7	81	98	7						7.1	
2/16/2017	1.379			372	4278				11	127	97	15	36	4.25	1.34	0.1	41.5	7	
2/17/2017	1.333	275	3057	356	3958	9	100	97	11	122	97	17						7	
2/18/2017	1.304			256	2784				11	120	96							7.3	
2/19/2017	1.377			308	3537				12	138	96							7.1	
2/20/2017	1.335			240	2672				10	111	96	8						7.1	
2/21/2017	1.402	183	2140	212	2479	6	70	97	10	117	95	19						7	
2/22/2017	1.316	252	2766	224	2458	10	110	96	11	121	95	10						7	
2/23/2017	1.446			396	4776				15	181	96	21						7	
2/24/2017	1.398	285	3323	296	3451	14	163	95	13	152	96	15						6.8	
2/25/2017	1.359			308	3491				15	170	95							7.1	
2/26/2017	1.515			172	2173				4	51	98							7	
2/27/2017	1.650	209	2876	200	2752	9	124	96	13	179	94	8						7.1	
2/28/2017	1.540			336	4315				13	167	96	47						7.1	
3/1/2017	1.496	186	2321	208	2595	12	150	94	15	187	93	32						7.1	
3/2/2017	1.596			164	2183				15	200	91	13						7.1	
3/3/2017	1.536	233	2985	212	2716	12	154	95	15	192	93	15						6.9	
3/4/2017	1.786			356	5303				19	283	95							7	
3/5/2017	1.836			228	3491				16	245	93							7	
3/6/2017	1.728	181	2608	172	2479	12	173	93	18	259	90	19						6.8	
3/7/2017	1.652			256	3527				21	289	92	8						7	
3/8/2017	1.660	234	3240	252	3489	16	222	93	24	332	90	13						6.8	
3/9/2017	1.680			276	3867				20	280	93	5	24.4	2.5	6.4	0.2	24.2	7.2	
3/10/2017	1.771	195	2880	208	3072	15	222	92	18	266	91	8						7	
3/11/2017	1.739			224	3249				20	290	91							7.1	
3/12/2017	1.638			208	2841				19	260	91							7.2	
3/13/2017	1.662	209	2897	192	2661	12	166	94	17	236	91	25						7	
3/14/2017	1.788			252	3758				17	254	93	68						7	
3/15/2017	1.744	187	2720	220	3200	14	204	93	17	247	92	32						7	
3/16/2017	1.832			228	3484				18	275	92	8						7.1	
3/17/2017	1.728	252	3632	244	3516	16	231	94	23	331	91	21						7.1	
3/18/2017	1.763			288	4235				17	250	94							7.3	
3/19/2017	1.936			152	2454				19	307	88							7	
3/20/2017	1.784	173	2574	184	2738	10	149	94	9	134	95	9						7	
3/21/2017	1.734			304	4396				17	246	94	11						7	
3/22/2017	1.690	239	3369	288	4059	14	197	94	12	169	96	7						7.1	
3/23/2017	1.664			224	3109				15	208	93	3						6.9	
3/24/2017	1.654	243	3352	252	3476	11	152	95	12	166	95	7						7	
3/25/2017	1.607			384	5147				7	94	98							7.2	
3/26/2017	1.723			240	3449				5	72	98							7	
3/27/2017	1.806	205	3088	268	4037	22	331	89	41	618	85	1						6.9	
3/28/2017	1.711	213	3039	224	3196	15	214	93	22	314	90	4						6.9	
3/29/2017	1.826	255	3883	288	4386	18	274	93	17	259	94	1						7	
3/30/2017	1.877			340	5322				65	1018	81	40						7.1	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
3/31/2017	1.736			220	3185				22	319	90	14						7.1	
4/1/2017	1.701			284	4029				16	227	94							7.1	
4/2/2017	1.740			160	2322				17	247	89							7.2	
4/3/2017	1.549	119	1537	260	3359	12	155	90	13	168	95	3						7	
4/4/2017	1.645			252	3457				19	261	92	1						7.1	
4/5/2017	1.656	133	1837	292	4033	12	166	91	16	221	95	10						7.2	
4/6/2017	1.735			308	4457				26	376	92	8						7.1	
4/7/2017	1.741	122	1771	376	5459	12	174	90	16	232	96	1						7.2	
4/8/2017	1.758			256	3753				23	337	91							7.2	
4/9/2017	1.866			208	3237				18	280	91							7.1	
4/10/2017	1.825	143	2177	180	2740	3	46	98	15	228	92	11						7	
4/11/2017	1.782			204	3032				15	223	93	4						6.9	
4/12/2017	1.720	172	2467	384	5508	8	115	95	17	244	96	8						7.1	
4/13/2017	1.744			308	4480				4	58	99	1	23.2	1.71	0.78	0.6	20.4	7	
4/14/2017	1.686	204	2868	428	6018	4	56	98	4	56	99	2						7.2	
4/15/2017	1.606			268	3590				6	80	98							6.7	
4/16/2017	1.641			292	3996				7	96	98							7	
4/17/2017	1.557	193	2506	204	2649	5	65	97	5	65	98	25						6.7	
4/18/2017	1.555			320	4150				9	117	97	20						6.9	
4/19/2017	1.494	298	3713	744	9270	8	100	97	7	87	99	24						6.9	
4/20/2017	1.505			484	6075				9	113	98	21						7.2	
4/21/2017	1.452	242	2931	308	3730	9	109	96	7	85	98	12						6.9	
4/22/2017	1.431			376	4487				9	107	98							7.2	
4/23/2017	1.472			268	3290				7	86	97							7.2	
4/24/2017	1.498	232	2898	232	2898	6	75	97	8	100	97	5						7	
4/25/2017	1.421			332	3935				4	47	99	78						6.8	
4/26/2017	1.443	423	5091	492	5921	8	96	98	8	96	98	24						7.1	
4/27/2017	1.400			396	4624				6	70	98	64						6.8	
4/28/2017	1.402	248	2900	352	4116	7	82	97	8	94	98	12						7	
4/29/2017	1.324			376	4152				5	55	99							7.2	
4/30/2017	1.345			428	4801				3	34	99							6.8	
5/1/2017	1.360	256	2904	248	2813	4	45	98	6	68	98	11						7	
5/2/2017	1.328			360	3987				4	44	99	11						6.9	
5/3/2017	1.394	307	3569	356	4139	7	81	98	7	81	98	33						6.9	
5/4/2017	1.375			324	3715				7	80	98	91						7.1	
5/5/2017	1.477	275	3387	416	5124	8	99	97	7	86	98	45						7	
5/6/2017	1.486			324	4015				9	112	97							7.2	
5/7/2017	1.417			208	2458				7	83	97							7.1	
5/8/2017	1.391	299	3469	280	3248	8	93	97	10	116	96	43						7	
5/9/2017	1.376	247	2835	284	3259	16	184	94	18	207	94	52						7	
5/10/2017	1.408			308	3617				20	235	94	13						7	
5/11/2017	1.392			420	4876				9	104	98	38						7.1	
5/12/2017	1.453	279	3381	320	3878	11	133	96	10	121	97	20	35.2	3.66	1.21	0.55	34.9	6.9	
5/13/2017	1.372			356	4074				19	217	95							7.3	
5/14/2017	1.419			244	2888				33	391	86							7.1	
5/15/2017	1.401	290	3388	240	2804	15	175	95	11	129	95	42						6.9	
5/16/2017	1.587			320	4235				34	450	89	73						7	
5/17/2017	1.542	229	2945	248	3189	19	244	92	37	476	85	66						7.1	
5/18/2017	1.453			312	3781				21	254	93	26						7.1	
5/19/2017	1.471	255	3128	308	3779	8	98	97	23	282	93	30						7	
5/20/2017	1.383			300	3460				23	265	92							7.2	
5/21/2017	1.324			192	2120				16	177	92							7.1	
5/22/2017	1.342	137	1533	272	3044	12	134	91	20	224	93	20						7	
5/23/2017	1.362			260	2953				17	193	93	25						7.1	
5/24/2017	1.307	420	4578	424	4622	12	131	97	17	185	96	33						7.1	
5/25/2017	1.291			384	4135				22	237	94	90						7	
5/26/2017	1.268	376	3976	340	3596	23	243	94	19	201	94	45						7.3	
5/27/2017	1.226			460	4703				21	215	95							7.3	
5/28/2017	1.202			244	2446				15	150	94							7.2	
5/29/2017	1.173			248	2426				20	196	92	1						7.2	
5/30/2017	1.257	261	2736	284	2977	11	115	96	15	157	95	12						7	
5/31/2017	1.332	202	2244	272	3022	17	189	92	15	167	94	20						7.1	
6/1/2017	1.318			348	3825				9	99	97	20						7.1	
6/2/2017	1.282	280	2994	376	4020	18	192	94	10	107	97	1						7.3	18.1
6/3/2017	1.155			340	3275				11	106	97							7.4	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
6/4/2017	1.131			204	1924				8	75	96							7.3	
6/5/2017	1.166	377	3666	240	2334	15	146	96	6	58	98	8						7.1	17.6
6/6/2017	1.189			420	4165				13	129	97	15						7	
6/7/2017	1.179	306	3009	308	3029	12	118	96	12	118	96	10						7.2	18.5
6/8/2017	1.181			372	3664				15	148	96	40						7.2	
6/9/2017	1.281	356	3803	332	3547	16	171	96	12	128	96	3						6.9	17.8
6/10/2017	1.210			360	3633				9	91	98							7.2	
6/11/2017	1.187			244	2415				6	59	98							7.3	
6/12/2017	1.193	287	2856	232	2308	16	159	94	11	109	95	47						6.9	17.9
6/13/2017	1.193			412	4099				16	159	96	1						7.1	
6/14/2017	1.183	382	3769	396	3907	22	217	94	20	197	95	50						6.9	18
6/15/2017	1.171			400	3906				19	186	95	53	39.8	2.58	2.11	0.22	49.1	7.1	
6/16/2017	1.212	323	3265	360	3639	24	243	93	21	212	94	57						7.1	17.8
6/17/2017	1.212			344	3477				16	162	95							6.8	
6/18/2017	1.160			232	2244				19	184	92							7	
6/19/2017	1.195	333	3319	268	2671	16	159	95	13	130	95	43						6.9	18.4
6/20/2017	1.157			340	3281				32	309	91	20						6.9	
6/21/2017	1.169	343	3344	444	4329	24	234	93	37	361	92	53						6.8	18.1
6/22/2017	1.135			472	4468				37	350	92	217						7.1	
6/23/2017	1.145	489	4670	520	4966	20	191	96	27	258	95	180						7.1	18.9
6/24/2017	1.137			236	2238				17	161	93							7.1	
6/25/2017	1.110			244	2259				12	111	95							7	
6/26/2017	1.100	320	2936	260	2385	9	83	97	9	83	97	110						6.8	19.3
6/27/2017	1.131			408	3848				10	94	98	93						6.9	
6/28/2017	1.107	402	3711	388	3582	15	138	96	14	129	96	400						7.1	20.7
6/29/2017	1.087			380	3445				11	100	97	310						7.1	
6/30/2017	1.072	341	3049	364	3254	13	116	96	13	116	96	27						7	21
7/1/2017	1.082			384	3465				13	117	97							7.2	
7/2/2017	1.047			264	2305				14	122	95							7.2	
7/3/2017	1.044	231	2011	232	2020	13	113	94	17	148	93	217						7.1	
7/4/2017	1.044			324	2821				19	165	94	257						7.2	
7/5/2017	0.956	163	1300	236	1882	10	80	94	18	144	92	290						7.2	22.2
7/6/2017	1.066	191	1698	304	2703	6	53	97	14	124	95	290						7.3	22
7/7/2017	1.070			280	2499				16	143	94	553						7	21.6
7/8/2017	1.051			240	2104				19	167	92							7.3	
7/9/2017	1.066			232	2063				21	187	91							7.2	
7/10/2017	1.080	363	3270	283	2549	14	126	96	20	180	93	135						7	22.3
7/11/2017	1.014			300	2537				23	195	92	135						7	
7/12/2017	1.013	370	3126	320	2703	17	144	95	19	161	94	227						7	21.5
7/13/2017	0.980			316	2583				25	204	92	193	35.5	2.72	1.48	0.39	37.9	7	
7/14/2017	0.990	315	2601	316	2609	21	173	93	29	239	91	33						7	21.8
7/15/2017	1.000			340	2836				27	225	92							7.3	
7/16/2017	0.958			300	2397				24	192	92							7.2	
7/17/2017	0.958	312	2493	393	3140	23	184	93	25	200	94	29						7.1	21.2
7/18/2017	0.989			308	2540				29	239	91	1						7.1	
7/19/2017	0.989	411	3390	420	3464	27	223	93	29	239	93	23						7.1	22
7/20/2017	0.914			320	2439				29	221	91	30						7.4	
7/21/2017	0.923	353	2717	488	3757	25	192	93	27	208	94	20						7.3	21.9
7/22/2017	0.900			332	2492				21	158	94							7.5	
7/23/2017	0.873			196	1427				17	124	91							7.4	
7/24/2017	0.876	383	2798	324	2367	16	117	96	10	73	97	20						7.2	21.9
7/25/2017	0.937			608	4751				13	102	98	30						7.3	
7/26/2017	0.899	445	3336	564	4229	11	82	98	16	120	97	18						7.4	22.5
7/27/2017	0.974			588	4776				18	146	97	8						7.5	
7/28/2017	0.796	497	3299	816	5417	18	119	96	19	126	98	107						7.4	22.5
7/29/2017	0.870			484	3512				20	145	96							7.4	
7/30/2017	0.842			292	2051				21	147	93							7.4	
7/31/2017	0.838	422	2949	328	2292	17	119	96	25	175	92	7						7.2	22.6
8/1/2017	0.905			412	3110				33	249	92	7						7.2	
8/2/2017	0.979	446	3642	484	3952	24	196	95	36	294	93	23						7.4	
8/3/2017	0.991			504	4166				34	281	93	136						7.4	22.6
8/4/2017	0.987	336	2766	496	4083	13	107	96	15	123	97	55						7.4	
8/5/2017	0.993			504	4174				11	91	98							7.2	22.4
8/6/2017	0.971			256	2073				4	32	98							7.2	
8/7/2017	0.959	343	2743	344	2751	11	88	97	8	64	98	240						7.2	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
8/8/2017	0.970			404	3268				11	89	97	20						7.3	22.6
8/9/2017	0.930	373	2893	540	4188	15	116	96	9	70	98	209						7.2	
8/10/2017	0.942	474	3724	520	4085	12	94	97	9	71	98	720	29.1	1.16	0.76	2.51	28.9	7.1	22.8
8/11/2017	0.916			360	2750				5	38	99	162						7.4	
8/12/2017	0.917			484	3702				7	54	99							7.4	23.2
8/13/2017	0.928			348	2693				3	23	99							7.4	
8/14/2017	0.870	342	2481	328	2380	5	36	99	5	36	98	288						7.2	
8/15/2017	0.873			512	3728				5	36	99	13						7.1	22.5
8/16/2017	1.001	322	2688	372	3106	9	75	97	7	58	98	5						7.2	
8/17/2017	0.959			640	5119				5	40	99	50						7.3	22.5
8/18/2017	0.939	500	3916	568	4448	12	94	98	7	55	99	3						7.3	
8/19/2017	0.944			588	4629				11	87	98							7.3	22.9
8/20/2017	0.914			336	2561				6	46	98							7.1	
8/21/2017	0.926	361	2788	328	2533	9	70	98	5	39	98	45						7.1	
8/22/2017	0.941			408	3202				9	71	98	280						7.1	22.8
8/23/2017	0.975	380	3090	444	3610	12	98	97	7	57	98	44						7.4	
8/24/2017	0.965			432	3477				7	56	98	118						7.2	24.7
8/25/2017	0.975	472	3838	624	5074	13	106	97	11	89	98	2						7.2	
8/26/2017	0.923			572	4403				11	85	98							7.3	24.3
8/27/2017	0.922			312	2399				11	85	96							7.2	
8/28/2017	0.937	396	3095	392	3063	9	70	98	4	31	99	93						7.1	25
8/29/2017	0.976			452	3679				7	57	98	10						7.1	
8/30/2017	0.999	350	2916	412	3433	8	67	98	8	67	98	7						7.2	24.8
8/31/2017	1.007			500	4199				8	67	98	55						7.1	
9/1/2017	0.954	413	3286	472	3755	12	95	97	9	72	98	8						7.1	
9/2/2017	0.942			212	1666				11	86	95							7.3	
9/3/2017	0.939			296	2318				13	102	96	1						7.3	
9/4/2017	0.899			316	2369				15	112	95	72						7.3	
9/5/2017	0.997	290	2411	328	2727	7	58	98	12	100	96	6						7.3	
9/6/2017	0.952	444	3525	484	3843	10	79	98	15	119	97	1						7.3	
9/7/2017	0.977			712	5802				11	90	98	58						7.3	
9/8/2017	0.947	406	3207	464	3665	9	71	98	9	71	98							7	
9/9/2017	0.955			568	4524				9	72	98							7.2	
9/10/2017	0.987			368	3029				9	74	98	29	29.1	1.16	0.76	2.51	28.9	7.1	
9/11/2017	0.944	354	2787	308	2425	6	47	98	4	31	99	8						6.8	
9/12/2017	0.949			464	3672				7	55	98	17						7	
9/13/2017	0.931	385	2989	364	2826	6	47	98	5	39	99	102						6.6	
9/14/2017	0.924			416	3206				5	39	99	6						6.7	
9/15/2017	0.949	425	3364	440	3482	8	63	98	7	55	98							6.8	
9/16/2017	0.902			404	3039				4	30	99							7.3	
9/17/2017	0.892			304	2262				7	52	98	32						7	
9/18/2017	0.981	326	2667	352	2880	7	57	98	7	57	98	16						6.7	
9/19/2017	1.015			472	3996				6	51	99	29						6.8	
9/20/2017	0.983	503	4124	556	4558	9	74	98	8	66	99	23						7.2	
9/21/2017	0.968			472	3811				9	73	98	3						6.7	
9/22/2017	0.939	403	3156	500	3916	10	78	98	8	63	98							6.7	
9/23/2017	0.911			700	5318				12	91	98							7.2	
9/24/2017	0.915			348	2656				9	69	97	35						6.9	
9/25/2017	0.891	342	2541	280	2081	9	67	97	8	59	97	85						6.7	
9/26/2017	0.933			468	3642				7	54	99	4						6.7	
9/27/2017	0.917	394	3013	660	5048	9	69	98	9	69	99	1						6.6	
9/28/2017	0.900			484	3633				11	83	98	5						6.7	
9/29/2017	0.899	476	3569	472	3539	13	97	97	9	67	98							7	
9/30/2017	0.986			604	4967				12	99	98							7	
10/1/2017	0.948			372	2941				16	127	96							6.8	
10/2/2017	0.919	356	2729	276	2115	11	84	97	7	54	97	42						6.7	
10/3/2017	0.938			388	3035				8	63	98	10						6.6	
10/4/2017	0.928	413	3196	552	4272	10	77	98	9	70	98	18						6.8	
10/5/2017	0.907			544	4115				9	68	98	37						6.7	
10/6/2017	0.879	383	2808	452	3314	9	66	98	10	73	98	27						6.7	
10/7/2017	0.946			432	3408				10	79	98							7.1	
10/8/2017	0.911			304	2310				11	84	96							6.7	
10/9/2017	0.890	349	2590	344	2553	8	59	98	10	74	97	7						6.7	
10/10/2017	0.891			416	3091				7	52	98	8						6.6	
10/11/2017	0.909	406	3078	488	3700	10	76	98	9	68	98	9						6.9	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
10/12/2017	0.859			536	3840				7	50	99	27	20.2	0.653	0.201	7.44	20.6	6.8	
10/13/2017	0.991	448	3703	456	3769	11	91	98	7	58	98	27						6.8	
10/14/2017	0.910			400	3036				10	76	98							7.1	
10/15/2017	0.903			436	3284				10	75	98							6.9	
10/16/2017	0.877	366	2677	348	2545	8	59	98	10	73	97	7						6.8	
10/17/2017	0.905			392	2959				11	83	97	16						6.7	
10/18/2017	0.999	531	4424	640	5332	11	92	98	11	92	98	49						6.7	
10/19/2017	1.231			524	5380				17	175	97	7						6.9	
10/20/2017	1.150	362	3472	360	3453	18	173	95	14	134	96	4						7.2	
10/21/2017	1.036			360	3110				9	78	98							7.1	
10/22/2017	1.298			360	3897				11	119	97							7	
10/23/2017	1.119	285	2660	268	2501	13	121	95	12	112	96	8						7.1	
10/24/2017	1.057			456	4020				11	97	98	8						7.1	
10/25/2017	1.019	418	3552	468	3977	10	85	98	9	76	98	17						6.9	
10/26/2017	1.080			276	2486				8	72	97	4						6.8	
10/27/2017	1.104	370	3407	324	2983	10	92	97	9	83	97	7						7	
10/28/2017	0.939			364	2851				9	70	98							7.2	
10/29/2017	0.907			260	1967				4	30	98							7.1	
10/30/2017	0.951	327	2594	324	2570	7	56	98	4	32	99	14						7.1	
10/31/2017	0.961			416	3334				5	40	99	11						7.1	
11/1/2017	0.910	371	2816	380	2884	6	46	98	5	38	99	6						7.2	
11/2/2017	0.987			436	3589				5	41	99	10						7.2	
11/3/2017	1.237	487	5024	524	5406	9	93	98	5	52	99	6						6.9	
11/4/2017	1.093			496	4521				7	64	99							7.2	
11/5/2017	1.040			344	2984				5	43	99							7	
11/6/2017	1.072	311	2780	288	2575	9	80	97	6	54	98	5						6.9	
11/7/2017	1.013			456	3852				7	59	98	1						6.9	
11/8/2017	1.014	345	2918	456	3856	7	59	98	5	42	99	4						6.7	
11/9/2017	0.983	246	2017	388	3181	6	49	98	5	41	99	8	11.9	0.35	0.11	6.84	13	6.7	
11/10/2017	0.995			468	3884				7	58	99	133						6.9	
11/11/2017	0.965			380	3058				6	48	98							6.8	
11/12/2017	0.973			384	3116				7	57	98							6.7	
11/13/2017	1.126	369	3465	356	3343	9	85	98	8	75	98	108						6.6	
11/14/2017	1.255			552	5778				9	94	98	13						6.8	
11/15/2017	1.214	307	3108	356	3604	10	101	97	11	111	97	3						6.8	
11/16/2017	1.249			372	3875				7	73	98	1						6.8	
11/17/2017	1.157	345	3329	392	3783	10	96	97	11	106	97	12						7	
11/18/2017	1.090			368	3345				11	100	97							6.8	
11/19/2017	1.036			260	2246				7	60	97							6.7	
11/20/2017	1.176	287	2815	300	2942	4	39	99	7	69	98	2						6.4	
11/21/2017	1.295	318	3434	260	2808	8	86	97	8	86	97	1						6.7	
11/22/2017	1.311	299	3269	376	4111	7	77	98	8	87	98	1						6.8	
11/23/2017	1.284			384	4112				12	129	97	1						6.9	
11/24/2017	1.327			272	3010				12	133	96	1						6.6	
11/25/2017	1.256			304	3184				10	105	97							6.6	
11/26/2017	1.232			360	3699				10	103	97							6.6	
11/27/2017	1.458	276	3356	380	4621	6	73	98	9	109	98	2						6.5	
11/28/2017	1.369			300	3425				11	126	96	11						6.6	
11/29/2017	1.432	297	3547	344	4108	9	107	97	13	155	96	4						6.8	
11/30/2017	1.379	295	3393	356	4094	8	92	97	10	115	97	4						6.5	
12/1/2017	1.598			360	4798				12	160	97	12						6.6	
12/2/2017	1.574			352	4621				11	144	97							6.8	
12/3/2017	1.587			224	2965				9	119	96							6.6	
12/4/2017	1.476	219	2696	228	2807	7	86	97	9	111	96	17						6.2	
12/5/2017	1.344			276	3094				10	112	96	7						6.5	
12/6/2017	1.289	293	3150	272	2924	8	86	97	11	118	96	11						6.6	
12/7/2017	1.267			324	3424				9	95	97	3	22.2	5.28	3.04	8.16	26.9	6.6	
12/8/2017	1.258	340	3567	364	3819	8	84	98	11	115	97	3						6.7	
12/9/2017	1.178			552	5423				13	128	98							6.6	
12/10/2017	1.183			292	2881				13	128	96							6.6	
12/11/2017	1.204	342	3434	256	2571	8	80	98	13	131	95	11						6.7	
12/12/2017	1.161			384	3718				11	107	97	19						6.3	
12/13/2017	1.160	313	3028	336	3251	8	77	97	12	116	96	3						6.7	
12/14/2017	1.132			368	3474				11	104	97	8						6.5	
12/15/2017	1.125	320	3002	332	3115	9	84	97	12	113	96	7						6.5	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
12/16/2017	1.166			316	3073				7	68	98							6.9	
12/17/2017	1.184			356	3515				11	109	97							6.8	
12/18/2017	1.734	295	4266	336	4859	8	116	97	12	174	96	12						6.7	
12/19/2017	1.800			320	4804				11	165	97	3						6.6	
12/20/2017	1.900	224	3550	284	4500	9	143	96	13	206	95	11						6.3	
12/21/2017	1.579	227	2989	224	2950	10	132	96	11	145	95	52						6.4	
12/22/2017	1.480			272	3357				12	148	96	19						6.7	
12/23/2017	1.411			216	2542				13	153	94							6.8	
12/24/2017	1.339			240	2680				13	145	95							6.6	
12/25/2017	1.245			212	2201				11	114	95	4						6.8	
12/26/2017	1.112	205	1901	228	2114	7	65	97	8	74	96	347						6.6	
12/27/2017	1.236	335	3453	348	3587	10	103	97	13	134	96	3						6.5	
12/28/2017	1.203			408	4093				13	130	97	1						6.8	
12/29/2017	1.269	289	3059	412	4360	11	116	96	13	138	97	7						6.5	
12/30/2017	1.798			356	5338				16	240	96							6.9	
12/31/2017	1.536			288	3689				6	77	98							6.7	
1/1/2018	1.371	231	2641	300	3430	8	91	97	10	114	97	1						6.6	
1/2/2018	1.302			184	1998				10	109	95	4						6.5	
1/3/2018	1.388	281	3253	328	3797	11	127	96	12	139	96	25						6.8	
1/4/2018	1.326			428	4733				9	100	98	5						6.6	
1/5/2018	1.333	338	3758	456	5069	9	100	97	10	111	98	186						6.6	
1/6/2018	1.391			328	3805				9	104	97							6.8	
1/7/2018	1.375			284	3257				8	92	97							6.7	
1/8/2018	1.575	276	3625	272	3573	9	118	97	11	144	96	20						6.7	
1/9/2018	1.751			364	5316				7	102	98	28						6.6	
1/10/2018	1.742	256	3719	340	4940	9	131	96	11	160	97	5						6.7	
1/11/2018	1.620			328	4432				8	108	98	17	15.7	0.599	0.21	5.05	17.2	6.4	
1/12/2018	2.187	265	4833	232	4232	9	164	97	11	201	95	21						6.3	
1/13/2018	2.104			248	4352				10	175	96							6.9	
1/14/2018	1.944			156	2529				7	113	96							6.7	
1/15/2018	1.705			156	2218				8	114	95	7						6.7	
1/16/2018	1.661	182	2521	188	2604	7	97	96	7	97	96	13						6.6	
1/17/2018	1.621	223	3015	324	4380	7	95	97	7	95	98	8						6.8	
1/18/2018	1.588	226	2993	352	4662	7	93	97	9	119	97	20						6.7	
1/19/2018	1.512			208	2623				7	88	97	20						6.6	
1/20/2018	1.530			276	3522				10	128	96							6.8	
1/21/2018	1.361			216	2452				6	68	97							6.7	
1/22/2018	1.506	358	4496	268	3366	6	75	98	4	50	99	19						6.5	
1/23/2018	1.512			336	4237				6	76	98	4						6.6	
1/24/2018	1.732	267	3857	548	7916	7	101	97	8	116	99	31						6.6	
1/25/2018	1.660	270	3738	382	5289	7	97	97	4	55	99	4						6.7	
1/26/2018	1.634			404	5506				7	95	98	13						6.6	
1/27/2018	1.599			440	5868				10	133	98							7	
1/28/2018	1.523			224	2845				12	152	95							6.8	
1/29/2018	1.561			184	2395				4	52	98	5						6.7	
1/30/2018	1.983	183	3026	382	6318	7	116	96	7	116	98	3						6.7	
1/31/2018	1.984	234	3872	320	5295	9	149	96	7	116	98	3						6.6	
2/1/2018	1.861			288	4470				8	124	97	17						6.5	
2/2/2018	1.919	217	3473	272	4353	14	224	94	6	96	98	20						7	
2/3/2018	2.113			280	4934				9	159	97							6.7	
2/4/2018	2.537			172	3639				14	296	92							6.7	
2/5/2018	2.742	94	2150	304	6952	16	366	83	21	480	93	1						6.5	
2/6/2018	2.601			220	4772				6	130	97	1						6.5	
2/7/2018	2.514	184	3858	304	6374	11	231	94	9	189	97	11						6.6	
2/8/2018	2.471			192	3957				4	82	98	1	7.26	0.99	0.72	5.56	9.31	6.6	
2/9/2018	2.363	171	3370	216	4257	8	158	95	4	79	98	13						6.4	
2/10/2018	2.255			224	4213				5	94	98							6.7	
2/11/2018	2.181			132	2401				6	109	95							6.9	
2/12/2018	2.154	241	4329	148	2659	13	234	95	7	126	95	3						6.5	
2/13/2018	2.063			188	3235				6	103	97	1						6.6	
2/14/2018	2.139	235	4192	228	4067	18	321	92	9	161	96	12						6.4	
2/15/2018	2.255			300	5642				9	169	97	8						6.6	
2/16/2018	2.18	204	3709	280	5091	16	291	92	10	182	96	12						6.6	
2/17/2018	2.465			152	3125				8	164	95							6.8	
2/18/2018	2.626			172	3767				9	197	95							6.8	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
2/19/2018	2.368			116	2291				7	138	94	3						6.8	
2/20/2018	2.268	133	2516	136	2572	6	113	95	6	113	96	4						6.8	
2/21/2018	2.15	179	3210	196	3514	6	108	97	7	126	96	15						6.9	
2/22/2018	2.067			160	2758				7	121	96	1						6.9	
2/23/2018	1.975	263	4332	372	6127	6	99	98	8	132	98	11						6.8	
2/24/2018	1.925			272	4367				6	96	98							6.9	
2/25/2018	1.981			136	2247				7	116	95							6.9	
2/26/2018	1.961	173	2829	156	2551	5	82	97	5	82	97	11						6.5	
2/27/2018	1.928			196	3152				6	96	97	5						6.8	
2/28/2018	1.897	163	2579	192	3038	6	95	96	4	63	98	3						6.9	
3/1/2018	1.837			228	3493				6	92	97	3						6.9	
3/2/2018	1.841	256	3931	256	3931	6	92	98	7	107	97	1						6.8	
3/3/2018	1.777			232	3438				6	89	97							6.9	
3/4/2018	1.698			204	2889				7	99	97							6.7	
3/5/2018	1.715	204	2918	188	2689	6	86	97	9	129	95	21						6.5	
3/6/2018	1.674			244	3407				7	98	97	7						6.4	
3/7/2018	1.684	266	3736	288	4045	8	112	97	7	98	98	3						6.4	
3/8/2018	1.661			324	4488				8	111	98	3						6.9	
3/9/2018	1.686	215	3023	256	3600	7	98	97	8	112	97	4						6.8	
3/10/2018	1.625			292	3957				10	136	97							6.8	
3/11/2018	1.499			176	2200				7	88	96							6.4	
3/12/2018	1.559	218	2834	236	3068	8	104	96	17	221	93							6.7	
3/13/2018	1.556			296	3841				7	91	98	12						6.7	
3/14/2018	1.589	270	3578	312	4135	8	106	97	8	106	97	1						6.6	
3/15/2018	1.693			244	3445				11	155	95	13	11.7	0.629	0.16	4.81	16.8	6.7	
3/16/2018	1.597	232	3090	272	3623	11	147	95	11	147	96	7						6.9	
3/17/2018	1.544			368	4739				11	142	97	12						6.9	
3/18/2018	1.496			244	3044				6	75	98							6.9	
3/19/2018	1.470	250	3065	256	3139	10	123	96	11	135	96							6.7	
3/20/2018	1.458			344	4183				9	109	97	18						6.8	
3/21/2018	1.445	294	3543	328	3953	11	133	96	10	121	97	7						7.1	
3/22/2018	1.456			356	4323				11	134	97	16						6.9	
3/23/2018	1.670	346	4819	356	4958	11	153	97	15	209	96	2						6.9	
3/24/2018	1.586			292	3862				13	172	96	5						7.1	
3/25/2018	1.568			220	2877				11	144	95							7	
3/26/2018	1.534	289	3697	208	2661	10	128	97	13	166	94							6.9	
3/27/2018	1.751			376	5491				15	219	96	13						6.8	
3/28/2018	1.986	254	4207	276	4571	15	248	94	11	182	96	12						7.1	
3/29/2018	1.774			292	4320				11	163	96	8						6.8	
3/30/2018	1.752	383	5596	292	4267	15	219	96	12	175	96	33						7	
3/31/2018	1.693			288	4066				9	127	97	5						7.1	
4/1/2018	1.629			180	2445				9	122	95							7.1	
4/2/2018	1.628	216	2933	196	2661	8	109	96	11	149	94	9						7	
4/3/2018	1.672			264	3681				9	126	97	24						7	
4/4/2018	1.601	300	4006	300	4006	11	147	96	9	120	97	19						7.1	
4/5/2018	1.711			420	5993				12	171	97	16						6.9	
4/6/2018	2.082	263	4567	252	4376	10	174	96	9	156	96	3						6.8	
4/7/2018	1.933			184	2966				2	32	99							7	
4/8/2018	1.861			152	2359				8	124	95							6.8	
4/9/2018	1.878	272	4260	232	3634	8	125	97	10	157	96	16						6.8	
4/10/2018	1.873			252	3936				12	187	95	3						6.7	
4/11/2018	1.848	238	3668	276	4254	12	185	95	7	108	97	23						6.9	
4/12/2018	1.784			296	4404				9	134	97	10	18.7	1.97	1.17	1.34	23	6.8	
4/13/2018	1.688	238	3351	268	3773	9	127	96	8	113	97	15						6.9	
4/14/2018	1.696			424	5997				13	184	97							7.1	
4/15/2018	2.041			596	10145				11	187	98							6.8	
4/16/2018	2.033	183	3103	188	3188	7	119	96	8	136	96	10						6.7	
4/17/2018	2.533			256	5408				9	190	96	27						6.6	
4/18/2018	2.360	195	3838	220	4330	11	217	94	8	157	96	3						6.7	
4/19/2018	2.166			216	3902				11	199	95	7						6.6	
4/20/2018	2.004	231	3861	188	3142	9	150	96	11	184	94	5						6.7	
4/21/2018	1.896			264	4175				9	142	97							7	
4/22/2018	1.790			172	2568				8	119	95							6.9	
4/23/2018	1.751	195	2848	188	2745	8	117	96	7	102	96	7						6.7	
4/24/2018	1.758			232	3402				10	147	96	22						6.8	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
4/25/2018	1.685	227	3190	260	3654	8	112	96	13	183	95	3						6.9	
4/26/2018	1.619			288	3889				13	176	95	2						6.9	
4/27/2018	1.562	275	3582	348	4533	12	156	96	13	169	96	5						6.8	
4/28/2018	1.520			252	3195				13	165	95							7.1	
4/29/2018	1.565			220	2871				15	196	93							6.9	
4/30/2018	1.571	230	3013	228	2987	8	105	97	17	223	93	2						6.8	
5/1/2018	1.546			312	4023				16	206	95	2						6.7	
5/2/2018	1.493	260	3237	336	4184	10	125	96	16	199	95	5						6.9	
5/3/2018	1.489			320	3974				15	186	95	5						6.7	
5/4/2018	1.443	303	3646	312	3755	8	96	97	12	144	96	2						6.6	
5/5/2018	1.403			356	4166				13	152	96							6.6	
5/6/2018	1.404			248	2904				10	117	96							6.6	
5/7/2018	1.397	255	2971	260	3029	7	82	97	10	117	96	27						6.5	
5/8/2018	1.434			340	4066				12	144	96	108						6.8	
5/9/2018	1.399	326	3804	384	4480	8	93	98	8	93	98	12						6.6	
5/10/2018	1.385			332	3835				9	104	97	3						6.7	
5/11/2018	1.435	301	3602	336	4021	6	72	98	7	84	98	5						6.5	
5/12/2018	1.343			292	3271				7	78	98		18.7	1.97	1.17	1.34	23	6.8	
5/13/2018	1.386			304	3514				9	104	97							6.7	
5/14/2018	1.375	276	3165	284	3257	6	69	98	7	80	98	1						6.6	
5/15/2018	1.365			304	3461				10	114	97	1						6.5	
5/16/2018	1.367	289	3295	284	3238	9	103	97	13	148	95	8						6.4	
5/17/2018	1.297			372	4024				19	206	95	18						6.4	
5/18/2018	1.284	288	3084	356	3812	12	129	96	19	203	95	4						6.6	
5/19/2018	1.234			316	3252				11	113	97							6.7	
5/20/2018	1.236			248	2556				7	72	97							6.3	
5/21/2018	1.315	268	2939	252	2764	4	44	99	8	88	97	8						6.5	
5/22/2018	1.235			376	3873				9	93	98	31						6.5	
5/23/2018	1.189	301	2985	412	4085	6	59	98	9	89	98	27						6.5	
5/24/2018	1.306			400	4357				12	131	97	4						6.5	
5/25/2018	1.281	213	2276	400	4273	8	85	96	12	128	97	3						6.4	
5/26/2018	1.286			460	4934				13	139	97							6.6	
5/27/2018	1.287			372	3993				11	118	97							6.6	
5/28/2018	1.224			220	2246				10	102	95	7						6.5	
5/29/2018	1.280			232	2477				10	107	96	8						6.6	
5/30/2018	1.277	315	3355	352	3749	6	64	98	13	138	96	14						6.4	
5/31/2018	1.260	326	3426	336	3531	10	105	97	13	137	96	44						6.6	
6/1/2018	1.267	351	3709	332	3508	7	74	98	15	159	95	8						6.6	18
6/2/2018	1.202			452	4531				13	130	97							6.5	
6/3/2018	1.200			284	2842				10	100	96							6.5	
6/4/2018	1.339	315	3518	300	3350	7	78	98	16	179	95	2						6.6	18
6/5/2018	1.251			432	4507				8	83	98	60						6.6	
6/6/2018	1.243	353	3659	380	3939	7	73	98	10	104	97	27						6.5	18.1
6/7/2018	1.227			356	3643				17	174	95	20						6.7	
6/8/2018	1.250	365	3805	452	4712	10	104	97	11	115	98	7						6.8	18.3
6/9/2018	1.278			496	5287				10	107	98							6.4	
6/10/2018	1.190			236	2342				8	79	97							6.7	
6/11/2018	1.235	302	3111	292	3008	5	51	98	6	62	98	1						6.5	18.2
6/12/2018	1.234			440	4528				5	51	99	15						6.5	
6/13/2018	1.233	341	3507	460	4730	6	62	98	8	82	98	1						6.9	18.3
6/14/2018	1.272			324	3437				9	95	97	7						6.7	
6/15/2018	1.215	373	3780	372	3770	4	41	99	7	71	98	5	0.85	0.543	0.25	6.25	3.54	6.6	18.5
6/16/2018	1.204			308	3093				12	120	96							6.3	
6/17/2018	1.222			228	2324				9	92	96							6.7	
6/18/2018	1.217	312	3167	260	2639	5	51	98	6	61	98	19						6.6	19.5
6/19/2018	1.233			384	3949				7	72	98	2						6.5	
6/20/2018	1.216			392	3975				7	71	98	1						6.6	19.8
6/21/2018	1.182	320	3155	400	3943	6	59	98	5	49	99	5						6.7	
6/22/2018	1.206	329	3309	308	3098	8	80	98	9	91	97	9						6.6	19.7
6/23/2018	1.202			428	4291				9	90	98							6.6	
6/24/2018	1.168			308	3000				11	107	96							6.6	
6/25/2018	1.241	337	3488	320	3312	6	62	98	9	93	97	18						6.5	19.9
6/26/2018	1.235			428	4408				14	144	97	1						6.4	
6/27/2018	1.176	291	2854	328	3217	13	128	96	12	118	96	13						6.7	21.7
6/28/2018	1.171			416	4063				20	195	95	24						6.6	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
6/29/2018	1.148	373	3571	404	3868	11	105	97	23	220	94	13						6.4	21.7
6/30/2018	1.145			312	2979				24	229	92							6.4	
7/1/2018	1.227			444	4544				22	225	95							6.6	
7/2/2018	1.166	308	2995	288	2801	10	97	97	20	194	93	29						6.3	19.6
7/3/2018	1.188	344	3408	412	4082	10	99	97	22	218	95	23						6.7	
7/4/2018	1.088			316	2867				21	191	93	1						6.7	20.6
7/5/2018	1.053			456	4005				15	132	97	12						6.4	
7/6/2018	1.120	320	2989	432	4035	5	47	98	13	121	97	1						6.4	21.4
7/7/2018	1.118			380	3543				13	121	97							6.5	
7/8/2018	1.139			244	2318				11	104	95							6.5	
7/9/2018	1.118	314	2928	328	3058	5	47	98	9	84	97	11						6.3	22.8
7/10/2018	1.103			368	3385				11	101	97	8						6.4	22.5
7/11/2018	1.094	345	3148	416	3796	6	55	98	10	91	98	22						6.3	
7/12/2018	1.101			428	3930				9	83	98	17	0.29	3.96	3.44	12.1	3.43	6.5	
7/13/2018	1.126	392	3681	636	5973	10	94	97	13	122	98	29						6.6	23.3
7/14/2018	1.033			544	4687				12	103	98							6.6	
7/15/2018	1.101			420	3857				13	119	97							6.5	
7/16/2018	1.100	353	3238	376	3449	9	83	97	10	92	97	24						6.6	22.2
7/17/2018	1.010			552	4650				15	126	97	10						6.7	
7/18/2018	1.027	377	3229	548	4694	13	111	97	11	94	98	9						6.7	22
7/19/2018	0.992			516	4269				12	99	98	11						6.5	
7/20/2018	1.050	270	2364	218	1909	9	79	97	13	114	94	7						6.5	22.2
7/21/2018	1.005			692	5800				7	59	99							6.5	
7/22/2018	0.999			568	4732				9	75	98							6.4	
7/23/2018	1.040	551	4779	1276	11068	6	52	99	9	78	99	15						6.8	22.3
7/24/2018	1.039			512	4437				9	78	98	27						6.7	
7/25/2018	1.027	445	3812	488	4180	10	86	98	12	103	98	1						6.9	22.6
7/26/2018	1.020			672	5717				13	111	98	20						6.8	
7/27/2018	1.024	368	3143	424	3621	10	85	97	15	128	96	12						6.8	22.7
7/28/2018	1.018			432	3668				13	110	97							7.1	
7/29/2018	0.991			324	2678				13	107	96							6.7	
7/30/2018	0.989	307	2532	320	2639	5	41	98	9	74	97	17						6.9	23.3
7/31/2018	1.015			532	4503				14	119	97	9						6.9	
8/1/2018	1.009	409	3442	440	3703	6	50	99	15	126	97	18						6.7	22.6
8/2/2018	0.969			468	3782				13	105	97	43						7.1	
8/3/2018	0.992	385	3185	508	4203	6	50	98	9	74	98	5						6.9	22.7
8/4/2018	1.028			396	3395				10	86	97							7.3	
8/5/2018	0.980			288	2354				7	57	98							7.2	
8/6/2018	0.958	342	2732	332	2653	7	56	98	9	72	97	9						7.2	23
8/7/2018	1.025			468	4001				11	94	98	16	22.8	0.456	0.14	3.24	26.7	6.9	
8/8/2018	0.988	620	5109	568	4680	9	74	99	14	115	98	2						7.1	23.3
8/9/2018	0.964			528	4245				17	137	97	1						7.3	
8/10/2018	0.970	153	1238	604	4886	7	57	95	15	121	98	6						7.2	23.5
8/11/2018	1.011			584	4924				14	118	98							7.3	
8/12/2018	0.999			372	3099				17	142	95							7	
8/13/2018	0.974	204	1657	316	2567	7	57	97	21	171	93	1						6.9	
8/14/2018	0.982			524	4291				26	213	95	16						7	23
8/15/2018	0.993	284	2352	664	5499	9	75	97	29	240	96	1						6.8	23.7
8/16/2018	0.994			552	4576				33	274	94	9						7.2	
8/17/2018	0.998	281	2339	596	4961	8	67	97	25	208	96	5						6.9	24.7
8/18/2018	0.975			720	5855				27	220	96							6.7	
8/19/2018	0.960			340	2722				23	184	93							6.8	
8/20/2018	0.994	327	2711	304	2520	6	50	98	22	182	93	11						6.5	24.9
8/21/2018	0.999			476	3966				15	125	97	24						6.7	
8/22/2018	0.986	397	3265	336	2763	6	49	98	13	107	96	7						6.6	25
8/23/2018	0.941			476	3736				11	86	98	18						6.8	
8/24/2018	0.958	423	3380	528	4219	6	48	99	12	96	98	37						6.8	24.9
8/25/2018	0.932			712	5534				11	86	98							7	
8/26/2018	0.984			460	3775				10	82	98							6.8	
8/27/2018	1.025	327	2795	408	3488	4	34	99	9	77	98	24						6.7	24.5
8/28/2018	0.997			512	4257				9	75	98	27						6.6	
8/29/2018	0.951	340	2697	400	3173	6	48	98	9	71	98	62						6.3	24.2
8/30/2018	0.959	360	2879	472	3775	6	48	98	16	128	97	65						6.5	
8/31/2018	0.978			464	3785				11	90	98	173						6.5	24.2
9/1/2018	0.943			436	3429				10	79	98							6.7	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
9/2/2018	0.930			320	2482				11	85	97							6.7	
9/3/2018	0.909			356	2699				12	91	97	3						6.7	
9/4/2018	0.933	296	2303	336	2614	6	47	98	6	47	98	17						6.6	
9/5/2018	1.014	388	3281	436	3687	4	34	99	4	34	99	9						6.6	
9/6/2018	0.941			548	4301				10	78	98	3						6.4	
9/7/2018	0.927	408	3154	556	4299	5	39	99	11	85	98	2						6.8	
9/8/2018	0.959			408	3263				11	88	97							6.9	
9/9/2018	0.988			480	3955				9	74	98							6.9	
9/10/2018	1.048	413	3610	360	3147	5	44	99	8	70	98	15						6.7	
9/11/2018	1.046			420	3664				7	61	98	5						6.7	
9/12/2018	1.026	370	3166	488	4176	7	60	98	10	86	98	8						6.6	
9/13/2018	1.167			488	4750				7	68	99	11						6.7	
9/14/2018	1.088	329	2985	500	4537	7	64	98	8	73	98	1						6.7	
9/15/2018	1.031			404	3474				7	60	98							6.5	
9/16/2018	1.045			360	3138				8	70	98							6.6	
9/17/2018	1.079	332	2988	392	3528	5	45	98	7	63	98	23	2.06	1.35	1.01	13.1	4.82	6.5	
9/18/2018	1.013			308	2602				9	76	97	11						6.5	
9/19/2018	0.978	329	2683	372	3034	6	49	98	7	57	98	3						6.8	
9/20/2018	0.977			444	3618				9	73	98	19						6.7	
9/21/2018	0.968	370	2987	468	3778	5	40	99	9	73	98	21						6.8	
9/22/2018	0.981			492	4025				11	90	98							6.7	
9/23/2018	1.004			368	3081				11	92	97							6.5	
9/24/2018	0.979	383	3127	348	2841	5	41	99	9	73	97	37						6.6	
9/25/2018	0.920			504	3867				8	61	98	43						6.6	
9/26/2018	0.920	440	3376	528	4051	4	31	99	6	46	99	7						6.8	
9/27/2018	0.919			520	3986				9	69	98	47						6.6	
9/28/2018	0.925	413	3186	452	3487	5	39	99	7	54	98	1						6.9	
9/29/2018	0.899			472	3539				11	82	98							6.8	
9/30/2018	0.950			316	2504				6	48	98							6.6	
10/1/2018	0.995	330	2738	368	3054	7	58	98	11	91	97	33						6.7	
10/2/2018	1.025			364	3112				8	68	98	3						6.7	
10/3/2018	0.987	388	3194	372	3062	6	49	98	10	82	97	103						6.7	
10/4/2018	0.932			384	2985				10	78	97	74						6.8	
10/5/2018	0.910	376	2854	476	3613	6	46	98	8	61	98	49						6.7	
10/6/2018	0.924			428	3298				9	69	98							6.7	
10/7/2018	0.889			428	3173				7	52	98							6.6	
10/8/2018	0.941	433	3398	348	2731	7	55	98	7	55	98	35						6.5	
10/9/2018	0.979			412	3364				9	73	98	4						6.8	
10/10/2018	0.930	438	3397	496	3847	7	54	98	9	70	98	65						6.6	
10/11/2018	0.880			520	3816				8	59	98	44						6.7	
10/12/2018	0.878	410	3002	444	3251	7	51	98	8	59	98	15	18.3	4.96	3.84	14.3	23.5	6.6	
10/13/2018	0.867			588	4252				9	65	98							6.9	
10/14/2018	0.849			416	2946				7	50	98							6.7	
10/15/2018	0.848	375	2652	376	2659	4	28	99	7	50	98	31						6.6	
10/16/2018	0.853			428	3045				5	36	99	32						6.5	
10/17/2018	0.864	530	3819	512	3689	5	36	99	6	43	99	39						6.6	
10/18/2018	0.849			520	3682				8	57	98	15						6.8	
10/19/2018	0.831	539	3736	508	3521	7	49	99	11	76	98	21						6.9	
10/20/2018	0.835			520	3621				11	77	98							6.9	
10/21/2018	0.830			432	2990				7	48	98							6.8	
10/22/2018	0.851	393	2789	348	2470	4	28	99	7	50	98	36						6.6	
10/23/2018	0.845			416	2932				7	49	98	120						6.7	
10/24/2018	0.898	465	3483	592	4434	8	60	98	10	75	98	11						6.5	
10/25/2018	0.867			532	3847				10	72	98	36						6.5	
10/26/2018	0.901	596	4479	652	4899	8	60	99	9	68	99	28						6.5	
10/27/2018	0.963			612	4915				10	80	98							6.8	
10/28/2018	1.215			404	4094				11	111	97							6.8	
10/29/2018	1.284	306	3277	364	3898	7	75	98	10	107	97	85						6.6	
10/30/2018	1.107			468	4321				10	92	98	13						6.6	
10/31/2018	1.100	315	2890	344	3156	8	73	97	9	83	97	127						6.5	
11/1/2018	1.172			368	3597				13	127	96	65						6.7	
11/2/2018	1.756	325	4760	432	6327	9	132	97	11	161	97	16						6.5	
11/3/2018	1.319			176	1936				11	121	94							6.8	
11/4/2018	1.319			368	4048				11	121	97							6.6	
11/5/2018	1.283	263	2814	324	3467	4	43	98	8	86	98	84						6.7	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
11/6/2018	1.243			320	3317				19	197	94	12						6.4	
11/7/2018	1.156	341	3288	392	3779	14	135	96	15	145	96	72						6.8	
11/8/2018	1.050			423	3704				7	61	98	36	9.62	1.38	0.97	10.4	14.3	6.6	
11/9/2018	1.000	419	3494	600	5004	6	50	99	9	75	99	64						6.6	
11/10/2018	1.131			616	5810				9	85	99							7	
11/11/2018	1.099			380	3483				10	92	97							6.9	
11/12/2018	1.047			352	3074				11	96	97	65						6.7	
11/13/2018	1.058	253	2232	312	2753	6	53	98	7	62	98	42						6.6	
11/14/2018	1.044	475	4136	584	5085	10	87	98	11	96	98	65						6.8	
11/15/2018	1.079			496	4463				10	90	98	30						6.6	
11/16/2018	1.106	458	4225	544	5018	7	65	98	9	83	98	79						6.6	
11/17/2018	1.006			504	4229				9	76	98							6.8	
11/18/2018	0.988			456	3757				12	99	97							6.7	
11/19/2018	0.978	469	3825	388	3165	9	73	98	13	106	97	11						6.7	
11/20/2018	1.014	370	3129	432	3653	10	85	97	17	144	96	8						6.8	
11/21/2018	0.985	389	3196	424	3483	14	115	96	15	123	96	17						6.9	
11/22/2018	1.066			456	4054				18	160	96	71						7.1	
11/23/2018	1.092			348	3169				15	137	96	7						7	
11/24/2018	1.168			356	3468				13	127	96							6.9	
11/25/2018	1.101			308	2828				15	138	95							6.8	
11/26/2018	1.182	298	2938	280	2760	12	118	96	15	148	95	50						6.8	
11/27/2018	1.115			416	3868				15	139	96	17						6.6	
11/28/2018	1.159	261	2523	296	2861	10	97	96	13	126	96	23						6.7	
11/29/2018	1.136			308	2918				13	123	96	4						7	
11/30/2018	1.108	290	2680	304	2809	12	111	96	15	139	95	39						7.2	
12/1/2018	1.098			340	3113				9	82	97							7.1	
12/2/2018	1.050			280	2452				13	114	95							6.7	
12/3/2018	1.051	355	3112	380	3331	8	70	98	13	114	97	4						6.8	
12/4/2018	1.026			428	3662				13	111	97	4						7.1	
12/5/2018	1.039	349	3024	448	3882	8	69	98	12	104	97	8						6.7	
12/6/2018	1.000			380	3169				11	92	97	1						7.1	
12/7/2018	1.018	289	2454	440	3736	5	42	98	12	102	97	1						7.1	
12/8/2018	1.002			416	3476				11	92	97							6.9	
12/9/2018	1.019			432	3671				13	110	97							6.8	
12/10/2018	1.118	378	3525	448	4177	9	84	98	13	121	97	12						6.7	
12/11/2018	1.132			372	3512				11	104	97	8						6.9	
12/12/2018	1.333	310	3446	336	3735	14	156	95	14	156	96	1						6.8	
12/13/2018	1.163			392	3802				10	97	97	4						6.8	
12/14/2018	1.262	317	3336	400	4210	9	95	97	12	126	97	1						6.8	
12/15/2018	1.187			368	3643				10	99	97							6.6	
12/16/2018	1.196			184	1835				11	110	94							6.7	
12/17/2018	1.166	260	2528	264	2567	7	68	97	10	97	96	3	5.15	0.795	0.07	8.45	6.6	6.7	
12/18/2018	1.126			528	4958				12	113	98	4						6.5	
12/19/2018	1.251	277	2890	348	3631	11	115	96	12	125	97	50						6.9	
12/20/2018	1.239			384	3968				10	103	97	13						6.7	
12/21/2018	0.936	380	2966	488	3809	7	55	98	6	47	99	23						6.5	
12/22/2018	1.168		0	520	5065				19	185	96							6.9	
12/23/2018	1.198		0	340	3397				8	80	98							6.8	
12/24/2018	1.322	281	3098	284	3131	9	99	97	19	209	93	10						6.7	
12/25/2018	1.164		0	260	2524				15	146	94	22						6.7	
12/26/2018	1.039	258	2236	256	2218	7	61	97	13	113	95	8						6.5	
12/27/2018	1.175	332	3253	436	4273	11	108	97	13	127	97	98						6.6	
12/28/2018	1.117			520	4844				18	168	97	24						6.8	
12/29/2018	1.605			368	4926				20	268	95							6.8	
12/30/2018	1.713			284	4057				20	286	93							6.6	
12/31/2018	1.519	156	1976	224	2838	4	51	97	5	63	98	1						6.7	
1/1/2019	1.365			268	3051				15	171	94	4						6.9	
1/2/2019	1.284			232	2484				13	139	94	4						6.7	
1/3/2019	1.375	238	2729	368	4220	6	69	97	15	172	96	22						6.7	
1/4/2019	1.484	307	3800	400	4951	9	111	97	13	161	97	12						6.8	
1/5/2019	1.393			264	3067				14	163	95							7	
1/6/2019	1.342			224	2507				13	145	94							6.9	
1/7/2019	1.395	198	2304	224	2606	7	81	96	11	128	95	9						6.7	
1/8/2019	1.406			424	4972				8	94	98	7						6.6	
1/9/2019	1.399	314	3664	596	6954	11	128	96	13	152	98	1						6.9	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
1/10/2019	1.361			392	4449				11	125	97	21	15.9	1.34	0.67	5.17	24.1	6.7	
1/11/2019	1.301	285	3092	396	4297	11	119	96	12	130	97	4						6.8	
1/12/2019	1.256			300	3143				9	94	97							6.8	
1/13/2019	1.232			276	2836				9	92	97							6.9	
1/14/2019	1.252	290	3028	272	2840	9	94	97	12	125	96	8						7	
1/15/2019	1.195			392	3907				10	100	97	23						6.5	
1/16/2019	1.215	314	3182	420	4256	9	91	97	11	111	97	11						7	
1/17/2019	1.196	321	3202	416	4149	9	90	97	9	90	98	9						6.8	
1/18/2019	1.195			388	3867				9	90	98	23						6.8	
1/19/2019	1.190			376	3732				10	99	97							7	
1/20/2019	1.173			384	3757				9	88	98							6.8	
1/21/2019	1.188			308	3052				9	89	97	13						7	
1/22/2019	1.198			264	2638				8	80	97	13						6.6	
1/23/2019	1.466	325	3974	460	5624	10	122	97	10	122	98	8						6.7	
1/24/2019	1.488	250	3102	312	3872	13	161	95	14	174	96	3						6.9	
1/25/2019	1.373	314	3596	384	4397	14	160	96	12	137	97	8						6.9	
1/26/2019	1.310			284	3103				9	98	97							6.8	
1/27/2019	1.238			244	2519				12	124	95							6.5	
1/28/2019	1.281	254	2714	248	2650	11	118	96	9	96	96	5						6.6	
1/29/2019	1.236			340	3505				10	103	97	4						6.7	
1/30/2019	1.172	283	2766	388	3792	17	166	94	14	137	96	4						7	
1/31/2019	1.189			428	4244				13	129	97	7						6.9	
2/1/2019	1.194	345	3435	408	4063	10	100	97	13	129	97	18						7	
2/2/2019	1.211			396	3999				16	162	96							7.1	
2/3/2019	1.207			320	3221				7	70	98							6.9	
2/4/2019	1.279	294	3136	316	3371	13	139	96	24	256	92	1						6.8	
2/5/2019	1.152			348	3343				13	125	96	1						6.8	
2/6/2019	1.179	275	2704	296	2911	11	108	96	13	128	96	1						7	
2/7/2019	1.185			308	3044				11	109	96	7	18.4	2.7	2.05	6.92	19	6.8	
2/8/2019	1.225	309	3157	240	2452	9	92	97	11	112	95	5						7	
2/9/2019	1.190			256	2541				13	129	95							7	
2/10/2019	1.153			268	2577				11	106	96							6.9	
2/11/2019	1.154	266	2560	260	2502	10	96	96	13	125	95	3						6.9	
2/12/2019	1.112			236	2189				9	83	96	1						7.1	
2/13/2019	1.155	242	2331	252	2427	11	106	95	12	116	95	37						6.8	
2/14/2019	1.282			232	2481				9	96	96	31						7.1	
2/15/2019	1.333	279	3102	296	3291	7	78	97	11	122	96	33						7	
2/16/2019	1.492			260	3235				12	149	95							7	
2/17/2019	1.415			216	2549				11	130	95							6.9	
2/18/2019	1.376			156	1790				10	115	94	108						6.7	
2/19/2019	1.349			216	2430				12	135	94	81						6.9	
2/20/2019	1.348	335	3766	380	4272	12	135	96	21	236	94	9						7	
2/21/2019	1.361	243	2758	224	2543	11	125	95	15	170	93	112						7	
2/22/2019	1.274	296	3145	324	3443	10	106	97	13	138	96	157						7.1	
2/23/2019	1.332			464	5155				9	100	98							7.1	
2/24/2019	1.406			300	3518				8	94	97							7	
2/25/2019	1.400	231	2697	224	2615	10	117	96	12	140	95	97						6.9	
2/26/2019	1.332			300	3333				16	178	95	23						7	
2/27/2019	1.274	284	3018	336	3570	12	128	96	14	149	96	9						7.1	
2/28/2019	1.283			304	3253				15	161	95	23						7	
3/1/2019	1.205	283	2844	268	2693	9	90	97	15	151	94	8						7.2	
3/2/2019	1.174			284	2781				14	137	95							6.7	
3/3/2019	1.172			256	2502				12	117	95							6.9	
3/4/2019	1.258			264	2770				10	105	96	36						7	
3/5/2019	1.143	296	2822	312	2974	14	133	95	13	124	96	8						7.1	
3/6/2019	1.155	335	3227	428	4123	10	96	97	10	96	98	132						7	
3/7/2019	1.143			372	3546				12	114	97	196	31.75	0.759	0.26	0.75	36.1	7	
3/8/2019	1.299	324	3510	360	3900	12	130	96	13	141	96	30						6.9	
3/9/2019	1.277			476	5069				2	21	100							6.8	
3/10/2019	1.158			236	2279				9	87	96							6.9	
3/11/2019	1.222	282	2874	240	2446	8	82	97	8	82	97	8						6.8	
3/12/2019	1.358			332	3760				9	102	97	116						6.7	
3/13/2019	1.457	310	3767	420	5104	12	146	96	9	109	98	66						6.8	
3/14/2019	1.312			364	3983				11	120	97	31						6.9	
3/15/2019	1.290	300	3228	372	4002	12	129	96	13	140	97	360						7	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
3/16/2019	1.223			256	2611				14	143	95	28						7	
3/17/2019	1.230			272	2790				5	51	98							7	
3/18/2019	1.234	295	3036	292	3005	11	113	96	16	165	95	281						6.9	
3/19/2019	1.185			328	3242				12	119	96	24						7.1	
3/20/2019	1.179	337	3314	388	3815	11	108	97	17	167	96	43						7	
3/21/2019	1.171			292	2852				13	127	96	23						7	
3/22/2019	1.188	243	2408	360	3567	14	139	94	13	129	96	80						7	
3/23/2019	1.142			420	4000				12	114	97							7.1	
3/24/2019	1.179			284	2793				11	108	96							7.2	
3/25/2019	1.195	381	3797	284	2830	15	149	96	8	80	97	50						7	
3/26/2019	1.167			432	4205				9	88	98	33						7	
3/27/2019	1.188	325	3220	356	3527	15	149	95	7	69	98	56						7.1	
3/28/2019	1.178			388	3812				7	69	98	15						7.1	
3/29/2019	1.148	356	3408	340	3255	11	105	97	7	67	98	19						7.1	
3/30/2019	1.173			376	3678				7	68	98							7.2	
3/31/2019	1.062			252	2232				5	44	98							7	
4/1/2019	1.112	290	2689.4832	272	2523	15	139	95	7	65	97	8						7	
4/2/2019	1.144			492	4694				3	29	99	352						7	
4/3/2019	1.158	271	2617.24212	428	4134	15	145	94	3	29	99	16						7.3	
4/4/2019	1.194			464	4620				9	90	98	1						7	
4/5/2019	1.116	402	3741.59088	388	3611	8	74	98	10	93	97	162	54.2	0.509	0.15	0.6	59.6	7.2	
4/6/2019	1.151			304	2918				10	96	97							7.1	
4/7/2019	1.213			380	3844				10	101	97							7.1	
4/8/2019	1.200	302	3022.416	336	3363	14	140	95	7	70	98	28						7.2	
4/9/2019	1.271			284	3010				6	64	98	192						6.8	
4/10/2019	1.28	352	3757.6704	452	4825	16	171	95	6	64	99	85						7.3	
4/11/2019	1.304			452	4916				9	98	98	8						7.4	
4/12/2019	1.464	375	4578.66	452	5519	15	183	96	9	110	98	78						7.1	
4/13/2019	1.403			476	5570				7	82	99							7.2	
4/14/2019	1.551			240	3104				5	65	98							6.8	
4/15/2019	1.561	262	3410.90988	228	2968	9	117	97	5	65	98	13						7.1	
4/16/2019	1.352			368	4149				5	56	99	11						7.2	
4/17/2019	1.353	291	3283.64982	264	2979	9	102	97	5	56	98	23						7.1	
4/18/2019	1.316			372	4083				7	77	98	15						7.2	
4/19/2019	1.492	342	4255.60176	432	5375	9	112	97	8	100	98	15						7	
4/20/2019	1.556			320	4153				4	52	99							7	
4/21/2019	1.454			292	3541				5	61	98							6.6	
4/22/2019	1.369	264	3014.20944	248	2832	7	80	97	4	46	98	16						7	
4/23/2019	1.317			372	4086				5	55	99	9						7.1	
4/24/2019	1.256	334	3498.66336	372	3897	7	73	98	5	52	99	3						7.1	
4/25/2019	1.189			376	3729				3	30	99	24						7	
4/26/2019	1.179	350	3441.501	360	3540	9	88	97	5	49	99	7						7.1	
4/27/2019	1.169		0	448	4368				7	68	98							6.7	
4/28/2019	1.18		0	336	3307				1	10	100							6.9	
4/29/2019	1.225	320	3269.28	296	3024	5	51	98	5	51	98	4						6.8	
4/30/2019	1.123			348	3259				4	37	99	8						7	
5/1/2019	1.112	328	3042	420	3895	7	65	98	5	46	99	100						6.6	
5/2/2019	1.139			416	3952				7	66	98	3						7.2	
5/3/2019	1.080	386	3477	452	4071	7	63	98	6	54	99	145						7.1	
5/4/2019	1.043			448	3897				11	96	98							7.2	
5/5/2019	1.084			384	3472				8	72	98							7.1	
5/6/2019	1.122	417	3902	356	3331	3	28	99	7	66	98	4						6.5	
5/7/2019	1.102			384	3529				7	64	98	11						6.8	
5/8/2019	1.065	369	3277	336	2984	6	53	98	6	53	98	27						6.5	
5/9/2019	1.094			440	4015				8	73	98	117						6.5	
5/10/2019	1.083	443	4001	660	5961	8	72	98	8	72	99	118	16.8	7.58	3.12	12.8	21.4	6.8	
5/11/2019	1.075			416	3730				9	81	98							6.8	
5/12/2019	1.087			368	3336				11	100	97							6.8	
5/13/2019	1.082	371	3348	356	3213	11	99	97	11	99	97	115						6.7	
5/14/2019	1.055			484	4259				11	97	98	40						6.5	
5/15/2019	1.063	331	2934	460	4078	11	98	97	9	80	98	89						6.4	
5/16/2019	1.025			472	4035				11	94	98	23						6.5	
5/17/2019	1.067	375	3337	468	4165	11	98	97	11	98	98	7						6.5	
5/18/2019	1.083			464	4191				9	81	98							6.7	
5/19/2019	1.040			476	4129				10	87	98	1						6.7	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
5/20/2019	1.104	360	3315	324	2983	12	110	97	8	74	98	5						6.5	
5/21/2019	1.079			304	2736				8	72	97	1						6.7	
5/22/2019	1.078	293	2634	336	3021	8	72	97	7	63	98	16						6.4	
5/23/2019	1.050			468	4098				8	70	98	1						6.4	
5/24/2019	1.054	434	3815	512	4501	13	114	97	11	97	98							6.9	
5/25/2019	1.026			244	2088				5	43	98							7	
5/26/2019	1.101			296	2718				10	92	97	27						6.7	
5/27/2019	1.029			332	2849				5	43	98	3						6.8	
5/28/2019	1.086			312	2826				7	63	98	4						6.5	
5/29/2019	1.064	402	3567	488	4330	14	124	97	12	106	98	1						6.8	
5/30/2019	1.035	294	2538	408	3522	14	121	95	13	112	97							6.7	
5/31/2019	1.041	373	3238	604	5244	11	96	97	13	113	98							6.6	
6/1/2019	1.038			340	2943				11	95	97							6.5	
6/2/2019	1.085			324	2932				8	72	98							6.7	
6/3/2019	1.105	297	2737.0629	284	2617	6	55	98	7	65	98	25						6.8	20.8
6/4/2019	1.052			372	3264				8	70	98	4						6.6	
6/5/2019	1.068	353	3144.21336	412	3670	9	80	97	8	71	98	58						6.5	21.2
6/6/2019	1.120			580	5418				9	84	98	35						6.8	
6/7/2019	1.067	440	3915.4632	588	5232	10	89	98	10	89	98	7						6.9	20.6
6/8/2019	1.038			428	3705				12	104	97							6.6	
6/9/2019	1.057			448	3949				15	132	97							6.5	
6/10/2019	1.101	338	3103.63092	300	2755	8	73	98	7	64	98	64						6.6	21.3
6/11/2019	0.928			476	3684				11	85	98	10						6.5	
6/12/2019	0.910	432	3278.6208	544	4129	13	99	97	18	137	97	7						6.8	22.4
6/13/2019	0.942			468	3677				22	173	95	24	17.3	14.3	10.3	20.6	21.4	6.6	
6/14/2019	0.889	425	3151.0605	494	3663	16	119	96	25	185	95	36						6.6	22.4
6/15/2019	0.900			488	3663				19	143	96							7.1	
6/16/2019	0.930			400	3102				11	85	97							7.1	
6/17/2019	0.928	477	3691.75104	400	3096	11	85	98	8	62	98	43						6.9	20.7
6/18/2019	0.903			572	4308				10	75	98	215						6.8	
6/19/2019	1.054	426	3744.69336	444	3903	12	105	97	9	79	98	91						7	20.3
6/20/2019	1.015			468	3962				12	102	97	83						7.2	
6/21/2019	1.008	374	3144.11328	508	4271	18	151	95	15	126	97	11						7.1	20.3
6/22/2019	0.991			484	4000				11	91	98							7	
6/23/2019	0.958			368	2940				11	88	97							7.1	
6/24/2019	0.961	370	2965.4538	308	2469	11	88	97	6	48	98	140						7.1	20.1
6/25/2019	0.857			332	2373				8	57	98	49						7	
6/26/2019	0.979	469	3829.31934	288	2351	16	131	97	13	106	95	28						7.3	20.3
6/27/2019	1.047			408	3563				12	105	97	44						7.2	
6/28/2019	1.069	511	4555.80006	460	4101	14	125	97	9	80	98	33						6.9	20.6
6/29/2019	1.000			388	3236				13	108	97							7.1	
6/30/2019	0.971			404	3272				11	89	97							6.8	
7/1/2019	1.018	355	3014	328	2785	11	93	97	14	119	96	73						6.8	21.1
7/2/2019	1.029			332	2849				17	146	95	44						6.5	
7/3/2019	1.048	416	3636	400	3496	14	122	97	22	192	95	43						6.7	21.1
7/4/2019	0.996			316	2625				21	174	93	17						6.5	
7/5/2019	0.865	368	2655	336	2424	10	72	97	11	79	97	7						6.5	20.8
7/6/2019	0.995			380	3153				16	133	96							6.8	
7/7/2019	0.992			412	3409				16	132	96							6.7	
7/8/2019	1.002	418	3493	340	2841	14	117	97	14	117	96	73						6.7	21.1
7/9/2019	1.004			324	2713				15	126	95	11						6.5	
7/10/2019	1.005	346	2900	340	2850	10	84	97	15	126	96	49						6.6	21.2
7/11/2019	1.010			328	2763				11	93	97	133	0.81	7.45	4.74	9.6	3.87	6.7	
7/12/2019	1.001	360	3005	348	2905	8	67	98	15	125	96	11						6.4	21.5
7/13/2019	0.991			412	3405				14	116	97							6.8	
7/14/2019	1.033			380	3274				13	112	97							6.8	
7/15/2019	0.974	348	2827	368	2989	6	49	98	15	122	96	49						6.7	21.6
7/16/2019	0.961			420	3366				9	72	98	9						6.7	
7/17/2019	0.956	458	3652	464	3699	6	48	99	12	96	97	29						6.7	21.4
7/18/2019	1.082			984	8879				9	81	99	29						6.6	
7/19/2019	0.990	326	2692	300	2477	8	66	98	9	74	97	109						6.8	21.3
7/20/2019	0.972			480	3891				11	89	98							7	
7/21/2019	0.934			412	3209				5	39	99							6.8	
7/22/2019	0.919	380	2912	356	2729	4	31	99	5	38	99	202						6.2	22.6
7/23/2019	0.937			420	3282				6	47	99	58						6.6	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
7/24/2019	0.893	460	3426	484	3605	7	52	98	9	67	98	98						6.9	23.5
7/25/2019	0.913			780	5939				10	76	99	18						6.4	
7/26/2019	0.923	352	2710	440	3387	12	92	97	13	100	97	620						6.6	23.8
7/27/2019	0.937			296	2313				10	78	97							6.8	
7/28/2019	0.929			448	3471				11	85	98							6.9	
7/29/2019	0.923	526	4049	364	2802	4	31	99	9	69	98	7						6.7	24.9
7/30/2019	0.914			428	3263				10	76	98	14						6.6	
7/31/2019	0.893	444	3307	548	4081	9	67	98	13	97	98	13						6.6	24.8
8/1/2019	0.874			488	3557				8	58	98	20						6.6	
8/2/2019	0.902	402	3024	560	4213	5	38	99	9	68	98	37						6.5	25.5
8/3/2019	0.999			512	4266				12	100	98							6.7	
8/4/2019	0.963			453	3638				10	80	98							6.8	
8/5/2019	0.968	302	2438	384	3100	5	40	98	9	73	98	9						6.7	25.3
8/6/2019	0.912			456	3468				7	53	98	39						6.7	
8/7/2019	0.960	376	3010	508	4067	6	48	98	9	72	98	5						6.6	24.1
8/8/2019	0.957			432	3448				12	96	97	40						6.5	
8/9/2019	0.981	402	3289	444	3633	7	57	98	12	98	97	13	18.9	11.2	8.95	15.6	21.9	6.8	23.3
8/10/2019	0.923			312	2402				12	92	96							6.6	
8/11/2019	1.050			612	5359				9	79	99							6.7	
8/12/2019	1.063	365	3236	388	3440	7	62	98	13	115	97	20						6.8	23.3
8/13/2019	0.987			428	3523				14	115	97	38						6.8	
8/14/2019	0.989	334	2755	444	3662	8	66	98	17	140	96	30						6.7	23.1
8/15/2019	1.019			332	2821				19	161	94	17						6.8	
8/16/2019	0.988	410	3378	512	4219	10	82	98	23	190	96	20						6.8	22.8
8/17/2019	0.988			568	4680				21	173	96							6.8	
8/18/2019	0.999			472	3933				23	192	95							6.8	
8/19/2019	1.000	366	3052	236	1968	10	83	97	24	200	90	11						6.7	22.7
8/20/2019	0.983			360	2951				17	139	95	200						7	
8/21/2019	1.009	379	3189	440	3703	9	76	98	12	101	97	29						6.7	22.9
8/22/2019	1.085			572	5176				12	109	98	67						7	
8/23/2019	0.977	265	2159	500	4074	8	65	97	12	98	98	59						7	22.4
8/24/2019	0.989			544	4487				14	115	97	24						7.1	
8/25/2019	0.992			444	3673				9	74	98							6.8	
8/26/2019	0.969	362	2925	532	4299	9	73	98	14	113	97	5						6.6	22.7
8/27/2019	0.969			600	4849				13	105	98	65						6.8	
8/28/2019	1.003	333	2786	516	4316	11	92	97	13	109	97	18						6.9	23.2
8/29/2019	0.937			496	3876				9	70	98	32						6.7	
8/30/2019	1.018	463	3931	600	5094	10	85	98	9	76	99	14						6.7	23.7
8/31/2019	0.980			496	4054				8	65	98							6.7	
9/1/2019	0.964			344	2766				8	64	98							6.8	
9/2/2019	0.932	376	2923	364	2829	5	39	99	6	47	98	6						6.7	
9/3/2019	0.946			372	2935				5	39	99	1						6.8	
9/4/2019	0.987	390	3210	476	3918	7	58	98	7	58	99	20						6.6	
9/5/2019	0.888			472	3496				9	67	98	51						6.6	
9/6/2019	0.93	433	3358	540	4188	5	39	99	8	62	99	19						6.9	
9/7/2019	0.875			308	2248				11	80	96							6.9	
9/8/2019	0.919			308	2361				10	77	97							7.1	
9/9/2019	1.185	407	4022	448	4428	5	49	99	8	79	98	19						6.6	
9/10/2019	1.231			440	4517				9	92	98	13						6.6	
9/11/2019	1.034	378	3260	456	3932	8	69	98	12	103	97	7						6.5	
9/12/2019	1.011			412	3474				10	84	98	70	0.97	5.9	5.35	25.9	4.13	6.8	
9/13/2019	1.068	420	3741	444	3955	8	71	98	11	98	98	200						6.8	
9/14/2019	1.099			448	4106				11	101	98							6.6	
9/15/2019	1.211			500	5050				12	121	98							6.7	
9/16/2019	1.417	273	3226	276	3262	9	106	97	10	118	96	200						6.6	
9/17/2019	1.219			236	2399				14	142	94	4						6.6	
9/18/2019	1.209	257	2591	312	3146	12	121	95	16	161	95	13						6.3	
9/19/2019	1.172			344	3362				15	147	96	252						6.7	
9/20/2019	1.148	356	3408	400	3830	8	77	98	19	182	95	3						6.7	
9/21/2019	1.049			404	3534				9	79	98							6.5	
9/22/2019	1.059			364	3215				9	79	98							6.7	
9/23/2019	1.171	172	1680	352	3438	9	88	95	12	117	97	46						6.6	
9/24/2019	1.165			344	3342				11	107	97	186						6.6	
9/25/2019	1.126	223	2094	324	3043	11	103	95	10	94	97	45						6.7	
9/26/2019	1.146			396	3785				7	67	98	3						6.8	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
9/27/2019	1.15	339	3251	420	4028	11	106	97	12	115	97	15						6.9	
9/28/2019	1.217			248	2517				10	101	96							6.7	
9/29/2019	1.147			448	4286				7	67	98							6.6	
9/30/2019	1.134	285	2695	304	2875	5	47	98	5	47	98	44						6.8	
10/1/2019	1.057			276	2433				7	62	97	12						6.4	
10/2/2019	1.026	348	2978	396	3389	8	68	98	7	60	98	31						6.4	
10/3/2019	0.967			526	4242				9	73	98	81						6.6	
10/4/2019	0.944	416	3275	520	4094	8	63	98	5	39	99	20	0.65	3.51	3.55	12.1	3.98	6.6	
10/5/2019	0.968			480	3875				11	89	98							6.7	
10/6/2019	0.938			348	2722				9	70	97							6.8	
10/7/2019	0.937	373	2915	384	3001	8	63	98	12	94	97	16						6.8	
10/8/2019	1.251			472	4925				13	136	97	3						6.8	
10/9/2019	1.116	349	3248	332	3090	9	84	97	11	102	97	20						6.8	
10/10/2019	1.048			404	3531				10	87	98	21						6.8	
10/11/2019	1.036	368	3180	392	3387	8	69	98	25	216	94	5						6.5	
10/12/2019	1.019			428	3637				9	76	98							6.5	
10/13/2019	1.062			380	3366				17	151	96							6.6	
10/14/2019	1.107	328	3028	384	3545	9	83	97	15	138	96	8						6.7	
10/15/2019	1.027			380	3255				14	120	96	30						6.6	
10/16/2019	1.051	281	2463	364	3191	8	70	97	18	158	95	25						6.8	
10/17/2019	1.116			420	3909				16	149	96	18						7	
10/18/2019	1.249	397	4135	660	6875	10	104	97	19	198	97	27						6.8	
10/19/2019	1.184			276	2725				15	148	95							6.8	
10/20/2019	1.186			380	3759				22	218	94							6.7	
10/21/2019	1.217	512	5197	304	3086	16	162	97	10	101	97	5						6.6	
10/22/2019	2.200			752	13798				26	477	97	33						6.7	
10/23/2019	1.659	236	3265	472	6531	10	138	96	19	263	96	33						6.6	
10/24/2019	1.283			232	2482				15	161	94	20						6.6	
10/25/2019	1.196	526	5247	396	3950	14	140	97	19	190	95	80						6.6	
10/26/2019	1.258			316	3315				14	147	96							6.9	
10/27/2019	1.189			300	2975				15	149	95							6.7	
10/28/2019	1.156	383	3693	472	4551	13	125	97	23	222	95	37						6.7	
10/29/2019	1.123			336	3147				21	197	94	47						6.8	
10/30/2019	1.110	304	2814	332	3073	15	140	95	21	194	94	25						6.7	
10/31/2019	1.110			372	3444				19	176	95	72						6.9	
11/1/2019	1.0480	318	2779	308	2692	11	96	97	15	131	95	44						6.8	
11/2/2019	1.0100			340	2864				11	93	97							6.7	
11/3/2019	1.0660			404	3592				11	98	97							6.8	
11/4/2019	1.0860	344	3116	300	2717	9	82	97	22	199	93	213						6.8	
11/5/2019	1.0280			644	5521				20	171	97	58						7	
11/6/2019	1.0320	298	2565	332	2857	12	103	96	19	164	94	52						6.7	
11/7/2019	1.0360			348	3007				19	164	95	40						6.7	
11/8/2019	1.0040	338	2830	332	2780	7	59	98	19	159	94	18	20.9	2.68	2.13	8.64	21.8	6.7	
11/9/2019	1.0150			444	3759				20	169	95							6.8	
11/10/2019	1.0690			352	3138				21	187	94							6.7	
11/11/2019	1.0140			356	3011				20	169	94	16						6.7	
11/12/2019	1.0680			328	2922				21	187	94	48						6.5	
11/13/2019	1.0790	320	2880	384	3456	11	99	97	25	225	93	52						6.5	
11/14/2019	1.0280	337	2889	372	3189	13	111	96	22	189	94	36						6.9	
11/15/2019	1.0560	254	2237	320	2818	9	79	96	19	167	94	24						6.8	
11/16/2019	1.0870			308	2792				19	172	94							6.7	
11/17/2019	1.2620			296	3115				19	200	94							6.7	
11/18/2019	1.6240	283	3833	304	4117	13	176	95	18	244	94	99						6.6	
11/19/2019	1.7450			336	4890				21	306	94	8						6.8	
11/20/2019	1.5770	255	3354	268	3525	14	184	95	21	276	92	272						6.6	
11/21/2019	1.4060			248	2908				15	176	94	285						6.9	
11/22/2019	1.3010	314	3407	296	3212	10	109	97	9	98	97	21						6.9	
11/23/2019	1.2380			360	3717				9	93	98							6.9	
11/24/2019	1.2350			332	3420				10	103	97							6.9	
11/25/2019	1.2340	285	2933	236	2429	8	82	97	7	72	97	17						6.8	
11/26/2019	1.2150	299	3030	264	2675	7	71	98	9	91	97	23						6.9	
11/27/2019	1.1900	377	3742	356	3533	8	79	98	14	139	96	12						7	
11/28/2019	1.1490			240	2300				9	86	96	36						6.9	
11/29/2019	1.0630			364	3227				9	80	98	15						6.7	
11/30/2019	1.0750			384	3443				11	99	97							6.7	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
12/1/2019	1.081			292	2633				11	99	96							6.8	
12/2/2019	1.081	293	2642	260	2344	7	63	98	9	81	97	40						6.4	
12/3/2019	1.050			348	3047				7	61	98	2						6.7	
12/4/2019	1.082	320	2888	360	3249	8	72	98	9	81	98	23						6.4	
12/5/2019	1.094			364	3321				8	73	98	1						6.6	
12/6/2019	1.028	330	2829	360	3086	4	34	99	6	51	98	3	2.13	0.026	0.06	12.3	5.01	6.6	
12/7/2019	1.043			280	2436				8	70	97							6.9	
12/8/2019	1.153			300	2885				11	106	96							6.5	
12/9/2019	1.160	331	3202	304	2941	11	106	97	12	116	96	42						6.6	
12/10/2019	1.089			324	2943				11	100	97	105						6.6	
12/11/2019	1.127	289	2716	320	3008	10	94	97	9	85	97	212						6.6	
12/12/2019	1.162			380	3683				8	78	98	80						6.7	
12/13/2019	1.291	364	3919	488	5254	10	108	97	7	75	99	12						6.4	
12/14/2019	1.219			432	4392				5	51	99							6.8	
12/15/2019	1.261			392	4123				10	105	97							6.5	
12/16/2019	1.274	306	3251	300	3188	11	117	96	12	128	96	24						6.7	
12/17/2019	1.239			388	4009				14	145	96	11						6.6	
12/18/2019	1.238	303	3128	320	3304	12	124	96	13	134	96	36						6.4	
12/19/2019	1.249			336	3500				10	104	97	44						6.9	
12/20/2019	1.256	363	3802	372	3897	10	105	97	11	115	97	51						6.5	
12/21/2019	1.547			176	2271				11	142	94							6.5	
12/22/2019	1.824			392	5963				13	198	97							6.8	
12/23/2019	1.822	114	1732	396	6017	9	137	92	15	228	96	120						6.8	
12/24/2019	1.507			328	4122				12	151	96	200						7	
12/25/2019	1.371			280	3202				9	103	97	35						6.6	
12/26/2019	1.123	159	1489	260	2435	8	75	95	9	84	97	19						6.5	
12/27/2019	1.360	211	2393	396	4492	12	136	94	12	136	97	16						6.5	
12/28/2019	1.240			312	3227				9	93	97							6.7	
12/29/2019	1.195			288	2870				9	90	97							6.9	
12/30/2019	1.180	344	3385	244	2401	13	128	96	10	98	96	33						7	
12/31/2019	1.350	372	4188	336	3783	15	169	96	13	146	96	19						6.7	
1/1/2020	1.655			552	7619				6	83	99	124						6.9	
1/2/2020	1.362			312	3544				15	170	95	35						6.4	
1/3/2020	1.592	316	4196	424	5630	13	173	96	9	119	98	136						6.6	
1/4/2020	1.595			292	3884				5	67	98							6.8	
1/5/2020	1.541			260	3342				7	90	97							6.7	
1/6/2020	1.534	257	3288	228	2917	11	141	96	11	141	95	48						6.6	
1/7/2020	2.385			348	6922				20	398	94	622						6.6	
1/8/2020	2.143	199	3557	204	3646	19	340	90	13	232	94	520						6.7	
1/9/2020	1.845			312	4801				11	169	96	3						6.7	
1/10/2020	1.738	245	3551	392	5682	3	43	99	11	159	97	28	17.4	0.415	0.03	7.03	12.1	6.7	
1/11/2020	1.781			204	3030				14	208	93							6.9	
1/12/2020	1.967			248	4068				7	115	97							6.8	
1/13/2020	2.163	190	3427	188	3391	10	180	95	13	235	93	3						6.7	
1/14/2020	1.912			180	2870				9	144	95	124						6.6	
1/15/2020	1.555			156	2023				9	117	94	4						6.8	
1/16/2020	1.497	217	2709	212	2647	12	150	94	11	137	95	11						6.6	
1/17/2020	1.886	143	2249	168	2643	10	157	93	9	142	95	8						7	
1/18/2020	1.836			176	2695				7	107	96							6.6	
1/19/2020	1.891			172	2713				8	126	95							6.5	
1/20/2020	1.876			136	2128				7	110	95	136						6.5	
1/21/2020	1.837			172	2635				9	138	95	121						6.5	
1/22/2020	1.734	337	4874	272	3934	11	159	97	9	130	97	4						6.7	
1/23/2020	1.968	377	6188	368	6040	12	197	97	9	148	98	3						6.7	
1/24/2020	2.041	250	4255	352	5992	8	136	97	9	153	97	3						6.7	
1/25/2020	1.869			296	4614				6	94	98							6.6	
1/26/2020	1.788			192	2863				6	89	97							6.6	
1/27/2020	1.697	192	2717	200	2831	6	85	97	8	113	96	128						6.7	
1/28/2020	1.815			532	8053				9	136	98	7						6.8	
1/29/2020	2.089	254	4425	380	6620	9	157	96	9	157	98	9						6.7	
1/30/2020	2.001			336	5607				9	150	97	2						6.7	
1/31/2020	2.050	283	4838	312	5334	6	103	98	8	137	97	9						6.7	
2/1/2020	2.368			148	2923				11	217	93							6.9	
2/2/2020	2.339			172	3355				14	273	92							6.7	
2/3/2020	2.334	166	3231	320	6229	8	156	95	8	156	98	9						6.7	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
2/4/2020	2.149			732	13119				7	125	99	12						6.5	
2/5/2020	2.359	188	3699	516	10152	5	98	97	9	177	98	3						6.7	
2/6/2020	2.617			628	13707				15	327	98	17						6.8	
2/7/2020	2.619	118	2577	248	5417	4	87	97	7	153	97	17	4.14	0.15	0.05	4.18	5.72	6.6	
2/8/2020	2.535			240	5074				9	190	96							6.7	
2/9/2020	2.439			208	4231				7	142	97							6.6	
2/10/2020	2.375	101	2001	204	4041	4	79	96	7	139	97	7						6.6	
2/11/2020	2.332			856	16648				4	78	100	13						6.6	
2/12/2020	2.253	198	3720	796	14957	4	75	98	5	94	99	2						6.8	
2/13/2020	2.219			560	10364				4	74	99	1						6.9	
2/14/2020	2.229	203	3774	328	6097	5	93	98	5	93	98	11						6.6	
2/15/2020	2.082			660	11460				3	52	100							6.9	
2/16/2020	2.079			168	2913				5	87	97							6.8	
2/17/2020	2.081			156	2707				4	69	97	8						6.8	
2/18/2020	1.996	91	1515	180	2996	3	50	97	2	33	99	4						6.9	
2/19/2020	1.961	219	3582	300	4906	7	114	97	5	82	98	1						6.7	
2/20/2020	1.880			260	4077				6	94	98	11						6.9	
2/21/2020	1.837	249	3815	192	2942	7	107	97	5	77	97	32						6.9	
2/22/2020	1.829			332	5064				7	107	98							7	
2/23/2020	1.865			240	3733				4	62	98							6.9	
2/24/2020	1.970	172	2826	220	3615	3	49	98	5	82	98	17						6.7	
2/25/2020	1.855			244	3775				6	93	98	8						6.7	
2/26/2020	1.784	296	4404	380	5654	6	89	98	8	119	98	15						6.9	
2/27/2020	1.713			324	4629				5	71	98	9						6.8	
2/28/2020	1.678	211	2953	236	3303	5	70	98	6	84	97	7						6.9	
2/29/2020	1.745			336	4890				7	102	98							7	
3/1/2020	1.694			300	4238				7	99	98							7	
3/2/2020	1.693	202	2852.16324	272	3841	5	71	98	6	85	98	1						6.7	
3/3/2020	2.078			248	4298				7	121	97	15						6.6	
3/4/2020	2.049	253	4323.43098	308	5263	8	137	97	7	120	98	4						6.8	
3/5/2020	1.941			324	5245				3	49	99	1	16.3	0.458	0.18	4.38	11.9	6.8	
3/6/2020	2.007	232	3883.30416	308	5155	6	100	97	7	117	98	7						6.7	
3/7/2020	1.943			152	2463				5	81	97							6.9	
3/8/2020	1.839			348	5337				5	77	99							6.9	
3/9/2020	1.885	253	3977.3877	196	3081	5	79	98	8	126	96	7						6.7	
3/10/2020	1.774			224	3314				5	74	98	4						6.7	
3/11/2020	1.789	217	3237.69642	232	3462	6	90	97	8	119	97	5						6.9	
3/12/2020	1.760	179	2627.4336	356	5226	7	103	96	8	117	98	7						6.8	
3/13/2020	1.712			304	4341				9	129	97	4						6.6	
3/14/2020	1.662			180	2495				7	97	96							6.9	
3/15/2020	1.636			220	3002				6	82	97							6.8	
3/16/2020	1.600	203	2708.832	188	2509	5	67	98	6	80	97	5						6.5	
3/17/2020	1.517			272	3441				7	89	97	4						6.6	
3/18/2020	1.474	214	2630.73624	244	3000	5	61	98	7	86	97	11						6.8	
3/19/2020	1.492			272	3385				5	62	98	4						6.7	
3/20/2020	1.409	259	3043.52454	332	3901	6	71	98	7	82	98	7						6.8	
3/21/2020	1.368			276	3149				7	80	97							6.7	
3/22/2020	1.375			180	2064				7	80	96							6.7	
3/23/2020	1.379	199	2288.67114	220	2530	6	69	97	5	58	98	1						6.8	
3/24/2020	1.398			284	3311				11	128	96	12						6.7	
3/25/2020	1.390	284	3292.2984	340	3941	8	93	97	9	104	97	5						6.6	
3/26/2020	1.312			308	3370				10	109	97	10						6.9	
3/27/2020	1.346	170	1908.3588	436	4894	5	56	97	10	112	98	5						6.9	
3/28/2020	1.333			364	4047				7	78	98							6.8	
3/29/2020	1.269			256	2709				7	74	97							6.7	
3/30/2020	1.358	208	2355.74976	200	2265	5	57	98	7	79	97	5						6.7	
3/31/2020	1.545			324	4175				7	90	98	3						6.8	
4/1/2020	1.577	239	3143	276	3630	6	79	97	7	92	97	3						6.9	
4/2/2020	1.482			316	3906				9	111	97	7						6.8	
4/3/2020	1.449	280	3384	336	4060	6	73	98	7	85	98	5						6.6	
4/4/2020	1.461			272	3314				7	85	97							6.9	
4/5/2020	1.373			256	2931				7	80	97							6.8	
4/6/2020	1.357	202	2286	236	2671	6	68	97	10	113	96	3						6.4	
4/7/2020	1.335			220	2449				9	100	96	7						6.6	
4/8/2020	1.313	280	3066	280	3066	6	66	98	5	55	98	3						6.6	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
4/9/2020	1.291			388	4178				7	75	98	5	6.67	1.28	1	11	11.5	6.7	
4/10/2020	1.250	287	2992	332	3461	7	73	98	8	83	98	2						7	
4/11/2020	1.224			456	4655				8	82	98							6.8	
4/12/2020	1.169			248	2418				7	68	97							6.5	
4/13/2020	1.192	220	2187	232	2306	7	70	97	8	80	97	7						6.5	
4/14/2020	1.218			396	4023				8	81	98	4						6.6	
4/15/2020	1.185	276	2728	308	3044	9	89	97	8	79	97	4						6.9	
4/16/2020	1.126			276	2592				9	85	97	3						6.9	
4/17/2020	1.182	326	3214	272	2681	9	89	97	7	69	97	3						6.5	
4/18/2020	1.168			428	4169				9	88	98							6.9	
4/19/2020	1.173			524	5126				11	108	98							6.7	
4/20/2020	1.152	285	2738	264	2536	9	86	97	11	106	96	1						6.7	
4/21/2020	1.136			500	4737				9	85	98	3						6.6	
4/22/2020	1.145	323	3084	348	3323	10	95	97	11	105	97	1						6.9	
4/23/2020	1.471			288	3533				10	123	97	1						6.5	
4/24/2020	1.294	360	3885	400	4317	7	76	98	11	119	97	1						6.5	
4/25/2020	1.279			352	3755				12	128	97							6.9	
4/26/2020	1.256			308	3226				9	94	97							6.6	
4/27/2020	1.246	231	2400	264	2743	5	52	98	7	73	97	7						6.5	
4/28/2020	1.258			236	2476				8	84	97	9						6.4	
4/29/2020	1.243	279	2892	292	3027	4	41	99	5	52	98	1						6.4	
4/30/2020	1.240			456	4716				9	93	98	1						6.6	
5/1/2020	1.293			476	5133				9	97	98	1						6.3	
5/2/2020	1.212			376	3801				15	152	96							6.4	
5/3/2020	1.383			288	3322				12	138	96							6.3	
5/4/2020	1.492	246	3061	320	3982	6	75	98	6	75	98	7						6.4	
5/5/2020	1.336			260	2897				5	56	98	9						6.5	
5/6/2020	1.361	309	3507	248	2815	4	45	99	5	57	98	3						6.5	
5/7/2020	1.369			320	3654				7	80	98	5	0.17	1.42	1.23	10.5	2.45	6.5	
5/8/2020	1.334	227	2526	308	3427	6	67	97	6	67	98	2						6.4	
5/9/2020	1.272			332	3522				13	138	96							6.2	
5/10/2020	1.256			244	2556				25	262	90							6.4	
5/11/2020	1.239	271	2800	408	4216	7	72	97	15	155	96	3						6.4	
5/12/2020	1.268			288	3046				7	74	98	5						6.7	
5/13/2020	1.273	301	3196	332	3525	10	106	97	13	138	96	1						6.4	
5/14/2020	1.222			268	2731				6	61	98	4						6.6	
5/15/2020	1.217	312	3167	332	3370	6	61	98	13	132	96	5						6.6	
5/16/2020	1.165			204	1982				5	49	98							6.5	
5/17/2020	1.224			292	2981				5	51	98							6.5	
5/18/2020	1.237	265	2734	268	2765	4	41	98	8	83	97	5						6.3	
5/19/2020	1.233			332	3414				9	93	97	1						6.3	
5/20/2020	1.228	303	3103	388	3974	7	72	98	12	123	97	2						6.5	
5/21/2020	1.219			396	4026				11	112	97	4						6.5	
5/22/2020	1.207	332	3342	444	4469	6	60	98	12	121	97	1						6.4	
5/23/2020	1.185			364	3597				14	138	96							6.5	
5/24/2020	1.102			236	2169				12	110	95							6.3	
5/25/2020	1.118			220	2051				10	93	95	3						6.3	
5/26/2020	1.266	256	2703	252	2661	6	63	98	8	84	97	3						6.4	
5/27/2020	1.244	275	2853	300	3112	5	52	98	7	73	98	1						6.4	
5/28/2020	1.194			384	3824				9	90	98	1						6.4	
5/29/2020	1.150	324	3107	596	5716	6	58	98	11	106	98	5						6.3	
5/30/2020	1.170			386	3767				7	68	98							6.5	
5/31/2020	1.555			256	3320				6	78	98							6.5	
6/1/2020	1.469	212	2597	204	2499	6	74	97	8	98	96	5						6.4	17
6/2/2020	1.389			344	3985				12	139	97	3						6.4	
6/3/2020	1.390	180	2087	348	4034	8	93	96	10	116	97	4						6.3	17.3
6/4/2020	1.330			256	2840				13	144	95	4						6.6	
6/5/2020	1.313	311	3406	400	4380	8	88	97	8	88	98	11	5.21	5.07	4.15	17.1	6.96	6.3	17.4
6/6/2020	1.307			332	3619				13	142	96							6.6	
6/7/2020	1.334			336	3738				13	145	96							6.4	
6/8/2020	1.331	320	3552	384	4263	14	155	96	11	122	97	1						6.4	17.1
6/9/2020	1.330			644	7143				12	133	98	7						6.5	
6/10/2020	1.365	276	3142	368	4189	7	80	97	9	102	98	2						6.5	17.8
6/11/2020	1.373			428	4901				11	126	97	8						6.6	
6/12/2020	1.390	168	1948	272	3153	7	81	96	9	104	97	8						6.5	17.6

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
6/13/2020	1.701			356	5050				13	184	96							6.6	
6/14/2020	1.457			252	3062				13	158	95							6.5	
6/15/2020	1.441	130	1562	172	2067	5	60	96	10	120	94	12						6.5	17.4
6/16/2020	1.555			308	3994				11	143	96	9						6.6	
6/17/2020	1.047	265	2313	208	1816	7	61	97	5	44	98	8						6.3	18.9
6/18/2020	1.429			272	3242				8	95	97	3						6.6	
6/19/2020	1.397	316	3682	360	4194	8	93	97	10	117	97	9						6.4	18.6
6/20/2020	1.449			400	4834				14	169	97							6.6	
6/21/2020	1.608			272	3648				9	121	97							6.8	
6/22/2020	1.546	245	3159	224	2888	5	64	98	4	52	98	3						6.5	19.5
6/23/2020	1.455			268	3252				7	85	97	4						6.4	
6/24/2020	1.428	319	3799	392	4669	5	60	98	7	83	98	8						6.5	19.8
6/25/2020	1.417			372	4396				9	106	98	1						6.8	
6/26/2020	1.407	285	3344	372	4365	7	82	98	15	176	96	1						6.5	20.1
6/27/2020	1.357			388	4391				15	170	96							6.3	
6/28/2020	1.320			332	3655				17	187	95							6.5	
6/29/2020	1.321	188	2071	236	2600	7	77	96	12	132	95	3						6.5	20.4
6/30/2020	1.262			232	2442				11	116	95	7						6.4	
7/1/2020	1.269	330	3493	412	4360	7	74	98	13	138	97	13						6.5	18.7
7/2/2020	1.393	402	4670	436	5065	9	105	98	12	139	97	8	22.6	6.12	4.88	6.06	23.1	7	18.9
7/3/2020	1.363			612	6957				7	80	99	1						7	
7/4/2020	1.280			228	2434				14	149	94							6.7	
7/5/2020	1.179	272	2675	264	2596	6	59	98	9	88	97							6.5	
7/6/2020	1.247			260	2704				12	125	95	4						6.5	18.9
7/7/2020	1.260	344	3615	376	3951	8	84	98	7	74	98	1						6.7	
7/8/2020	1.219			428	4351				12	122	97	11						6.8	19.2
7/9/2020	1.236	337	3474	428	4412	13	134	96	9	93	98	15						6.6	
7/10/2020	1.278			432	4604				13	139	97	3						6.6	19
7/11/2020	1.122			216	2021				11	103	95							6.8	
7/12/2020	1.189	303	3005	268	2658	5	50	98	6	59	98							6.5	
7/13/2020	1.181			240	2364				7	69	97	4						6.5	19.4
7/14/2020	1.183	531	5239	388	3828	7	69	99	9	89	98	7						6.5	
7/15/2020	1.156			412	3972				11	106	97	5						6.5	19.6
7/16/2020	1.179	321	3156	320	3147	6	59	98	7	69	98	0						6.9	
7/17/2020	1.143			356	3394				13	124	96	0						6.6	19.9
7/18/2020	1.110			208	1926				13	120	94							6.7	
7/19/2020	1.092	206	1876	304	2769	5	46	98	12	109	96							6.7	
7/20/2020	1.110			320	2962				10	93	97	0						6.6	20.8
7/21/2020	1.101	342	3140	280	2571	5	46	99	8	73	97	3						6.8	
7/22/2020	1.041			440	3820				8	69	98	31						6.5	20.6
7/23/2020	1.102	263	2417	524	4816	4	37	98	7	64	99	5						6.6	
7/24/2020	1.087			428	3880				8	73	98	3						6.7	20.2
7/25/2020	1.078			308	2769				9	81	97							6.6	
7/26/2020	1.044	244	2124	356	3100	9	78	96	9	78	97							6.5	
7/27/2020	1.045			308	2684				9	78	97	3						6.7	21.3
7/28/2020	1.059	436	3851	436	3851	7	62	98	7	62	98	8						6.7	
7/29/2020	1.033			368	3170				8	69	98	4						6.7	21.5
7/30/2020	1.030	322	2766	340	2921	6	52	98	10	86	97	3						6.5	
7/31/2020	1.091			372	3385				11	100	97	2						6.5	21.6
8/1/2020	1.056			448	3946				8	70	98							6.8	
8/2/2020	1.052			264	2316				10	88	96							6.6	
8/3/2020	1.051	291	2551	316	2770	6	53	98	9	79	97	15						6.4	
8/4/2020	1.055			440	3871				9	79	98	28						6.7	21.8
8/5/2020	1.064	323	2866	428	3798	5	44	98	9	80	98	4						6.7	
8/6/2020	1.062			348	3082				9	80	97	3						6.7	22.7
8/7/2020	1.115	378	3515	372	3459	9	84	98	13	121	97	24	30.1	7.18	7.15	10.2	29.7	6.7	
8/8/2020	1.095			444	4055				15	137	97							6.9	23.2
8/9/2020	1.054			268	2356				12	105	96							6.8	
8/10/2020	1.030	315	2706	312	2680	5	43	98	5	43	98	6						6.5	
8/11/2020	1.052			280	2457				8	70	97	30						6.6	23.3
8/12/2020	1.053	423	3715	384	3372	6	53	99	11	97	97	10						6.7	
8/13/2020	1.041			400	3473				11	96	97	10						6.5	23.1
8/14/2020	1.048	347	3033	392	3426	7	61	98	13	114	97	13						6.4	
8/15/2020	1.058			380	3353				15	132	96							6.8	23.2
8/16/2020	1.011			284	2395				13	110	95							6.7	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
8/17/2020	1.022	375	3196	268	2284	4	34	99	7	60	97	7						6.8	
8/18/2020	1.068			292	2601				7	62	98	11						6.7	24.4
8/19/2020	1.056	337	2968	444	3910	6	53	98	9	79	98	5						6.5	
8/20/2020	1.050			440	3853				11	96	98	4						6.6	22.8
8/21/2020	1.063	424	3759	432	3830	12	106	97	15	133	97	175						6.7	
8/22/2020	1.138			420	3986				9	85	98							6.8	22.8
8/23/2020	1.027			268	2295				11	94	96							6.7	
8/24/2020	1.027	331	2835	408	3495	6	51	98	12	103	97	130						6.5	22.3
8/25/2020	1.026	364	3115	404	3457	6	51	98	10	86	98	5						6.7	
8/26/2020	1.033			644	5548				11	95	98	25						6.7	22.2
8/27/2020	1.026			484	4142				7	60	99	8						6.5	
8/28/2020	1.015	359	3039	440	3725	8	68	98	11	93	98	8						6.6	21.2
8/29/2020	1.026			336	2875				11	94	97							6.9	
8/30/2020	0.967			380	3065				13	105	97							6.5	
8/31/2020	1.052	390	3422	360	3159	8	70	98	10	88	97	134						6.5	22.1
9/1/2020	1.033			416	3584				9	78	98	50						6.5	
9/2/2020	1.015	363	3073	424	3589	9	76	98	13	110	97	3						6.3	
9/3/2020	1.012			488	4119				7	59	99	5						6.6	
9/4/2020	1.063	227	2012	404	3582	4	35	98	11	98	97	16						7	
9/5/2020	1.010			388	3268				13	110	97							7.2	
9/6/2020	0.980			336	2746				9	74	97							6.8	
9/7/2020	0.949	308	2438	332	2628	4	32	99	7	55	98	5						6.4	
9/8/2020	1.024	305	2605	280	2391	5	43	98	9	77	97	3						6.3	
9/9/2020	1.020			288	2450				10	85	97	20						6.7	
9/10/2020	1.009	367	3088	460	3871	6	50	98	8	67	98	122	20.9	7.1	6.84	14.4	22.9	6.8	
9/11/2020	1.027			460	3940				11	94	98	15						6.3	
9/12/2020	0.998			372	3096				10	83	97							6.8	
9/13/2020	0.964			308	2476				10	80	97							6.7	
9/14/2020	0.980	303	2476	280	2288	5	41	98	11	90	96	7						6.5	
9/15/2020	1.030	325	2792	312	2680	7	60	98	15	129	95	20						6.6	
9/16/2020	1.027			424	3632				9	77	98	7						6.5	
9/17/2020	1.013			524	4427				14	118	97	8						6.5	
9/18/2020	1.002	213	1780	448	3744	5	42	98	9	75	98	9						6.6	
9/19/2020	1.014			496	4195				17	144	97							6.4	
9/20/2020	1.011			308	2597				13	110	96							6.4	
9/21/2020	0.990	180	1486	304	2510	3	25	98	9	74	97	7						6.7	
9/22/2020	1.021			288	2452				7	60	98	28						6.7	
9/23/2020	1.017	307	2604	412	3494	5	42	98	10	85	98	19						6.3	
9/24/2020	1.116			316	2941				7	65	98	11						6.7	
9/25/2020	1.080	388	3495	468	4215	7	63	98	12	108	97	28						6.7	
9/26/2020	1.029			392	3364				14	120	96							6.7	
9/27/2020	1.041			284	2466				11	96	96							6.7	
9/28/2020	0.950	319	2527	308	2440	4	32	99	7	55	98	8						6.3	
9/29/2020	0.997			380	3160				11	91	97	27						6.5	
9/30/2020	0.983	324	2656	356	2919	6	49	98	9	74	97	31						6.3	
10/1/2020	0.984			320	2626				9	74	97	4	14.4	5.2	5.01	18.8	16.9	6.6	
10/2/2020	0.994	358	2968	492	4079	4	33	99	7	58	99	9						6.6	
10/3/2020	0.950			332	2630				3	24	99							6.4	
10/4/2020	0.976			204	1661				9	73	96							6.5	
10/5/2020	1.009	219	1843	296	2491	4	34	98	8	67	97	31						6.2	
10/6/2020	1.008			332	2791				9	76	97	7						6.2	
10/7/2020	0.997	231	1921	444	3692	7	58	97	7	58	98	20						6.4	
10/8/2020	1.010			512	4313				9	76	98	13						6.4	
10/9/2020	1.020	217	1846	332	2824	6	51	97	8	68	98	3						6.4	
10/10/2020	1.132			336	3172				11	104	97							6.7	
10/11/2020	1.059			336	2968				8	71	98							6.6	
10/12/2020	1.188	226	2239	328	3250	8	79	96	10	99	97	21						6.6	
10/13/2020	1.215			468	4742				7	71	99	25						6.4	
10/14/2020	1.171	250	2442	308	3008	5	49	98	5	49	98	9						6.2	
10/15/2020	1.267			416	4396				7	74	98	5						6.2	
10/16/2020	1.182	389	3835	420	4140	6	59	98	7	69	98	20						6.5	
10/17/2020	1.387			164	1897				10	116	94							6	
10/18/2020	1.344			304	3408				7	78	98							6.2	
10/19/2020	1.426	271	3223	236	2807	4	48	99	7	83	97	13						6.2	
10/20/2020	1.279			332	3541				7	75	98	7						6.3	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
10/21/2020	1.428	357	4252	480	5717	6	71	98	11	131	98	11						6.9	
10/22/2020	1.140			348	3309				13	124	96	13						6.3	
10/23/2020	1.045	234	2039	252	2196	9	78	96	16	139	94	13						6.2	
10/24/2020	1.194			364	3625				13	129	96							6.2	
10/25/2020	1.066			328	2916				16	142	95							6.5	
10/26/2020	1.053	187	1642	260	2283	7	61	96	11	97	96	1						6.3	
10/27/2020	1.108			384	3548				8	74	98	24						6.5	
10/28/2020	1.134	350	3310	388	3670	6	57	98	13	123	97	31						6.4	
10/29/2020	1.114			500	4645				8	74	98	13						6.5	
10/30/2020	1.101	348	3195	348	3195	6	55	98	5	46	99	8						6.6	
10/31/2020	1.082			256	2310				11	99	96							6.8	
11/1/2020	1.037			300	2595				11	95	96							6.7	
11/2/2020	0.990	335	2766	312	2576	6	50	98	10	83	97	17						6.5	
11/3/2020	1.069			388	3459				13	116	97	36						6.6	
11/4/2020	1.305	337	3668	408	4441	7	76	98	15	163	96	8						6.3	
11/5/2020	1.262			600	6315				9	95	99	37						6.6	
11/6/2020	1.244	348	3610	360	3735	7	73	98	13	135	96	17	17.9	5.29	4.75	11.2	18.8	6.7	
11/7/2020	1.196			276	2753				12	120	96							6.5	20
11/8/2020	1.139			220	2090				12	114	95							6.5	
11/9/2020	1.114	261	2425	272	2527	8	74	97	11	102	96	15						6.7	
11/10/2020	1.144	242	2309	280	2671	9	86	96	11	105	96	20						6.6	
11/11/2020	1.159			336	3248				7	68	98	0						6.8	
11/12/2020	1.125	324	3040	292	2740	10	94	97	15	141	95	81						6.5	
11/13/2020	1.121			292	2730				15	140	95	16						6.7	
11/14/2020	1.225			340	3474				9	92	97							6.7	13
11/15/2020	1.132			360	3399				13	123	96							6.7	
11/16/2020	1.179	334	3284	268	2635	8	79	98	15	147	94	33						6.6	
11/17/2020	1.492			320	3982				23	286	93	16						6.4	
11/18/2020	1.463	317	3868	336	4100	10	122	97	17	207	95	16						6.8	
11/19/2020	1.496			308	3843				15	187	95	12						6.6	
11/20/2020	1.441	337	4050	364	4375	6	72	98	15	180	96	16						6.6	
11/21/2020	1.407			344	4037				10	117	97							6.8	17
11/22/2020	1.297			220	2380				11	119	95							6.8	
11/23/2020	1.302	279	3030	200	2172	4	43	99	8	87	96	37						6.6	
11/24/2020	1.345	413	4633	530	5945	6	67	99	9	101	98	20						6.8	
11/25/2020	1.350	338	3806	320	3603	7	79	98	8	90	98	9						6.9	
11/26/2020	1.359			404	4579				8	91	98	11						6.9	
11/27/2020	1.282			328	3507				8	86	98	4						6.6	
11/28/2020	1.319			260	2860				10	110	96							6.6	12
11/29/2020	1.268			236	2496				7	74	97							6.6	
11/30/2020	1.275			240	2552				8	85	97	0						6.7	
12/1/2020	1.418	301	3560	452	5345	5	59	98	4	47	99	3						6.7	
12/2/2020	1.365	286	3256	364	4144	6	68	98	9	102	98	8						6.9	
12/3/2020	1.280			304	3245				4	43	99	7	14.8	1.84	1.5	7.9	14.6	6.7	
12/4/2020	1.263	365	3845	532	5604	7	74	98	13	137	98	14						6.6	
12/5/2020	1.223			384	3917				11	112	97							6.9	
12/6/2020	1.194			288	2868				11	110	96							6.9	
12/7/2020	1.178	318	3124	308	3026	10	98	97	9	88	97	9						6.6	
12/8/2020	1.280			464	4953				10	107	98	30						6.6	
12/9/2020	1.460	252	3068	408	4968	9	110	96	13	158	97	7						7	
12/10/2020	1.508			416	5232				13	163	97	14						6.6	
12/11/2020	1.397	317	3693	380	4427	9	105	97	12	140	97	27						6.7	
12/12/2020	1.395			188	2187				8	93	96							7.1	
12/13/2020	1.284			256	2741				5	54	98							6.9	
12/14/2020	1.388	272	3149	276	3195	6	69	98	9	104	97	23						6.6	
12/15/2020	1.496			272	3394				11	137	96	117						6.5	
12/16/2020	1.471	286	3509	248	3042	7	86	98	9	110	96	11						6.7	
12/17/2020	1.515			328	4144				9	114	97	77						6.7	
12/18/2020	1.497	289	3608	280	3496	7	87	98	9	112	97	4						6.8	
12/19/2020	1.486			328	4065				9	112	97							6.8	
12/20/2020	1.580			220	2899				11	145	95							6.7	
12/21/2020	1.597	206	2744	200	2664	9	120	96	12	160	94	50						6.6	
12/22/2020	2.126	149	2642	236	4184	5	89	97	7	124	97	5						6.7	
12/23/2020	1.902	224	3553	244	3870	6	95	97	12	190	95	1						6.7	
12/24/2020	1.717			220	3150				11	158	95	5						6.7	

Monitoring Point	INFLUENT (IN1)					EFFLUENT													
Parameter	FLOW	BOD5	BOD5	TSS	TSS	BOD5	BOD5	BOD5	TSS	TSS	TSS	FECAL COLIFORM	TOTAL AMMONIA	TOTAL PHOSPHORUS	SOLUBLE REACTIVE PHOSPHORUS	NITRATE-NITRITE	TOTAL KJELDAHL NITROGEN	pH	TEMP.
Unit	MGD	MG/L	LB/DAY	MG/L	LB/DAY	MG/L	LB/DAY	% REMOVAL	MG/L	LB/DAY	% REMOVAL	#/100 ML	MG/L	MG/L	MG/L	MG/L	MG/L	STD. UNITS	DEG C
Frequency	CONT.	3/WK	3/WK	3/WK	3/WK	3/WK	3/WK	1/MTH	3/WK	3/WK	1/MTH	5/WK	1/MTH	1/MTH	1/MTH	1/MTH	1/MTH	DAILY	3/WK
Type	METER	24 HC	CALC	24 HC	CALC	24 HC	CALC	CALC	24 HC	CALC	CALC	GRAB	24 HC	24 HC	24 HC	24 HC	24 HC	GRAB	GRAB
Date																			
12/25/2020	1.566			180	2351				7	91	96	4						6.5	
12/26/2020	1.144			256	2442				7	67	97							6.4	
12/27/2020	1.494			204	2542				8	100	96							6.5	
12/28/2020	1.477	258	3178	240	2956	9	111	97	12	148	95	11						6.5	
12/29/2020	1.459	264	3212	292	3553	8	97	97	11	134	96	4						6.7	
12/30/2020	1.613			288	3874		0		12	161	96	15						6.6	
12/31/2020	1.752	146	2133	260	3799	9	132	94	13	190	95	76						6.6	
Permit Limit	3.79	REPORT	7356	REPORT	7660	30	948	85%	30	948	85%	200						6.2	
Permit Limit	REPORT	REPORT	REPORT	REPORT	REPORT	45	1422		45	1422		400	REPORT	REPORT	REPORT	REPORT	REPORT	9.0	
Statistical Base	AVG	AVG	AVG	AVG	AVG	AVG	AVG	MIN	AVG	AVG	MIN	GEM						MIN-DAY	
Statistical Base	MAX	MAX	MAX	MAX	MAX	AVW	AVW		AVW	AVW		GM7	MAX	MAX	MAX	MAX	MAX	MAX-DAY	

APPENDIX E

HYDRAULIC MODEL FLOW INPUTS

Sewer Model Manhole Flow Inputs - 2040

City Manhole Number	Sewer Manhole Number	Flow Description	Percentage of Drainage Basin Flow into Manhole	Drainage Basin	Drainage Basin Peak Hour Flow with I/I (gpm)	Manhole Peak Hour Flow with I/I (gpm)
1332	MH-1332	1/2 LS#16 Gravity Flow	50%	16	96	48
1318	MH-1318	1/2 LS#16 Gravity Flow	50%	16	96	48
1323	MH-1323	Drainage Basin #30 Flows	100%	30	0	0
1269	MH-1269	1/10 Drainage Basin #10 Gravity Flow	10%	10	564	56
1260	MH-1260	Drainage Basin #29 Flow	100%	29	0	0
1250	MH-1250	2/10 Drainage Basin #10 Gravity Flow	20%	10	564	113
1239	MH-1239	2/10 Drainage Basin #10 Gravity Flow	20%	10	564	113
1238	MH-1238	Drainage Basin #31 Flow	100%	31	0	0
1225	MH-1225	2/10 Drainage Basin #10 Gravity Flow	20%	10	564	113
1202	MH-1202	Drainage Bain #32 Flow	100%	32	0	0
1190	MH-1190	1/10 Drainage Basin #10 Gravity Flow	10%	10	564	56
1184	MH-1184	2/10 Drainage Basin #10 Gravity Flow	20%	10	564	113
1184	MH-1184	Drainage Basin #16 Flow	100%	16	96	96
1184	MH-1184	Drainage Basin #20 Flow	100%	20	31	31
1086	MH-1086	Drainage Basin #9 Flow	100%	9	250	250
464	MH-464	1/4 Drainage Basin #13 Flow	25%	13	242	60
456	MH-456	1/4 Drainage Basin #13 Flow	25%	13	242	60
445	MH-445	1/4 Drainage Basin #13 Flow	25%	13	242	60
435	MH-435	1/4 Drainage Basin #13 Flow	25%	13	242	60
438	MH-438	Drainage Bain #12 Flow	100%	12	22	22
538	MH-538	2/10 Drainage Basin #11 Flow	20%	11	1,233	247
441	MH-441	Drainage Basin #35 Flow	100%	35	80	80
542	MH-542	1/10 Drainage Basin #11 Flow	10%	11	1,233	123
545	MH-545	1/10 Drainage Basin #11 Flow	10%	11	1,233	123
531	MH-531	1/10 Drainage Basin #11 Flow	10%	11	1,233	123
567	MH-567	1/10 Drainage Basin #11 Flow	10%	11	1,233	123
595	MH-595	2/10 Drainage Basin #11 Flow	20%	11	1,233	247
641	MH-641	2/10 Drainage Basin #11 Flow	20%	11	1,233	247
638	MH-638	1/4 Drainage Basin #3 Flow	25%	3	228	57
904	MH-904	1/4 Drainage Basin #3 Flow	25%	3	228	57
293	MH-293	1/4 Drainage Basin #3 Flow	25%	3	228	57
323	MH-323	1/4 Drainage Basin #3 Flow	25%	3	228	57
295	MH-295	Drainage Basin #2 Flow	100%	2	149	149
357	MH-357	1/2 Drainage Basin #1 Flow	50%	1	288	144
351	MH-351	1/2 Drainage Basin #1 Flow	50%	1	288	144
325	MH-325	Drainage Basin #1 Flow	100%	1	288	288
332	MH-332	Drainage Basin #14 Flow	100%	14	34	34
331A	MH-331A	1/2 Drainage Basin #2 Flow	50%	2	149	74
328	MH-328	Drainage Basin #21 Flow	100%	21	33	33
328	MH-328	1/2 Drainage Basin #2 Flow	50%	2	149	74
268	MH-268	1/3 Drainage Basin #15 Flow	33%	15	150	49
261	MH-261	1/3 Drainage Basin #15 Flow	67%	15	150	100
114	MH-114	1/10 Drainage Basin #5 Flow	10%	5	719	72
100	MH-100	1/10 Drainage Basin #5 Flow	10%	5	719	72
104	MH-104	2/10 Drainage Basin #5 Flow	20%	5	719	144
120	MH-120	1/10 Drainage Basin #5 Flow	10%	5	719	72
276	MH-276	1/10 Drainage Basin #5 Flow	10%	5	719	72
74	MH-74	1/10 Drainage Basin #5 Flow	10%	5	719	72
682	MH-682	1/10 Drainage Basin #5 Flow	10%	5	719	72
153	MH-153	1/10 Drainage Basin #5 Flow	10%	5	719	72

Sewer Model Manhole Flow Inputs - 2040

City Manhole Number	Sewer Manhole Number	Flow Description	Percentage of Drainage Basin Flow into Manhole	Drainage Basin	Drainage Basin Peak Hour Flow with I/I (gpm)	Manhole Peak Hour Flow with I/I (gpm)
59	MH-59	1/10 Drainage Basin #5 Flow	10%	5	719	72
47	MH-47	1/4 Drainage Basin #4 Flow	25%	4	310	78
47	MH-47	Drainage Basin #40 Flow	100%	40	33	33
47	MH-47	Drainage Basin #41 Flow	100%	41	114	114
41	MH-41	1/4 Drainage Basin #4 Flow	25%	4	310	78
34	MH-34	1/4 Drainage Basin #4 Flow	25%	4	310	78
28	MH-28	1/4 Drainage Basin #4 Flow	25%	4	310	78
28	MH-28	Drainage Basin #38 Flow	100%	38	102	102
7	MH-7	1/4 Drainage Basin #22 Flow	25%	22	607	152
7	MH-7	Drainage Basin #37 Flow	100%	37	45	45
12	MH-12	Drainage Basin #36 Flow	100%	36	0	0
19	MH-19	Drainage Basin #4 Flow	100%	4	310	310
786	MH-786	1/4 Drainage Basin #22 Flow	25%	22	607	152
739	MH-739	1/4 Drainage Basin #22 Flow	25%	22	607	152
729	MH-729	1/4 Drainage Basin #22 Flow	25%	22	607	152
729	MH-729	1/2 Drainage Basin #8 Flow	50%	8	279	140
729	MH-729	1/2 Drainage Basin #11 Flow	50%	11	1,233	617
729	MH-729	1/2 Drainage Basin #13 Flow	50%	13	242	121
729	MH-729	1/2 Drainage Basin #47 Flow	50%	47	0	0
708	MH-708	1/2 Drainage Basin #8 Flow	50%	8	279	140
708	MH-708	1/2 Drainage Basin #11 Flow	50%	11	1,233	617
708	MH-708	1/2 Drainage Basin #13 Flow	50%	13	242	121
708	MH-708	1/2 Drainage Basin #47 Flow	50%	47	0	0
691	MH-691	Drainage Basin #3 Flow	100%	3	228	228
691	MH-691	Drainage Basin #5 Flow	100%	5	719	719
691	MH-691	Drainage Basin #6 Flow	100%	6	14	14

Sewer Model Manhole Flow Inputs - Buildout

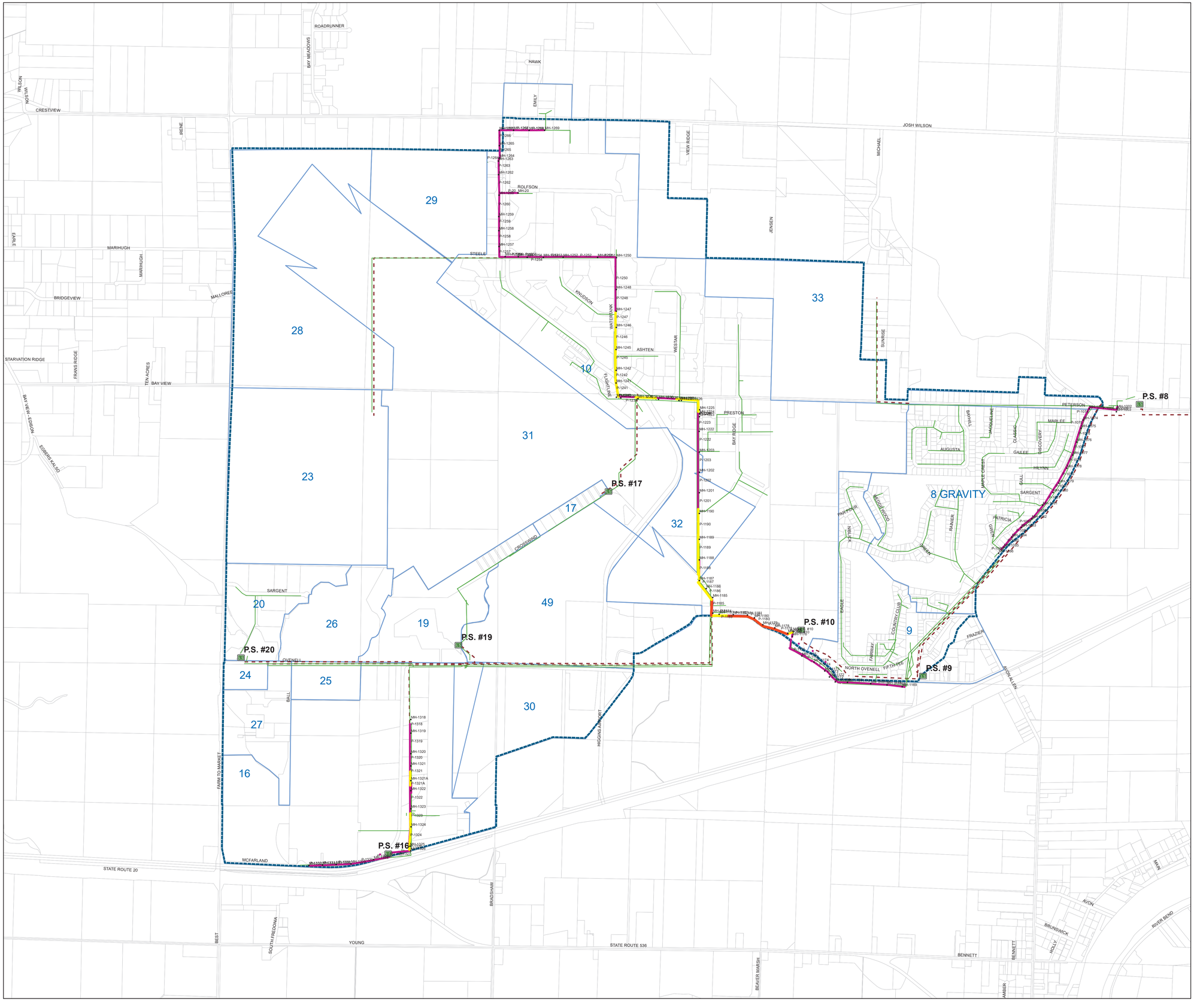
City Manhole Number	Sewer Manhole Number	Flow Description	Percentage of Drainage Basin Flow into Manhole	Drainage Basin	Drainage Basin Peak Hour Flow with I/I (gpm)	Manhole Peak Hour Flow with I/I (gpm)
1332	MH-1332	1/2 LS#16 Gravity Flow	50%	16	642	321
1318	MH-1318	1/2 LS#16 Gravity Flow	50%	16	642	321
1323	MH-1323	Drainage Basin #30 Flows	100%	30	276	276
1269	MH-1269	1/10 Drainage Basin #10 Gravity Flow	10%	10	1,337	134
1260	MH-1260	Drainage Basin #29 Flow	100%	29	0	0
1250	MH-1250	2/10 Drainage Basin #10 Gravity Flow	20%	10	1,337	267
1239	MH-1239	2/10 Drainage Basin #10 Gravity Flow	20%	10	1,337	267
1238	MH-1238	Drainage Basin #31 Flow	100%	31	0	0
1225	MH-1225	2/10 Drainage Basin #10 Gravity Flow	20%	10	1,337	267
1202	MH-1202	Drainage Bain #32 Flow	100%	32	1	1
1190	MH-1190	1/10 Drainage Basin #10 Gravity Flow	10%	10	1,337	134
1184	MH-1184	2/10 Drainage Basin #10 Gravity Flow	20%	10	1,337	267
1184	MH-1184	Drainage Basin #16 Flow	100%	16	642	642
1184	MH-1184	Drainage Basin #20 Flow	100%	20	135	135
1086	MH-1086	Drainage Basin #9 Flow	100%	9	323	323
464	MH-464	1/4 Drainage Basin #13 Flow	25%	13	713	178
456	MH-456	1/4 Drainage Basin #13 Flow	25%	13	713	178
445	MH-445	1/4 Drainage Basin #13 Flow	25%	13	713	178
435	MH-435	1/4 Drainage Basin #13 Flow	25%	13	713	178
438	MH-438	Drainage Bain #12 Flow	100%	12	118	118
538	MH-538	2/10 Drainage Basin #11 Flow	20%	11	3,402	680
441	MH-441	Drainage Basin #35 Flow	100%	35	159	159
542	MH-542	1/10 Drainage Basin #11 Flow	10%	11	3,402	340
545	MH-545	1/10 Drainage Basin #11 Flow	10%	11	3,402	340
531	MH-531	1/10 Drainage Basin #11 Flow	10%	11	3,402	340
567	MH-567	1/10 Drainage Basin #11 Flow	10%	11	3,402	340
595	MH-595	2/10 Drainage Basin #11 Flow	20%	11	3,402	680
641	MH-641	2/10 Drainage Basin #11 Flow	20%	11	3,402	680
638	MH-638	1/4 Drainage Basin #3 Flow	25%	3	707	177
904	MH-904	1/4 Drainage Basin #3 Flow	25%	3	707	177
293	MH-293	1/4 Drainage Basin #3 Flow	25%	3	707	177
323	MH-323	1/4 Drainage Basin #3 Flow	25%	3	707	177
295	MH-295	Drainage Basin #2 Flow	100%	2	452	452
357	MH-357	1/2 Drainage Basin #1 Flow	50%	1	352	176
351	MH-351	1/2 Drainage Basin #1 Flow	50%	1	352	176
325	MH-325	Drainage Basin #1 Flow	100%	1	352	352
332	MH-332	Drainage Basin #14 Flow	100%	14	253	253
331A	MH-331A	1/2 Drainage Basin #2 Flow	50%	2	452	226
328	MH-328	Drainage Basin #21 Flow	100%	21	289	289
328	MH-328	1/2 Drainage Basin #2 Flow	50%	2	452	226
268	MH-268	1/3 Drainage Basin #15 Flow	33%	15	318	105
261	MH-261	1/3 Drainage Basin #15 Flow	67%	15	318	213
114	MH-114	1/10 Drainage Basin #5 Flow	10%	5	967	97
100	MH-100	1/10 Drainage Basin #5 Flow	10%	5	967	97
104	MH-104	2/10 Drainage Basin #5 Flow	20%	5	967	193
120	MH-120	1/10 Drainage Basin #5 Flow	10%	5	967	97
276	MH-276	1/10 Drainage Basin #5 Flow	10%	5	967	97
74	MH-74	1/10 Drainage Basin #5 Flow	10%	5	967	97
682	MH-682	1/10 Drainage Basin #5 Flow	10%	5	967	97
153	MH-153	1/10 Drainage Basin #5 Flow	10%	5	967	97

Sewer Model Manhole Flow Inputs - Buildout

City Manhole Number	Sewer Manhole Number	Flow Description	Percentage of Drainage Basin Flow into Manhole	Drainage Basin	Drainage Basin Peak Hour Flow with I/I (gpm)	Manhole Peak Hour Flow with I/I (gpm)
59	MH-59	1/10 Drainage Basin #5 Flow	10%	5	967	97
47	MH-47	1/4 Drainage Basin #4 Flow	25%	4	333	83
47	MH-47	Drainage Basin #40 Flow	100%	40	69	69
47	MH-47	Drainage Basin #41 Flow	100%	41	195	195
41	MH-41	1/4 Drainage Basin #4 Flow	25%	4	333	83
34	MH-34	1/4 Drainage Basin #4 Flow	25%	4	333	83
28	MH-28	1/4 Drainage Basin #4 Flow	25%	4	333	83
28	MH-28	Drainage Basin #38 Flow	100%	38	162	162
7	MH-7	1/4 Drainage Basin #22 Flow	25%	22	661	165
7	MH-7	Drainage Basin #37 Flow	100%	37	85	85
12	MH-12	Drainage Basin #36 Flow	100%	36	0	0
19	MH-19	Drainage Basin #4 Flow	100%	4	333	333
786	MH-786	1/4 Drainage Basin #22 Flow	25%	22	661	165
739	MH-739	1/4 Drainage Basin #22 Flow	25%	22	661	165
729	MH-729	1/4 Drainage Basin #22 Flow	25%	22	661	165
729	MH-729	1/2 Drainage Basin #8 Flow	50%	8	657	329
729	MH-729	1/2 Drainage Basin #11 Flow	50%	11	3,402	1,701
729	MH-729	1/2 Drainage Basin #13 Flow	50%	13	713	357
729	MH-729	1/2 Drainage Basin #47 Flow	50%	47	169	85
708	MH-708	1/2 Drainage Basin #8 Flow	50%	8	657	329
708	MH-708	1/2 Drainage Basin #11 Flow	50%	11	3,402	1,701
708	MH-708	1/2 Drainage Basin #13 Flow	50%	13	713	357
708	MH-708	1/2 Drainage Basin #47 Flow	50%	47	169	85
691	MH-691	Drainage Basin #3 Flow	100%	3	707	707
691	MH-691	Drainage Basin #5 Flow	100%	5	967	967
691	MH-691	Drainage Basin #6 Flow	100%	6	27	27

APPENDIX F

SEWER MODEL RESULTS MAP



N

Legend

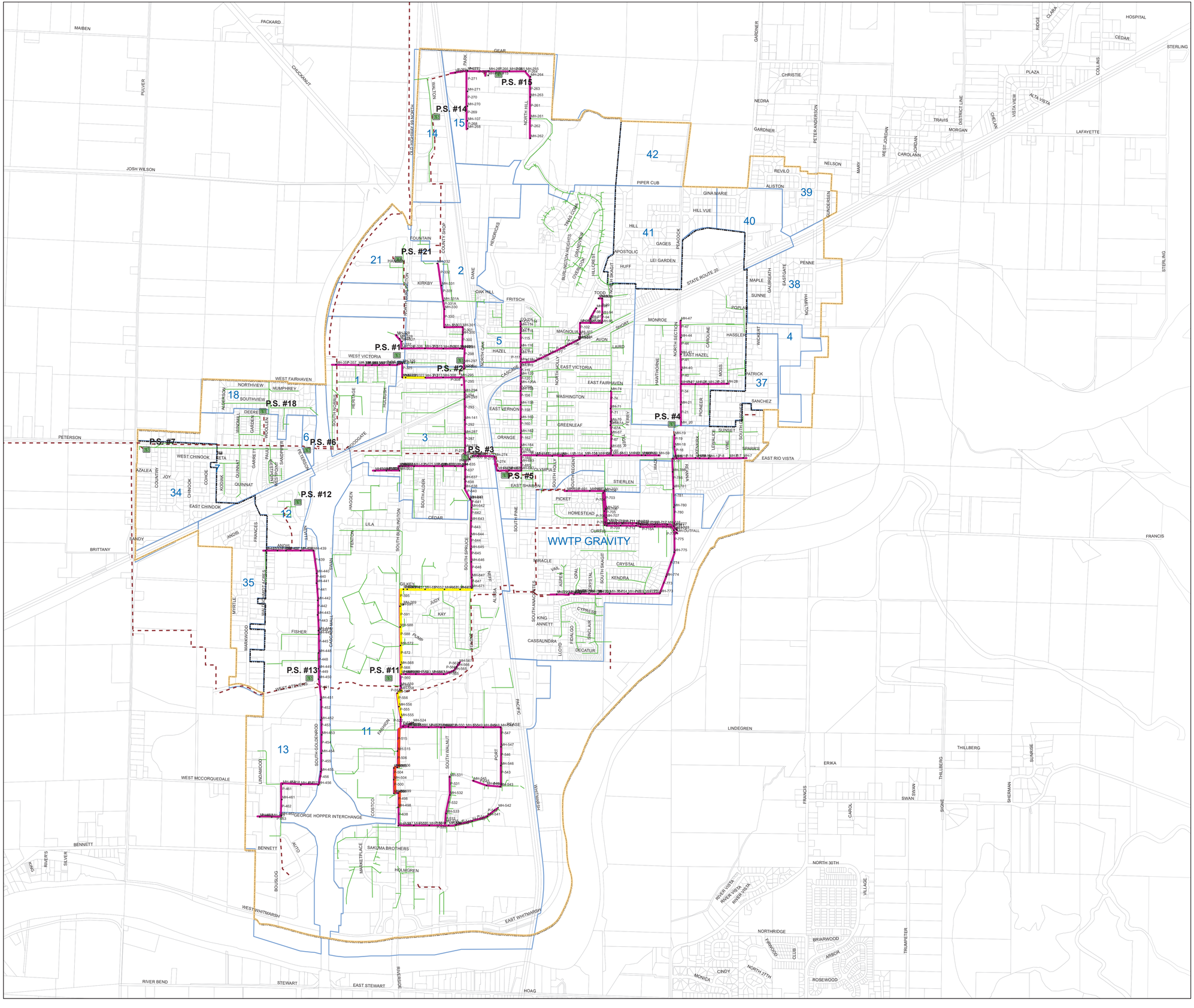
- LIFT STATION
- MODELED SEWER PIPES
- OVER CAPACITY AT 2040
- OVER CAPACITY AT BUILDOUT
- SEWER MAIN
- FORCEMAIN
- CITY LIMITS
- CITY UGA
- BAYVIEW RIDGE UGA
- BASINS

DATA SOURCES:
CITY OF BURLINGTON

CITY OF BURLINGTON

WASTEWATER COMPREHENSIVE PLAN
BASE MAP (VIEW 1)

Gray & Osborne, Inc.
CONSULTING ENGINEERS



DATA SOURCES:
CITY OF BURLINGTON

CITY OF BURLINGTON

WASTEWATER COMPREHENSIVE PLAN
BASE MAP (VIEW 2)

Gray & Osborne, Inc.
CONSULTING ENGINEERS

APPENDIX G

WWTP CONDITION ASSESSMENT

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 1 - Influent Pump Station	**YEAR FIRST CONSTRUCTED**	2000
YEAR UPGRADED	2008	**ITEM UPGRADED**	Replaced Pump 2
YEAR UPGRADED	2010	**ITEM UPGRADED**	Replaced Pump 3
YEAR UPGRADED	2016	**ITEM UPGRADED**	Replaced Jib Crane Hoist
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	Yes

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	4	• Paint system failure and corrosion on piping and pipe supports in the wet well due to exposure of hydrogen sulfide gas.
	4	• The reliability of the pump station operation in the case of an extreme emergency, such as extended power outages and the WWTP generator fails or runs out of fuel, should be implemented
Electrical / Instrumentation & Controls / Power	4	• VFDs, PLCs, and communications system are obsolete and should be replaced.
Structural / Architectural	4	• The canopy for the electrical controls should be replaced. The roof should be replaced and there are seismic concerns with the overall structure.
HVAC / Odor Control	5	• Presently, there is no HVAC or odor control. Ventilation and odor control for the control of hydrogen sulfide gas should be installed.
Overall Facility Rating	**4.2**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 1 - Headworks	**YEAR FIRST CONSTRUCTED**	1997
YEAR UPGRADED	2011	**ITEM UPGRADED**	Added Second Influent Screen
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	Yes

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	2	• All in good condition. Condition rating 2 is solely based on age
Electrical / Instrumentation & Controls / Power	4	• Any PLC in the control panel for the original screen is obsolete and should be replaced
	5	• pH monitoring and control instrumentation of the influent should be added to the headworks to respond to rapidly changing pH of the WWTP influent
Structural / Architectural	3	• Spalled concrete was noted at the connection of the west stair stringer. The spalled concrete should be repaired.
HVAC / Odor Control	N/A	N/A
Overall Facility Rating	**3.5**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 2 - Primary Clarifier 2	**YEAR FIRST CONSTRUCTED**	2000
YEAR UPGRADED	N/A	**ITEM UPGRADED**	N/A
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	Yes

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	3	• All in good condition. Condition rating 3 is solely based on age.
Electrical / Instrumentation & Controls / Power	3	• All in good condition. Condition rating 3 is solely based on age.
Structural / Architectural	3	• Moderate corrosion damage of the end of the steel beams for the bridge, where the beams land on the perimeter wall.
	4	• The slab on grade is slightly undermined by erosion of soil and there are cracks in the slab. It is recommended that gravel be added around slab.
HVAC / Odor Control	N/A	N/A
Overall Facility Rating	**3.25**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 3 - Primary Clarifiers 1A & 1B	**YEAR FIRST CONSTRUCTED**	1976
YEAR UPGRADED	2000	**ITEM UPGRADED**	Install overflow in splitter box; replace weirs and scum baffles
YEAR UPGRADED	2020	**ITEM UPGRADED**	Replace mechanisms
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	Yes

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	1	• All in good condition
Electrical / Instrumentation & Controls / Power	1	• All in good condition
Structural / Architectural	3	• All in acceptable condition. Condition rating 3 is solely based on age
HVAC / Odor Control	N/A	N/A
Overall Facility Rating	**1.67**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 4 - Aeration Basins Splitter Box	**YEAR FIRST CONSTRUCTED**	2000
YEAR UPGRADED	2017	**ITEM UPGRADED**	Replaced influent sampler
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	Yes

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	2	• All in good condition. Condition rating 2 is solely based on age.
Electrical / Instrumentation & Controls / Power	2	• All in good condition. Condition rating 2 is solely based on age.
Structural / Architectural	2	• All in good condition. Condition rating 2 is solely based on age.
HVAC / Odor Control	N/A	N/A
Overall Facility Rating	**2.0**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 5 - Aeration Basins 2 & 3	**YEAR FIRST CONSTRUCTED**	2000
YEAR UPGRADED	2018	**ITEM UPGRADED**	Replaced diffusers in Aeration Basin 2
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	Aeration Basin 2: Yes - Aeration Basin 3: No

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	2	• Equipment is in good condition. Condition rating 2 is solely based on age.
	5	• Shutoff valves should be installed on the air supply pipes to each of the aeration basins to isolate each aeration basin.
Electrical / Instrumentation & Controls / Power	3	• All in acceptable condition. Condition rating 3 is solely based on age.
	5	• pH monitoring and control instrumentation should be added in the aeration basins to respond to rapidly changing pH of the WWTP influent
Structural / Architectural	2	• All in good condition. Condition rating 2 is solely based on age.
HVAC / Odor Control	N/A	N/A
Overall Facility Rating	**3.4**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 6 - Aeration Basins 1A & 1B	**YEAR FIRST CONSTRUCTED**	1976
YEAR UPGRADED	1995	**ITEM UPGRADED**	Replace air diffusion system; install selector walls
YEAR UPGRADED	2000	**ITEM UPGRADED**	Modify influent piping and aeration headers. Install spray bars.
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	No

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	2	• All in good condition. Condition rating 2 is solely based on age.
Electrical / Instrumentation & Controls / Power	3	• All in acceptable condition. Condition rating 3 is solely based on age.
	5	• pH monitoring and control instrumentation should be added in the aeration basins to respond to rapidly changing pH of the WWTP influent
Structural / Architectural	3	• The coating has failed on some steel supports for baffle walls and there is some corrosion and metal loss. Recoating will lengthen their service life.
HVAC / Odor Control	N/A	N/A
Overall Facility Rating	**3.25**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 7 - Blower Building	**YEAR FIRST CONSTRUCTED**	1976
YEAR UPGRADED	2000	**ITEM UPGRADED**	Replaced all mechanical equipment and electrical gear. Some structural and architectural modifications
YEAR UPGRADED	2015	**ITEM UPGRADED**	Installed fourth blower
YEAR UPGRADED	2021	**ITEM UPGRADED**	Replaced check valves on Primary Sludge Pumps 1 & 2
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	Yes (except one original blower from 1976)

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	4	• The existing blowers are inefficient at the loadings presently experienced at the WWTP. These blowers should be replaced by smaller positive displacement blowers
	3	• Corrosion noted on air gap system
Electrical / Instrumentation & Controls / Power	4	• VFDs, PLCs, and communication equipment are obsolete and should be replaced
Structural / Architectural	3	• In one location at base of concrete basement wall there is significant spalling that has exposed rebar in the wall. This should be repaired to protect against rebar corrosion and further spalling.
HVAC / Odor Control	4	• The Blower Building basement is suspected to be Class I Division 2 (NFPA 820) based on the observed ventilation system. Because the ground level contains significant electrical gear, the basement should be unclassified. An NFPA 820 evaluation and an upgrade of the ventilation system is recommended.
Overall Facility Rating	**3.6**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 7 - Generator Building	**YEAR FIRST CONSTRUCTED**	2000
YEAR UPGRADED	2021	**ITEM UPGRADED**	Replace Control Panel
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	Yes

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	3	• All in acceptable condition. Condition rating 3 is solely based on age.
	4	• Any older PLCs and communication equipment are obsolete and should be replaced
Structural / Architectural	2	• All in good condition. Condition rating 2 is solely based on age.
HVAC / Odor Control	3	• All in acceptable condition. Condition rating 3 is solely based on age.
Overall Facility Rating	**3.00**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 7 - Gravity Thickener	**YEAR FIRST CONSTRUCTED**	1976
YEAR UPGRADED	2015	**ITEM UPGRADED**	Replace Thickener Mechanism
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	Yes

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	2	• All in good condition. Condition rating 2 is solely based on age.
Electrical / Instrumentation & Controls / Power	2	• All in good condition. Condition rating 2 is solely based on age.
Structural / Architectural	3	• Slight steel corrosion was found on bridge. Recoating will lengthen its service life.
HVAC / Odor Control	N/A	N/A
Overall Facility Rating	**2.33**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 8 - Secondary Clarifier Splitter Box	**YEAR FIRST CONSTRUCTED**	2000
YEAR UPGRADED	N/A	**ITEM UPGRADED**	N/A
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	Yes

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	2	• All in good condition. Condition rating 2 is solely based on age
Electrical / Instrumentation & Controls / Power	N/A	N/A
Structural / Architectural	2	• All in good condition. Condition rating 2 is solely based on age
HVAC / Odor Control	N/A	N/A
Overall Facility Rating	**2.00**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Atea 9 - Secondary Clarifier 2	**YEAR FIRST CONSTRUCTED**	2000
YEAR UPGRADED	N/A	**ITEM UPGRADED**	N/A
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	Yes

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	3	• All in acceptable condition. Condition rating 3 is solely based on age.
Electrical / Instrumentation & Controls / Power	3	• All in acceptable condition. Condition rating 3 is solely based on age.
Structural / Architectural	4	• An elevated walkway added around a portion of the tank to improve access for maintenance. Currently some portions of the wall are too tall relative to grade level, inhibiting access for maintenance.
HVAC / Odor Control	N/A	N/A
Overall Facility Rating	**3.33**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 10 - Secondary Clarifiers 1A & 1B	**YEAR FIRST CONSTRUCTED**	1976
YEAR UPGRADED	2000	**ITEM UPGRADED**	Modifications to splitter box and scum boxes; replace weirs and scum baffles
YEAR UPGRADED	2017	**ITEM UPGRADED**	Replace mechanisms
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	Yes

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	1	• All in very good condition
Electrical / Instrumentation & Controls / Power	1	• All in very good condition
Structural / Architectural	3	• Minor corrosion on structural frame of rake arm. Moderate to heavy corrosion on guy wires for scum skimmer post. Recoating / replacement will lengthen the service life of these items.
	3	• Slightly exposed aggregate on concrete walls, possibly due to exposure to acid. This should be monitored and corrected.
HVAC / Odor Control	N/A	• N/A
Overall Facility Rating	**2.0**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 11 - Ultraviolet Disinfection Systems	**YEAR FIRST CONSTRUCTED**	2000 (structure built in 1976)
YEAR UPGRADED	2017	**ITEM UPGRADED**	Added second UV system. Replaced effluent sampler
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	New system: Yes, old system: No

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	4	• Original system no longer supported by manufacturer
	2	• New System Condition rating 2 is solely based on age (includes effluent sampler)
Electrical / Instrumentation & Controls / Power	4	• Original system no longer supported by manufacturer
	5	• Need effluent pH monitoring of effluent
	2	• New System Condition rating 2 is solely based on age
Structural / Architectural	2	• All in good condition. Condition rating 2 is solely based on age
HVAC / Odor Control	N/A	N/A
Overall Facility Rating	**3.17**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 11 - Effluent Pump Station	**YEAR FIRST CONSTRUCTED**	2000 (structure constructed in 1976)
YEAR UPGRADED	N/A	**ITEM UPGRADED**	N/A
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	No

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	4	• The reliability of the pump station operation in the case of an extreme emergency, such as extended power outages and the WWTP generator fails or runs out of fuel, should be implemented
Electrical / Instrumentation & Controls / Power	4	• VFDs, PLCs, and communications system are obsolete and should be replaced.
Structural / Architectural	3	• All in acceptable condition. Condition rating 3 is solely based on age.
HVAC / Odor Control	N/A	N/A
Overall Facility Rating	**3.67**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 11 - Effluent Structure	**YEAR FIRST CONSTRUCTED**	1976
YEAR UPGRADED	2000	**ITEM UPGRADED**	Retrofitted for additional outfall pipes
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	Yes

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	3	• All in acceptable condition. Condition rating 3 is solely based on age.
Electrical / Instrumentation & Controls / Power	N/A	N/A
Structural / Architectural	3	• The steel stair providing access to the top of the structure has settled and is no longer plumb. This may be causing excessive stress on connections of the stair to the concrete structure. A more detailed inspection could be done to verify that connections of the stair to the concrete structure have not been compromised.
HVAC / Odor Control	N/A	N/A
Overall Facility Rating	**3**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 11 - Non-Potable Water System	**YEAR FIRST CONSTRUCTED**	2000 (structure constructed in 1976)
YEAR UPGRADED	N/A	**ITEM UPGRADED**	N/A
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	Yes

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	4	• All in acceptable condition. However, a separate non-potable water supply for the sludge dryer should be installed. Required capacity = 200 gpm
Electrical / Instrumentation & Controls / Power	4	• VFDs, PLCs and communications systems are obsolete and should be replaced
Structural / Architectural	3	• All in acceptable condition. Condition rating 3 is solely based on age.
HVAC / Odor Control	N/A	N/A
Overall Facility Rating	**3.67**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 11 – Disinfection Building	**YEAR FIRST CONSTRUCTED**	1976
YEAR UPGRADED	2000	**ITEM UPGRADED**	Install sodium hydroxide and sodium hypochlorite storage and feed equipment and irrigation system controls
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	Yes

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	3	• Equipment requires considerable maintenance.
	3	• NaOH storage tank and piping exhibit leaking at a few connection points with some precipitate build-up.
Electrical / Instrumentation & Controls / Power	3	• All in acceptable condition. Condition rating 3 is solely based on age.
Structural / Architectural	4	• A Building Code analysis is recommended for both storage rooms (NaOCl and NaOH) to ensure compliance with current and best practices. Note, there may be some additional building safety measures warranted if stored volumes exceed exempt amount thresholds.
HVAC / Odor Control	4	• The ventilation system will have to be upgraded as a result of the Building Code analysis recommended above.
Overall Facility Rating	**3.40**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 11 - Vactor Dump Station and Drain Pump Station	**YEAR FIRST CONSTRUCTED**	2000 (drain pump station structure constructed in 1976)
YEAR UPGRADED	2019	**ITEM UPGRADED**	Pumps replaced in 2019 with pumps purchased in 2006
YEAR UPGRADED	2020	**ITEM UPGRADED**	Replace mechanisms
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	No

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	3	• All in acceptable condition. Condition rating 3 is solely based on age.
Electrical / Instrumentation & Controls / Power	3	• All in acceptable condition. Condition rating 3 is solely based on age.
Structural / Architectural	3	• The concrete slab of the dump station is slightly higher than the adjacent asphalt, and it appears the bucket of excavators has been catching on this lip, causing chipping of the concrete. Asphalt could be raised slightly in front of the concrete slab to improve this condition.
HVAC / Odor Control	N/A	N/A
Overall Facility Rating	**3.0**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 12 – Anaerobic DIgesters	**YEAR FIRST CONSTRUCTED**	2000
YEAR UPGRADED	N/A	**ITEM UPGRADED**	N/A
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	Yes

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	3	• Generally, in acceptable condition. Condition rating 3 is solely based on age and maintenance history
	3	• The air gap unit and plumbing associated with the backflow assembly in the basement is showing signs of surface corrosion. It is understood to be operating sufficiently but should be monitored.
	4	• Struvite formation has been observed under the top access cover on the primary anaerobic digester. Remediation of this formation should be investigated
Electrical / Instrumentation & Controls / Power	4	• VFDs, PLCs, and communications system are obsolete and should be replaced.
Structural / Architectural	2	• Generally, in good condition. Condition rating 2 is solely based on age.
	3	• The ceiling tiles in the restroom show signs of water damage. Replacement may be considered for aesthetic reasons and the area should be monitored for any future water damage (it is understood previous issues have been addressed).
HVAC / Odor Control	3	• Grilles and Louvers should be cleaned
	4	• An NFPA 820 evaluation should be conducted for this building to ensure the ventilation system operates in accordance with the most recent NFPA code.
Overall Facility Rating	**3.25**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 12 – Sludge Thickening and Dewatering	**YEAR FIRST CONSTRUCTED**	2000
YEAR UPGRADED	2017	**ITEM UPGRADED**	Replaced Belt Filter Press Dewatering Unit
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	Yes

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	3	• Generally, in acceptable condition. Condition rating 3 is solely based on age and maintenance history
	4	• The polymer feed systems are nearing the end of their useful life and should be replaced
Electrical / Instrumentation & Controls / Power	4	• VFDs, PLCs, and communications system are obsolete and should be replaced.
Structural / Architectural	2	• Generally, in good condition. Condition rating 2 is solely based on age.
HVAC / Odor Control	3	• Grilles and Louvers should be cleaned
	4	• An NFPA 820 evaluation should be conducted for this building to ensure the ventilation system operates in accordance with the most recent NFPA code.
	4	• The electrical room includes a thru-wall air conditioner that has been retrofitted into the space. This has been done well and is operating sufficiently, but this area may be considered for a more permanent ductless split system similar to other electrical rooms at the plant.
Overall Facility Rating	**3.43**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 12 – Sludge Drying and Storage	**YEAR FIRST CONSTRUCTED**	2000
YEAR UPGRADED	2002	**ITEM UPGRADED**	Installed Sludge Dryer
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	No

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	4	• The sludge dryer is approaching the end of its useful life. Replacement spare parts are not available from the manufacturer.
	4	• A separate non-potable water supply for the sludge dryer should be installed. Required capacity = 200 gpm
Electrical / Instrumentation & Controls / Power	3	• Generally, in acceptable condition. Condition rating 3 is solely based on age.
Structural / Architectural	2	• Generally, in good condition. Condition rating 2 is solely based on age.
HVAC / Odor Control	N/A	N/A
Overall Facility Rating	**3.25**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 12 - Septage Receiving Station	**YEAR FIRST CONSTRUCTED**	1990
YEAR UPGRADED	2017	**ITEM UPGRADED**	Replace receiving station equipment
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	Yes

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	3	• All in acceptable condition. Condition rating 3 is solely based on age.
Electrical / Instrumentation & Controls / Power	3	• All in acceptable condition. Condition rating 3 is solely based on age.
Structural / Architectural	2	• All in good condition. Condition rating 2 is solely based on age.
HVAC / Odor Control	N/A	N/A
Overall Facility Rating	**2.67**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 12 – Plant Drain Pump Station	**YEAR FIRST CONSTRUCTED**	2000
YEAR UPGRADED	N/A	**ITEM UPGRADED**	N/A
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	Yes

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	3	• All in acceptable condition. Condition rating 3 is solely based on age.
Electrical / Instrumentation & Controls / Power	3	• All in acceptable condition. Condition rating 3 is solely based on age.
Structural / Architectural	2	• All in good condition. Condition rating 2 is solely based on age.
HVAC / Odor Control	N/A	N/A
Overall Facility Rating	**2.67**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 13 – Vehicle Storage Building	**YEAR FIRST CONSTRUCTED**	2000
YEAR UPGRADED	N/A	**ITEM UPGRADED**	N/A
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	Yes

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	3	• All in acceptable condition. Condition rating 3 is solely based on age
Electrical / Instrumentation & Controls / Power	4	• Any PLCs and communication equipment are obsolete and should be replaced
Structural / Architectural	2	• All in good condition. Condition rating 2 is solely based on age
HVAC / Odor Control	3	• All in acceptable condition. Condition rating 3 is solely based on age
Overall Facility Rating	**3.0**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 14 – Administration Building	**YEAR FIRST CONSTRUCTED**	1976
YEAR UPGRADED	1997	**ITEM UPGRADED**	Added second building
YEAR UPGRADED	2000	**ITEM UPGRADED**	Upgraded communication equipment
YEAR UPGRADED	2015	**ITEM UPGRADED**	Upgraded laboratory and added employee training room
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	Yes

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	3	• All in acceptable condition. Condition rating 3 is solely based on age
Electrical / Instrumentation & Controls / Power	4	• Any PLCs and communication equipment are obsolete and should be replaced
Structural / Architectural	2	• All in good condition. Condition rating 2 is solely based on age
HVAC / Odor Control	3	• All in acceptable condition. Condition rating 3 is solely based on age
Overall Facility Rating	**3.0**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable or Function Lacking and Should Be Added

City of Burlington Wastewater Treatment Plant
Facility Condition Assessment Form

FACILITY / PROCESS NAME	Area 15 - Sludge Storage Tank	**YEAR FIRST CONSTRUCTED**	1976 (as an aerobic digester)
YEAR UPGRADED	2000	**ITEM UPGRADED**	Taken out of service. Presently used for storing sludge when anaerobic digesters are cleaned
DATE INSPECTED	July 23, 2021	**OPERATING (Yes/No)**	No

Condition Rankings

Discipline	Condition Rating	Comments
Mechanical / Process / Piping	N/A	• Equipment abandoned in place – not needed
Electrical / Instrumentation & Controls / Power	N/A	• Abandoned in place – not needed
Structural / Architectural	3	• Coating on concrete has failed in many locations.
HVAC / Odor Control	N/A	N/A
Overall Facility Rating	**3.0**	**System asset criteria weighted equally**

	Ranking	Description
CONDITION RANKING SCALE	1	Very Good Condition
	2	Minor Defects
	3	Maintenance Required to Return to Accepted Level of Service
	4	Requires Rehabilitation
	5	Facility Unserviceable of Function Lacking and Should Be Added

City of Burlington WWTP – Electrical Assessment

On July 23, 2021 David Bowman of Conley Engineering visited the site in conjunction with staff of Gray & Osborne for the purpose of performing a condition assessment of the Wastewater Treatment Plant. In addition to the site visit, telephone discussions occurred with Mark Holland (plant electrician), Geoff Hawes (City IT), and Kurk Kembel (integration vendor) as to their assessment of the electrical systems at the plant. This report documents the findings of the above with respect to the electrical installation.

General Electrical Condition Assessment

A large portion of the electrical installation at the treatment plant was installed as part of the 1999 Improvements project. Additional improvements/additions have been made since then in portions of the plant. However, the bulk of the electrical distribution and process control systems date from the 1999 project.

The general condition of the electrical installation is very good. The electrical equipment appears to have been well maintained, and improvements have been made since the 1999 project to add air conditioning in many of the electrical rooms, and to eliminate unfiltered air ingress. This has improved the air by removing airborne dust, dirt and other contaminants before entry to the electrical rooms. LED lighting fixture replacements or retrofits have been made at almost all of the original fluorescent and HPS lighting fixtures at the plant.

A few locations have issues of corrosion of enclosures, conduit, fittings, lighting fixtures, and similar items. These are mainly at the plant influent station, headworks, and solids handling building. Efforts have been made to address this by repeated painting and other methods. At the plant influent pump station, the proximity of the electrical enclosures to the grated cover of the wetwell makes them vulnerable to the corrosive vapors off-gassing from of the raw sewage. Conditions are similar at the headworks, but most of the enclosures there are stainless steel construction.

Electrical Distribution

The plant is supplied power from Puget Sound Energy (PSE) and is primary metered at 12.47kV. The primary feeder supplies a 1000/1120/1288 kVA unit substation. This substation provides 3 phase 480Y/277 volt power to the Main Distribution Switchboard with a 1600 Amp main circuit breaker with ground fault protection. An 800 Amp circuit breaker located in the same enclosure is interlocked with the main breaker in an automatic transfer switch configuration to also allow a standby generator to provide power to the entire plant. Distribution to the plant is through individual feeder circuit breakers located in the two distribution sections of the switchboard. A list of the individual feeders is as follows:

Switchboard A	Influent Pump No. 1	UV PDC No. 3
Switchboard B	Influent Pump No. 2	Panel HUV
MCC C1	Influent Pump No.3	Panel LGB
Effluent Pump No. 1	UV PDC No. 1	Panel HP
Effluent Pump No.2	UV PDC No. 2	Harmonic Filter

Switchboards A and B, in turn, supply the following loads:

Switchboard A:
- MCBA
- MCC-A1 / MCC A2
- Blower No.3

Switchboard B:
- MCBB
- MCC-B1 / MCC B2
- Blower No.1
- Blower No.2

Almost all the electrical distribution gear was manufactured by SquareD. The motor control centers are SquareD Model 6 units. Mark Holland has indicated that he has few issues in maintaining the motor control center units with conventional (across the line type) starters. Replacement parts are available, either as original equipment, replacement equipment, or reconditioned equipment. However, the units with variable frequency drives (VFDs) are of concern. The existing VFD models are obsolete and utilize a communications bus (Modbus Plus) which is also obsolete. Newer models of VFDs can be substituted for the older models, but the newer models are incompatible with the existing Modbus Plus network. Effectively using newer VFD models would require modernizing and extending the existing Ethernet communications network and leveraging the Modbus TCP protocol.

The City has replaced some of the existing VFDs with models made by ABB. These ABB units do not connect to the existing Modbus Plus network. Mark Holland indicated that he finds these ABB models easy to work with and would prefer to see the City continue to use ABB VFDs for replacement and to transition away from a Modbus Plus communications network to different communications bus such as Ethernet IP (an Allen Bradley/Rockwell Automation protocol) or Modbus TCP. Communications with newer (ABB) VFDs has typically been handled in the SCADA HMI, bypassing the PLCs. A potential issue with replacement of the MCC mounted VFDs is that some of the existing buckets may not always have space for the newer model VFDs that would be used as replacements.

Generator

The generator is a Caterpillar 550 kW rated standby diesel-powered unit. The unit is located inside a dedicated room of the Generator Building. The room and the unit appear well maintained and in good condition. The complete control panel of the generator was recently successfully replaced with a new control panel. No issues have been noted by staff. It is believed the unit is regularly exercised, and provisions for connection to a test load bank were recently installed. Revisions to the status and alarming connections of the generator controls to the SCADA system were recently implemented allowing for greater resolution of individual alarms.

Control Systems

The Control System utilizes Quantum PLCs and Momentum IO units. These units are end-of-life, no longer manufacturer supported, and the City should plan for replacement of these. The City presently has adequate spares on hand, but this supply is limited and finite. The processor units are of greatest concern as they require maintenance of programming which becomes more problematic as time passes. The required programming software has become outdated and requires maintenance of older Windows OS virtual machines or old programming computers running an outdated insecure Windows OS to connect and modify the programming in the PLC.

The existing PLCs utilize the same plant Modbus Plus communications protocol for their own network communications as they do with the VFDs. It is now considered an outdated architecture and is generally not available with new equipment such as VFDs and remote IO equipment. The PLCs include an Ethernet TCP/IP adapter card with fiber ports for communication over the plant network to the HMI. An upgrade path for the PLCs is available that allows for continued use of the existing IO modules. This involves replacing the existing SquareD (Schneider) Quantum processors with new communications modules (utilizing Modbus TCP, ethernet, or other current protocols), and installing new Schneider 584 PLC (or related) processors to communicate with IO modules through the communications modules.

The downside to this approach is that these existing IO modules suffer the same age issues as the existing CPUs for repair and replacement. A major benefit to this approach over is that it limits downtime at the plant during equipment replacement as it is not necessary to de-terminate and re-terminate existing wiring at IO modules. The existing PLC programming can be upgraded to run on the new processors. Another alternative is to replace the existing PLC equipment in total with that of another manufacturer. This option would likely be more expensive and complicated as all of the existing IO wiring would need to be de-terminated and re-terminated after installation of new PLC and IO modules. This would have a significant effect on operation of the plant during the transition time. However, it has the benefit of having all new equipment without end-of-life supply limitations.

Although not directly part of this report, it is worth noting that the offsite collection system utilizes mainly Allen Bradley PLCs (Micrologix series).

Instrumentation

The process instrumentation at the plant is largely from the 1999 improvements project. The instrumentation appears to be in good condition and is performing well. No pressing issues have been identified. It can be expected that due to the age of the equipment that some repairs and or replacement s will become necessary, but there does not appear to be a need to address this wholesale throughout the plant at this time. Such work could probably be budgeted as maintenance items.

SCADA and IT Systems

The SCADA system includes the process control PLCs (discussed above) along with the HMI computer(s) and associated software, the communications systems pathways (copper and fiber circuits), and communications racks and IT equipment (servers, switches, patch panels, etc.).

The HMI computers are believed to be about 2 years old and are running the Windows 10 operating system. The HMI software is standard Aveva Intouch (not Aveva System Platform).

The plant communications system uses fiber optic cables for links between the campus buildings. The star network is centered in the Blower Building. Media convertors and hubs (not switches) are in place in the other buildings, and allow communications for the PLC processors as well as well as other systems. The fiber cable is multimode and was installed in the 1999 project. The City has standardized on single mode fiber for all of its other installations and would prefer to utilize single mode fiber at the plant for consistency. The City's existing IT network comes to the plant in the Lab Building where there are comm racks and network racks and managed switches. The City would like to modify the plant fiber network to more easily be connected to the City network, and to utilize managed switches at the outlying buildings. The switching fabric of the network should be fully replaced when possible. This could be done as a "forklift" replacement or possibly in phases.

Summary of Items for potential replacement/modification

- Replace process equipment VFDs
- Replace multimode fIber optic with single mode
- Replace SCADA network hubs with managed switches
- Replace PLC processors (and perhaps I/O modules)

- Address areas of corrosion/degradation of electrical equipment

A licensed building systems engineer performed a walkthrough and visual evaluation of the wastewater treatment plant. Note that the intent of the walkthrough was to note the general condition of the architectural and mechanical elements of buildings. A detailed evaluation was beyond the scope for this walkthrough.

The following observations were noted.

Location	Issue
Generator Building	Building, generator, fuel and HVAC systems were observed to be in good condition.
Blower Building	Building elements that could be observed from floor height were observed to be in good condition.
Blower Building	Intake and exhaust louvers should be cleaned and serviced to ensure allowable airflow is not restricted. At least one intake louver on the east side of the building was observed to have an insect screen with significant blanking due to dirt and build-up. In addition, several interior gravity backdraft dampers appeared to be in closed positions while the system was operating.
Blower Building	Significant airflow was observed being drawn into the building around the double door entrance into the foyer with the stairwell to the basement. The concern is that the louver and damper issue noted above is causing the basement ventilation system to move air thru the building in undesired and unintended ways. General airflow observations should be made after louvers and dampers are assured to be allowing maximum airflow.
Blower Building	An NFPA 820 evaluation should be conducted for this building to ensure the ventilation system operates in accordance with the NFPA code.
Blower Building	Both Electrical Rooms in this building contained relatively modern heat pump systems for heating and cooling. Plant staff did not report any known temperature issues.
Blower Building	The airgap pumping system in the basement is showing signs of corrosion of the tank and lid, but is otherwise operating sufficiently.
Solids Handling Building	Intake louver(s) should be cleaned and serviced to ensure allowable airflow is not restricted. The intake louver to the east of the main north entrance door was observed to have an insect

	screen with significant blanking due to dirt and build-up.
Solids Handling Building	The intake grilles on interior ductwork should be inspected on an annual basis to ensure maximum airflow. Cleaning and/or replacement due to corrosion should be done as required.
Solids Handling Building	An NFPA 820 evaluation should be conducted for this building to ensure the ventilation system operates in accordance with the NFPA code.
Solids Handling Building	The airgap pumping system in the basement is showing signs of corrosion of the tank and lid, but is otherwise operating sufficiently.
Solids Handling Building	Plumbing associated with the backflow assembly in the basement is showing signs of surface corrosion. It is understood to be operating sufficiently but should be monitored.
Solids Handling Building	The ceiling tiles in the ground floor restroom show signs of water damage. Replacement may be considered for aesthetic reasons and the area should be monitored for any future water damage (it is understood previous issues have been addressed).
Solids Handling Building	The electrical room includes a thru-wall air conditioner that has been retrofitted into the space. This has been done well and is operating sufficiently, but this area may be considered for a more permanent ductless split system similar to other electrical rooms at the plant.
Solids Handling Building	Intake louvers in the dewatering room should be cleaned and serviced to ensure allowable airflow is not restricted
Solids Handling Building	Roof membrane appeared in good condition. Membrane should continue to be cleaned in accordance with manufacturer's recommendations to ensure full life span.
Solids Handling Building	Rooftop mounted equipment appeared to be in serviceable condition; however it was not clear at the time of this observation whether all equipment is active. It is recommended that any non-active equipment be demolished and associated roof curbs be capped. Note, roof curbs could be removed during any future re-roofing projects.
Disinfection Building	NaOH storage tank and piping exhibit minor leaking at a few connection points with some precipitate build-up.

Disinfection Building	A Building Code analysis is recommended for both storage rooms (NaOCl and NaOH) to ensure compliance with current and best practices. Note, there may be some additional building safety measures warranted if stored volumes exceed exempt amount thresholds.

A licensed structural engineer performed a walkthrough and visual evaluation of the wastewater treatment plant. Note that the intent of the walkthrough was to note the general condition of structures. A detailed evaluation was beyond the scope for this walkthrough.

Generally concrete and steel items were in good condition, unless otherwise noted below. The following structural issues were noted.

Location	Issue
Influent Pump Station Wet Well	Water was found pooled on steel I-shaped beams for pipe support, with accompanying mild corrosion. The beams are installed on their side, creating a large flat area for water to pool. One way to address this would be to drill small weep holes in the web of the beams to promote drainage and to allow the beam to dry out after it is exposed to water.
Influent Pump Station Wet Well	The paint system on the main pipes entering the wet well has largely failed and there is surface corrosion on the pipes. Recoating the pipes would lengthen their service life.
Influent Pump Station Wet Well	The plastic corrugated roofing on the wood-framed canopy over the control panels for the Influent Pump Station is in fair condition but will soon be due for replacement
Influent Pump Station Wet Well	Some electrical items are attached to the north side of the wood-framed canopy, however the canopy does not appear adequate to be designed to resist ground motion from a design-level earthquake.
Headworks	At the top of the west stair, concrete is spalled at the connection of the west stair stringer. The spalled concrete should be repaired.
Primary Clarifier No. 2	There is moderate corrosion damage of the end of the steel beams for the bridge, where the beams land on the perimeter wall.
Primary Scum Pump Station	The slab on grade is slightly undermined by erosion of soil and there are cracks in the slab. It is recommended that gravel be added around slab.
Aeration Basins 1A and 1B	The coating has failed on some steel supports for baffle walls and there is some corrosion and metal loss. Recoating will lengthen their service life.

Blower Building	In one location at base of concrete basement wall there is significant spalling that has exposed rebar in the wall. This should be repaired to protect against rebar corrosion and further spalling.
Grit Classifier Structure	There is a gap at floor level between the grating of the Grit Classifier Structure and the roof of the adjacent building. This gap is wide enough for a person's foot to fall through and therefore is a safety issue. A closure plate placed on the gap and attached to structure on only one side of the gap is one way to address this issue.
Grit Classifier Structure	In general there is moderate corrosion on the structure but no excessive metal loss was found. The corrosion should be periodically checked for metal loss that may compromise structural members.
Gravity Thickener	Slight steel corrosion was found on bridge. Recoating will lengthen its service life.
Sludge Storage Tank	Coating on concrete has failed in many locations.
Secondary Clarifier 2	Staff would like an elevated walkway added around a portion of the tank to improve access for maintenance. Currently some portions of the wall are too tall relative to grade level, inhibiting access for maintenance.
Secondary Clarifier 1A and 1B	Minor corrosion was found on structural frame of rake arm. Moderate to heavy corrosion was found on guy wires for scum skimmer post. Recoating/replacement will lengthen the service life of these items.
Secondary Clarifier 1A and 1B	The concrete walls have slightly exposed aggregate, indicating that there has been some chemical deterioration of the concrete surface due to acid exposure. Continue to monitor the condition of the walls. A detailed investigation could be done to verify the depth of deterioration and whether rebar in the wall is at risk of being exposed.
Vactor Truck Unloading Station	The concrete slab of the station is slightly higher than the adjacent asphalt, and it appears the bucket of excavators has been catching on this lip, causing chipping of the concrete. Asphalt could be raised slightly in front of the concrete slab to improve this condition.
Outfall Structure	The steel stair providing access to the top of the structure has settled and is no longer plumb. This may be causing excessive stress on connections

	of the stair to the concrete structure. A more detailed inspection could be done to verify that connections of the stair to the concrete structure have not been compromised.

APPENDIX H

REASONABLE POTENTIAL EVALUATION

REASONABLE POTENTIAL UPDATE

In the *City of Burlington Outfall Evaluation and Mixing Zone Study* ("2020 MZS") Gray and Osborne, 2020), the results of dye testing to measure the dispersion of effluent and a reasonable potential analysis (RPA) for exceedance of water quality standards were provided. The conclusion of the 2020 MZS was that there was no reasonable potential for any of the parameters considered, and that no new permit limits were required.

For this 2023 Wastewater Comprehensive Plan (2023 WCP), the RPA was re-examined with the new flow projections for both 2040 and Buildout. The results are documented here.

Flows and Dilution Factors

Many of the flow projections developed in the 2023 WCP were similar to those from 2020 MZS, such that the 2020 MZS flows could be (conservatively) utilized for the updated RPA. Table 1 summarizes the flows utilized and dilution factors calculated in the 2020 MZS, the 2023 WCP, and the values selected for the updated RPA.

TABLE 1
Flows and Dilution Factors for Updated RPA

	Effluent Flow Criterion	**2020 Mixing Zone Study (Plumes Model)**			**2023 Wastewater Comprehensive Plan (Flow-based)**		**Selection for Reasonable Potential Calculation**	
		2020	**2030**	**Buildout**	**2040**	**Buildout**	**2040**	**Buildout**
Effluent Flows, mgd								
Peak Day		6	8	14	3.39	8.52	**3.39**	**8.52**
Max Month		2.55	3.55	7.36	2.78	7.34	**2.78**	**7.34**
Annual Average		1.74	2.51	5.54	1.98	6.48	**1.98**	**6.48**
Dilution Factors								
Acute WQ	Peak Day	12.61	10.64	8.58 (model) /6.62 (flow based)	24.2	10.2	**12.61**	**10.2**
Chronic WQ	Max Month	54.12	42.72	24.97	284.1	108.2	**54.12**	**24.97**
Human Health Criteria - Carcinogen	Annual Ave.	67.95	54.43	30.52	1193.4	365.4	**67.95**	**30.52**
Human Health Crit. - Non-carcinogen	Max Month	54.12	42.72	24.97	397.3	151.1	**54.12**	**24.97**

An explanation of the flows and dilution factors utilized is provided below.

2040 DF selection

- The updated 2040 PDF (3.39 mgd) in the 2023 WCP is lower than the 2020 PDF (6.0 mgd) in the 2020 MZS. Since the simple flow dilution-based ("flow-based") 2040 Acute DF (24.2) is

higher than that from modeling 2020 Acute DF (12.61) in 2020 MZS, the more stringent modeled DF 12.61 was used.

- The updated 2040 MMF (2.78 mgd) in the 2023 WCP is similar to the 2020 MMF (2.55 mgd) in the 2020 MZS. The more stringent Chronic DF from modeling (54.12) was used rather than the flow based DF (284.1). The same choice was made for HH Carcinogen which is also based on MMF.
- The updated 2040 AAF (1.98 mgd) in the 2023 WCP is similar to the 2020 AAF (1.74 mgd) in 2020 MZS. The more stringent 54.12 Chronic DF from modeling was used rather than the flow based DF 397.3.

Buildout DF selection

- The updated Buildout PDF (8.52 mgd) in the 2023 WCP is similar to the 2030 PDF (8.0 mgd) in the 2020 MZS. The more stringent flow-based Acute DF of 10.2 was used.
- The updated Buildout MMF (7.34 mgd) in the 2023 WCP is similar to the Buildout MMF (7.36 mgd) in the 2020 MZS. The more stringent model-based Chronic DF (24.97) rather than the flow-based DF (108.2) was used. The same choice was made for HH Carcinogen which is also based on MMF.
- The updated Buildout AAF (6.48 mgd) in the 2023 WCP is higher than the Buildout AAF (5.54 mgd) in the 2020 MZS. Since the flow-based HH-Non-carcinogen DF (151.1) is higher than the model-based HH-Non-carcinogen DF (24.97) in the 2020 MZS, the more stringent model resulted DF 24.97 was used.

Effluent Data

The same effluent data set utilized in the 2020 Mixing Zone Study, augmented with more recent reported data (from 2021-2022), was utilized for this RPA. The data includes pollutant concentrations reported in the City's NPDES permit application, in discharge monitoring reports, and in priority pollutant scans.

RPA Results

Copies of the RPA spreadsheets are provided below. The conclusion is that there is no reasonable potential to exceed water quality standards for any of the parameters considered.

Reasonable Potential Calculation - Page 1

Facility	Burlington WWTP
Water Body Type	Freshwater
Rec. Water Hardness	Acute=24.8, Chronic=21.2 mg/L

Dilution Factors:	Acute	Chronic
Aquatic Life	12.6	54.1
Human Health Carcinogenic		68.0
Human Health Non-Carcinogenic		54.1

Pollutant, CAS No. & NPDES Application Ref. No.			AMMONIA, Criteria as Total NH3	ANTIMONY (INORGANIC) 7440360 1M	ARSENIC (dissolved) 7440382 2M	CADMIUM - 7440439 4M Hardness dependent	CHLOROFORM 67663 11V	CHROMIUM(TRI) -16065831 5M Hardness dependent	COPPER - 744058 6M Hardness dependent	CYANIDE 57125 14M	1,4 DICHLOROBENZENE 106467 22B	LEAD - 7439921 7M Dependent on hardness	METHYLENE CHLORIDE 75092 22V
Effluent Data	# of Samples (n)		66	8	8	8	5	8	8	8	5	8	5
	Coeff of Variation (Cv)		0.65	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Effluent Concentration, ug/L (Max. or 95th Percentile)		40,100	1	1.1	0.2	3.6	1.4	6.5	19	3.6	0.8	0.8
	Calculated 50th percentile Effluent Conc. (when n>10)												
Receiving Water Data	90th Percentile Conc., ug/L		10		0	0		0	0.77	0		0.032	
	Geo Mean, ug/L			0			0		0.63	0	0		0
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	21,945	-	360	0.81603	-	175.224	4.57632	22	-	13.7647	-
		Chronic	1,707	-	190	0.32632	-	49.891	3.01076	5.2	-	0.44819	-
	WQ Criteria for Protection of Human Health, ug/L		-	6	-	-	100	-	1300	9	200	-	10
	Metal Criteria Translator, decimal	Acute	-	-	1	0.943	-	0.316	0.996	-	-	0.466	-
		Chronic	-	-	1	0.943	-	0.86	0.996	-	-	0.466	-
	Carcinogen?		N	N	Y	N	Y	N	N	N	N	N	Y

Aquatic Life Reasonable Potential

Effluent percentile value			0.950		0.950	0.950		0.950	0.950	0.950		0.950	
s	$s^2=\ln(CV^2+1)$		0.594		0.555	0.555		0.555	0.555	0.555		0.555	
Pn	Pn=(1-confidence level)$^{1/n}$		0.956		0.688	0.688		0.688	0.688	0.688		0.688	
Multiplier			1.00		1.90	1.90		1.90	1.90	1.90		1.90	
Max concentration (ug/L) at edge of…		Acute	3,189		0.166	0.028		0.067	1.683	2.860		0.086	
		Chronic	751		0.039	0.007		0.042	0.983	0.666		0.044	
Reasonable Potential? Limit Required?			**NO**		**NO**	**NO**		**NO**	**NO**	**NO**		**NO**	

Aquatic Life Limit Calculation

# of Compliance Samples Expected per month											
LTA Coeff. Var. (CV), decimal											
Permit Limit Coeff. Var. (CV), decimal											
Waste Load Allocations, ug/L		Acute									
		Chronic									
Long Term Averages, ug/L		Acute									
		Chronic									
Limiting LTA, ug/L											
Metal Translator or 1?											
Average Monthly Limit (AML), ug/L											
Maximum Daily Limit (MDL), ug/L											

Human Health Reasonable Potential

s	$s^2=\ln(CV^2+1)$		0.55451		0.55451		0.55451	0.55451	0.55451		0.55451
Pn	Pn=(1-confidence level)1/n		0.688		0.549		0.688	0.688	0.549		0.549
Multiplier			0.76241		0.93363		0.76241	0.76241	0.93363		0.93363
Dilution Factor			54.12		67.95		54.12	54.12	54.12		67.95
Max Conc. at edge of Chronic Zone, ug/L			0.01409		0.04946		7.1E-01	0.26766	0.0621		0.01099
Reasonable Potential? Limit Required?			**NO**		**NO**		**NO**	**NO**	**NO**		**NO**

Human Health Limit Calculation

# of Compliance Samples Expected per month											
Average Monthly Effluent Limit, ug/L											
Maximum Daily Effluent Limit, ug/L											

Comments/Notes:

References: WAC 173-201A,

Technical Support Document for Water Quality-based Toxics Control, US EPA, March 1991, EPA/505/2-90-001, pages 56/99

Reasonable Potential Calculation - Page 2

Facility	Burlington WWTP
Water Body Type	Freshwater
Rec. Water Hardness	Acute=24.8, Chronic=21.2 mg/L

Dilution Factors:	Acute	Chronic
Aquatic Life	12.6	54.1
Human Health Carcinogenic		68.0
Human Health Non-Carcinogenic		54.1

Pollutant, CAS No. & NPDES Application Ref. No.			MERCURY 7439976 8M	NICKEL - 7440020 9M - Dependent on hardness	SELENIUM 7782492 10M	SILVER - 7740224 11M dependent on hardness.	TOLUENE 108883 25V	ZINC- 7440666 13M hardness dependent	CHROMIUM(HEX) 18540299 - Dissolved	THALLIUM 7440280 12M			
Effluent Data	# of Samples (n)		14	8	8	8	5	8	2	3			
	Coeff of Variation (Cv)		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Effluent Concentration, ug/L (Max. or 95th Percentile)		0.00827	4.1	1.6	0.8	0.6	48.9	0.127	0.1			
	Calculated 50th percentile Effluent Conc. (when n>10)		0.0293										
Receiving Water Data	90th Percentile Conc., ug/L		0.0046	1.36	0	0		3.72	0				
	Geo Mean, ug/L		0.0046	1.36	0		0	3.72		0			
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	2.1	435.278	20	0.31379	-	35.1321	15	-			
		Chronic	0.012	42.2484	5	-	-	28.0318	10	-			
	WQ Criteria for Protection of Human Health, ug/L		0.14	80	60	-	72	1000	-	1.7			
	Metal Criteria Translator, decimal	Acute	0.85	0.998	-	0.85	-	0.996	-	-			
		Chronic	-	0.997	-	-	-	0.996	-	-			
	Carcinogen?		N	N	N	N	N	N	N	N			

Aquatic Life Reasonable Potential

Effluent percentile value			0.950	0.950	0.950	0.950		0.950	0.950	
s	$s^2=\ln(CV^2+1)$		0.555	0.555	0.555	0.555		0.555	0.555	
Pn	$Pn=(1\text{-confidence level})^{1/n}$		0.807	0.688	0.688	0.688		0.688	0.224	
Multiplier			1.54	1.90	1.90	1.90		1.90	3.79	
Max concentration (ug/L) at edge of…		Acute	0.005	1.868	0.241	0.102		10.756	0.038	
		Chronic	0.005	1.478	0.056	0.028		5.359	0.009	
Reasonable Potential? Limit Required?			**NO**	**NO**	**NO**	**NO**		**NO**	**NO**	

Aquatic Life Limit Calculation

# of Compliance Samples Expected per month										
LTA Coeff. Var. (CV), decimal										
Permit Limit Coeff. Var. (CV), decimal										
Waste Load Allocations, ug/L		Acute								
		Chronic								
Long Term Averages, ug/L		Acute								
		Chronic								
Limiting LTA, ug/L										
Metal Translator or 1?										
Average Monthly Limit (AML), ug/L										
Maximum Daily Limit (MDL), ug/L										

Human Health Reasonable Potential

s	$s^2=\ln(CV^2+1)$		0.55451	0.55451	0.55451		0.55451	0.55451	0.554513029	
Pn	Pn=(1-confidence level)1/n		0.807	0.688	0.688		0.549	0.688	0.368	
Multiplier			0.61789	0.76241	0.76241		0.93363	0.76241	1.204860577	
Dilution Factor			54.12	54.12	54.12		54.12	54.12	54.12	
Max Conc. at edge of Chronic Zone, ug/L			0.00506	1.39263	0.02254		0.01035	4.3E+00	0.002226276	
Reasonable Potential? Limit Required?			**NO**	**NO**	**NO**		**NO**	**NO**	**NO**	

Human Health Limit Calculation

# of Compliance Samples Expected per month		
Average Monthly Effluent Limit, ug/L		
Maximum Daily Effluent Limit, ug/L		

Comments/Notes:

References: WAC 173-201A,

Technical Support Document for Water Quality-based Toxics Control, US EPA, March 1991, EPA/505/2-90-001, pages 56/99

Reasonable Potential Calculation - Page 1

Facility	Burlington WWTP
Water Body Type	Freshwater
Rec. Water Hardness	Acute=25.9, Chronic=22.5 mg/L

Dilution Factors:	Acute	Chronic
Aquatic Life	10.2	25.0
Human Health Carcinogenic		30.5
Human Health Non-Carcinogenic		25.0

Pollutant, CAS No. & NPDES Application Ref. No.			AMMONIA, Criteria as Total NH3	ANTIMONY (INORGANIC) 7440360 1M	ARSENIC (dissolved) 7440382 2M	CADMIUM - 7440439 4M Hardness dependent	CHLOROFORM 67663 11V	CHROMIUM(TRI) -16065831 5M Hardness dependent	COPPER - 744058 6M Hardness dependent	CYANIDE 57125 14M	1,4 DICHLOROBENZENE 106467 22B	LEAD - 7439921 7M Dependent on hardness	METHYLENE CHLORIDE 75092 22V
Effluent Data	# of Samples (n)		66	8	8	8	5	8	8	8	5	8	5
	Coeff of Variation (Cv)		0.65	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Effluent Concentration, ug/L (Max. or 95th Percentile)		40,100	1	1.1	0.2	3.6	1.4	6.5	19	3.6	0.8	0.8
	Calculated 50th percentile Effluent Conc. (when n>10)												
Receiving Water Data	90th Percentile Conc., ug/L		10		0	0		0	0.77	0		0.032	
	Geo Mean, ug/L			0			0		0.63	0	0		0
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	21,945	-	360	0.8563	-	181.706	4.77159	22	-	14.4695	-
		Chronic	1,707	-	190	0.34104	-	52.3788	3.16756	5.2	-	0.47929	-
	WQ Criteria for Protection of Human Health, ug/L		-	6	-	-	100	-	1300	9	200	-	10
	Metal Criteria Translator, decimal	Acute	-	-	1	0.943	-	0.316	0.996	-	-	0.466	-
		Chronic	-	-	1	0.943	-	0.86	0.996	-	-	0.466	-
	Carcinogen?		N	N	Y	N	Y	N	N	N	N	N	Y

Aquatic Life Reasonable Potential

Effluent percentile value			0.950		0.950	0.950		0.950	0.950	0.950		0.950	
s	$s^2=\ln(CV^2+1)$		0.594		0.555	0.555		0.555	0.555	0.555		0.555	
Pn	Pn=(1-confidence level)$^{1/n}$		0.956		0.688	0.688		0.688	0.688	0.688		0.688	
Multiplier			1.00		1.90	1.90		1.90	1.90	1.90		1.90	
Max concentration (ug/L) at edge of…		Acute	3,940		0.205	0.035		0.082	1.899	3.536		0.098	
		Chronic	1,616		0.084	0.014		0.092	1.231	1.444		0.059	
Reasonable Potential? Limit Required?			**NO**		**NO**	**NO**		**NO**	**NO**	**NO**		**NO**	

Aquatic Life Limit Calculation

# of Compliance Samples Expected per month											
LTA Coeff. Var. (CV), decimal											
Permit Limit Coeff. Var. (CV), decimal											
Waste Load Allocations, ug/L		Acute									
		Chronic									
Long Term Averages, ug/L		Acute									
		Chronic									
Limiting LTA, ug/L											
Metal Translator or 1?											
Average Monthly Limit (AML), ug/L											
Maximum Daily Limit (MDL), ug/L											

Human Health Reasonable Potential

s	$s^2=\ln(CV^2+1)$		0.55451		0.55451		0.55451	0.55451	0.55451		0.55451
Pn	Pn=(1-confidence level)1/n		0.688		0.549		0.688	0.688	0.549		0.549
Multiplier			0.76241		0.93363		0.76241	0.76241	0.93363		0.93363
Dilution Factor			24.97		30.52		24.97	24.97	24.97		30.52
Max Conc. at edge of Chronic Zone, ug/L			0.03053		0.11013		8.0E-01	0.58012	0.1346		0.02447
Reasonable Potential? Limit Required?			**NO**		**NO**		**NO**	**NO**	**NO**		**NO**

Human Health Limit Calculation

# of Compliance Samples Expected per month											
Average Monthly Effluent Limit, ug/L											
Maximum Daily Effluent Limit, ug/L											

Comments/Notes:

References: WAC 173-201A,

Technical Support Document for Water Quality-based Toxics Control, US EPA, March 1991, EPA/505/2-90-001, pages 56/99

Reasonable Potential Calculation - Page 2

Facility	Burlington WWTP
Water Body Type	Freshwater
Rec. Water Hardness	Acute=25.9, Chronic=22.5 mg/L

Dilution Factors:	**Acute**	**Chronic**
Aquatic Life	10.2	25.0
Human Health Carcinogenic		30.5
Human Health Non-Carcinogenic		25.0

Pollutant, CAS No. & NPDES Application Ref. No.			MERCURY 7439976 8M	NICKEL - 7440020 9M - Dependent on hardness	SELENIUM 7782492 10M	SILVER - 7740224 11M dependent on hardness.	TOLUENE 108883 25V	ZINC- 7440666 13M hardness dependent	CHROMIUM(HEX) 18540299 - Dissolved	THALLIUM 7440280 12M			
Effluent Data	# of Samples (n)		14	8	8	8	5	8	2	3			
	Coeff of Variation (Cv)		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Effluent Concentration, ug/L (Max. or 95th Percentile)		0.00827	4.1	1.6	0.8	0.6	48.9	0.127	0.1			
	Calculated 50th percentile Effluent Conc. (when n>10)		0.0293										
Receiving Water Data	90th Percentile Conc., ug/L		0.0046	1.36	0	0		3.72	0				
	Geo Mean, ug/L		0.0046	1.36	0		0	3.72		0			
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	2.1	451.919	20	0.33866	-	36.4774	15	-			
		Chronic	0.012	44.4263	5	-	-	29.4791	10	-			
	WQ Criteria for Protection of Human Health, ug/L		0.14	80	60	-	72	1000	-	1.7			
	Metal Criteria Translator, decimal	Acute	0.85	0.998	-	0.85	-	0.996	-	-			
		Chronic	-	0.997	-	-	-	0.996	-	-			
	Carcinogen?		N	N	N	N	N	N	N	N			

Aquatic Life Reasonable Potential

Effluent percentile value			0.950	0.950	0.950	0.950		0.950	0.950				
s	$s^2=\ln(CV^2+1)$		0.555	0.555	0.555	0.555		0.555	0.555				
Pn	Pn=(1-confidence level)$^{1/n}$		0.807	0.688	0.688	0.688		0.688	0.224				
Multiplier			1.54	1.90	1.90	1.90		1.90	3.79				
Max concentration (ug/L) at edge of…		Acute	0.005	1.988	0.298	0.127		12.418	0.047				
		Chronic	0.005	1.616	0.122	0.061		7.273	0.019				
Reasonable Potential? Limit Required?			**NO**	**NO**	**NO**	**NO**		**NO**	**NO**				

Aquatic Life Limit Calculation

# of Compliance Samples Expected per month													
LTA Coeff. Var. (CV), decimal													
Permit Limit Coeff. Var. (CV), decimal													
Waste Load Allocations, ug/L		Acute											
		Chronic											
Long Term Averages, ug/L		Acute											
		Chronic											
Limiting LTA, ug/L													
Metal Translator or 1?													
Average Monthly Limit (AML), ug/L													
Maximum Daily Limit (MDL), ug/L													

Human Health Reasonable Potential

s	$s^2=\ln(CV^2+1)$		0.55451	0.55451	0.55451		0.55451	0.55451		0.55451			
Pn	Pn=(1-confidence level)1/n		0.807	0.688	0.688		0.549	0.688		0.368			
Multiplier			0.61789	0.76241	0.76241		0.93363	0.76241		1.20486			
Dilution Factor			24.97	24.97	24.97		24.97	24.97		24.97			
Max Conc. at edge of Chronic Zone, ug/L			0.00559	1.43072	0.04885		0.02243	5.1E+00		0.00483			
Reasonable Potential? Limit Required?			**NO**	**NO**	**NO**		**NO**	**NO**		**NO**			

Human Health Limit Calculation

# of Compliance Samples Expected per month													
Average Monthly Effluent Limit, ug/L													
Maximum Daily Effluent Limit, ug/L													

Comments/Notes:

References: WAC 173-201A,

Technical Support Document for Water Quality-based Toxics Control, US EPA, March 1991, EPA/505/2-90-001, pages 56/99

APPENDIX I

COST ESTIMATES

CITY OF BURLINGTON
GENERAL SEWER / WASTEWATER FACILITIES PLAN
PLANNING LEVEL COST ESTIMATE
PUMP STATION 14 CAPACITY UPGRADE

PS 14: Upsize pumps to 200 gpm to meet 2040 capacity requirement. Replace mechanical, electrical and I&C; Rehabilitate wetwell concrete surface; Replace discharge forcemain; Add bypass piping connection

NO.	DESCRIPTION	QUANTITY		PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$36,000	$36,000
2	Traffic Control	1	LS	$12,000	$12,000
3	Bypass Pumping	1	LS	$18,000	$18,000
4	Demolition	1	LS	$18,000	$18,000
5	Dewatering	1	LS	$7,000	$7,000
6	Piping & Valves	1	LS	$30,000	$30,000
7	Pumps	2	EA	$10,000	$19,000
8	Wetwell Rehabilitation	1	LS	$12,000	$12,000
9	Ladder and Hatch	1	LS	$14,000	$14,000
10	Site Work/Restoration/Cleanup	1	LS	$10,000	$10,000
11	Trench Excavation Saftey Systems	1	LS	$4,000	$4,000
12	Unsuitable Excavation	20	CY	$54	$1,080
13	Miscellaneous Structural Improvements	1	LS	$24,000	$24,000
14	Painting	1	LS	$6,000	$6,000
15	Bypass Piping Connection	1	LS	$24,000	$24,000
17	Electrical	1	LS	$73,000	$73,000
18	Instrumentation & Controls	1	LS	$54,000	$54,000
	Subtotal				$363,000
	Construction Contingencies (30%)				$109,000
	Subtotal				$472,000
	Sales Tax (8.5%)				$40,000
	Total Estimated Construction Cost (rounded)				**$512,000**
	Engineering Services (13%)				$67,000
	Construction Adminstration (12%)				$62,000
	Legal, Administration, Permitting (5%)				$26,000
	Total Estimated Project Cost (rounded)				**$668,000**

CITY OF BURLINGTON
GENERAL SEWER / WASTEWATER FACILITIES PLAN
PLANNING LEVEL COST ESTIMATE
PUMP STATION 11 FLOW METER

Installation of flow meter at Pump Station 11

NO.	DESCRIPTION	QUANTITY		PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$5,000	$5,000
2	10 inch Flow Meter	1	EA	$9,000	$9,000
3	Meter Vault	1	LS	$26,000	$26,000
4	Electrical	1	LS	$2,000	$2,000
5	Instrumentation & Controls	1	LS	$6,000	$6,000
	Subtotal				$49,000
	Construction Contingencies (30%)				$15,000
	Subtotal				$63,000
	Sales Tax (8.5%)				$5,000
	Total Estimated Construction Cost (rounded)				**$69,000**
	Engineering Services (13%)				$9,000
	Construction Adminstration (12%)				$9,000
	Legal, Administration, Permitting (5%)				$4,000
	Total Estimated Project Cost (rounded)				**$91,000**

CITY OF BURLINGTON
GENERAL SEWER / WASTEWATER FACILITIES PLAN
PLANNING LEVEL COST ESTIMATE
PUMP STATION 13 FLOW METER

Installation of flow meter at Pump Station 13

NO.	DESCRIPTION	QUANTITY		PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$5,000	$5,000
2	8 inch Flow Meter	1	EA	$6,000	$6,000
3	Meter Vault	1	LS	$26,000	$26,000
4	Electrical	1	LS	$2,000	$2,000
5	Instrumentation & Controls	1	LS	$6,000	$6,000
	Subtotal				$46,000
	Construction Contingencies (30%)				$14,000
	Subtotal				$59,000
	Sales Tax (8.5%)				$5,000
	Total Estimated Construction Cost (rounded)				**$64,000**
	Engineering Services (13%)				$9,000
	Construction Adminstration (12%)				$8,000
	Legal, Administration, Permitting (5%)				$4,000
	Total Estimated Project Cost (rounded)				**$86,000**

CITY OF BURLINGTON
GENERAL SEWER / WASTEWATER FACILITIES PLAN
PLANNING LEVEL COST ESTIMATE
FORCE MAIN UPGRADE FROM PUMP STATION 6 TO SHARON AVENUE

Replacement and upsize of 12-inch and 14-inch Force Main from Pump Station 6 to Sharon Avenue

NO.	DESCRIPTION	QUANTITY		PRICE	AMOUNT
Replace 3,058 LF of 12-inch w/12-inch forcemain between PS6 and PS 3					
1	Mobilization, Cleanup, and Demobilization	1	LS	$106,000	$106,200
2	Survey	1	LS	$12,000	$12,000
3	Locate Existing Utilities	1	LS	$8,400	$8,400
4	Project Temporary Traffic Control	1	LS	$50,000	$50,000
5	Temporary Erosion Control	1	LS	$8,400	$8,400
6	Trench Excavation Safety Systems	1	LS	$12,000	$12,000
7	Connection to Existing Sewer System	2	EA	$6,000	$12,000
8	Removal of Unsuitable Material	900	CY	$36	$32,000
9	Crushed Surfacing Top Course	410	TN	$48	$20,000
10	Crushed Surfacing Base Course	820	TN	$48	$39,000
11	Bank Run Gravel for Trench Backfill	7,200	TN	$24	$173,000
12	Foundation Gravel	900	CY	$72	$65,000
13	12-inch DI Sewer Pipe (Incl Bedding)	3,058	LF	$72	$220,000
14	Sawcutting	6,100	LF	$4	$22,000
15	HMA Trench Repair	340	TN	$240	$82,000
16	HMA Overlay	170	TN	$240	$41,000
17	CIP Concrete Panel	310	CY	$432	$134,000
18	Site Restoration	1	LS	$12,000	$12,000
19	Unexpected Site Changes	1	LS	$12,000	$12,000
20	SPCC Plan	1	LS	$1,200	$1,200
	Subtotal				$1,062,000
Replace 1,051 LF of 12-inch w/18-inch forcemain between PS3 and PS 5					
1	Mobilization, Cleanup, and Demobilization	1	LS	$59,000	$58,600
2	Survey	1	LS	$12,000	$12,000
3	Locate Existing Utilities	1	LS	$8,400	$8,400
4	Project Temporary Traffic Control	1	LS	$30,000	$30,000
5	Temporary Erosion Control	1	LS	$8,400	$8,400
6	Trench Excavation Safety Systems	1	LS	$12,000	$12,000
7	Connection to Existing Sewer System	2	EA	$6,000	$12,000
8	Removal of Unsuitable Material	500	CY	$36	$18,000
9	Crushed Surfacing Top Course	300	TN	$48	$14,000
10	Crushed Surfacing Base Course	600	TN	$48	$29,000
11	Bank Run Gravel for Trench Backfill	3,700	TN	$24	$89,000
12	Foundation Gravel	500	CY	$72	$36,000
13	18-inch DI Sewer Pipe (Incl Bedding)	1,051	LF	$108	$114,000
14	Sawcutting	2,100	LF	$4	$8,000
15	HMA Trench Repair	180	TN	$240	$43,000
16	HMA Overlay	90	TN	$240	$22,000
17	CIP Concrete Panel	110	CY	$432	$48,000
18	Site Restoration	1	LS	$12,000	$12,000

19	Unexpected Site Changes	1	LS	$12,000	$12,000
20	SPCC Plan	1	LS	$1,200	$1,200
	Subtotal				$586,000
Replace 1,375 LF of 14-inch w/20-inch forcemain between PS 5 and Sharon Ave.					
1	Mobilization, Cleanup, and Demobilization	1	LS	$81,000	$80,900
2	Survey	1	LS	$12,000	$12,000
3	Locate Existing Utilities	1	LS	$8,400	$8,400
4	Project Temporary Traffic Control	1	LS	$40,000	$40,000
5	Temporary Erosion Control	1	LS	$8,400	$8,400
6	Trench Excavation Safety Systems	1	LS	$12,000	$12,000
7	Connection to Existing Sewer System	2	EA	$6,000	$12,000
8	Removal of Unsuitable Material	700	CY	$36	$25,000
9	Crushed Surfacing Top Course	350	TN	$48	$17,000
10	Crushed Surfacing Base Course	690	TN	$48	$33,000
11	Bank Run Gravel for Trench Backfill	5,200	TN	$24	$125,000
12	Foundation Gravel	700	CY	$72	$50,000
13	20-inch DI Sewer Pipe (Incl Bedding)	1,375	LF	$144	$198,000
14	Sawcutting	2,800	LF	$4	$10,000
15	HMA Trench Repair	250	TN	$240	$60,000
16	HMA Overlay	130	TN	$240	$31,000
17	CIP Concrete Panel	140	CY	$432	$60,000
18	Site Restoration	1	LS	$12,000	$12,000
19	Unexpected Site Changes	1	LS	$12,000	$12,000
20	SPCC Plan	1	LS	$1,200	$1,200
	Subtotal				$809,000
Replace 182 LF of 6-inch w/8-inch forcemain between PS 5 and common forcemain					
1	Mobilization, Cleanup, and Demobilization	1	LS	$11,000	$11,400
2	Trench Excavation Safety Systems	1	LS	$4,000	$4,000
3	Connection to Existing Sewer System	2	EA	$6,000	$12,000
4	Removal of Unsuitable Material	0	CY	$36	$,000
5	Crushed Surfacing Top Course	190	TN	$48	$9,000
6	Crushed Surfacing Base Course	390	TN	$48	$19,000
7	Bank Run Gravel for Trench Backfill	300	TN	$24	$7,000
8	Foundation Gravel	0	CY	$72	$,000
9	8-inch DI Sewer Pipe (Incl Bedding)	182	LF	$48	$9,000
10	Sawcutting	400	LF	$4	$1,000
11	HMA Trench Repair	20	TN	$240	$5,000
12	HMA Overlay	10	TN	$240	$2,000
13	CIP Concrete Panel	20	CY	$432	$9,000
14	Site Restoration	1	LS	$12,000	$12,000
15	Unexpected Site Changes	1	LS	$12,000	$12,000
16	SPCC Plan	1	LS	$1,200	$1,200
	Subtotal				$114,000
	Grand Total				$2,571,000
	Construction Contingencies (30%)				$771,000
	Subtotal				$3,342,000
	Sales Tax (8.5%)				$284,000
	Total Estimated Construction Cost				**$3,626,000**

Engineering Services (13%)	$472,000
Construction Adminstration (12%)	$436,000
Legal, County Administration, Permitting (5%)	$182,000
Total Estimated Project Cost	**$4,716,000**

CITY OF BURLINGTON
GENERAL SEWER / WASTEWATER FACILITIES PLAN
PLANNING LEVEL COST ESTIMATE
NEW GRAVITY SEWER ACROSS THE UMBARGER ELEMENTARY SCHOOL PROPERTY

Construction of new gravity sewer across the Umbarger Elementary School property to provide additional capacity for buildout flows.

NO.	DESCRIPTION	QUANTITY		PRICE	AMOUNT
1	Mobilization	1	LS	$77,000	$77,000
2	Dewatering	1	LS	$32,000	$32,000
3	Traffic Control	1	LS	$1,000	$1,000
4	Relocate Existing Utilities	1	LS	$6,000	$6,000
5	18-Inch Gravity Sewer	1	LS	$415,000	$415,000
6	30-Inch Gravity Sewer	1	LS	$115,000	$115,000
7	48-Inch-Diameter Manholes	1	LS	$69,000	$69,000
8	96-Inch-Diameter Manholes	1	LS	$57,000	$57,000
9	Borrow Backfill	1	LS	$96,000	$96,000
10	Connection to Existing Structures	1	LS	$13,000	$13,000
11	Surface Restoration	1	LS	$13,000	$13,000
12	Bypass Pumping	1	LS	$38,000	$38,000
13	Flow Control Structure	1	LS	$128,000	$128,000
	Subtotal				$1059,000
	Construction Contingencies (20%)				$212,000
	Subtotal				$1,270,980
	Sales Tax (8.5%)				$108,000
	Total Estimated Construction Cost (rounded)				**$1,379,080**
	Engineering and Administration (25%)				$345,000
	Total Estimated Project Cost (rounded)				**$1,725,000**

CITY OF BURLINGTON
GENERAL SEWER / WASTEWATER FACILITIES PLAN
PLANNING LEVEL COST ESTIMATE
CLASS A - BIOSOLIDS DRYER UNDER CANOPY

NO.	DESCRIPTION	QUANTITY		PRICE	AMOUNT
1	Mobilization/ Demobilization	1	LS	$600,000	$600,000
2	Demolition and Wastehaul	1	LS	$10,000	$10,000
3	Builidng with Electrical Room and Thermal I	640	SF	$500	$320,000
4	Process Piping and Site Piping Modifications	1	LS	$329,000	$329,000
5	Dryer Package System, Including Screening	1	EA	$5425,000	$5425,000
6	Biofilter Odor Control Unit	1	EA	$203,000	$203,000
7	Electrical, Instrumentation and Control	1	LS	$957,000	$957,000
				Subtotal	**$7,844,000**
				Sales Tax (8.5%)	$667,000
				Subtotal	**$8,511,000**
				Construction Contingency (25%)	$2,128,000
				Subtotal	**$10,639,000**
				Design Engineering, Construction Management and Permitting (20%)	$2,128,000
				Total Estimated Capital Costs	**$12,767,000**

CITY OF BURLINGTON
GENERAL SEWER / WASTEWATER FACILITIES PLAN
PLANNING LEVEL COST ESTIMATE
UPGRADES TO THE INFLUENT PUMP STATION

Abandon existing motor control center and canopy; construct new building housing a new motor control center, including three new variable frequency drives (VFDs), a new programmable logic controller (PLC), input / output (I/O) cards, and communication terminations; cover existing wet well and install a new ventilation and odor control system; Install new standby generator dedicated to the Influent Pump Station; replace or recoat all salvageable piping and hardware inside the wet well.

NO.	DESCRIPTION	QUANTITY		PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$108,000	$108,000
2	Demolition	1	LS	$25,000	$25,000
3	MCC builidng	400	SF	$250	$100,000
4	VFDs	3	EA	$19,000	$56,000
5	PLC	1	EA	$50,000	$50,000
6	Input / output (I/O) cards, and communication terminations	1	LS	$50,000	$50,000
7	Wetwell cover	1	LS	$10,000	$10,000
8	Supply & exhaust systems	1	LS	$60,000	$60,000
9	HVAC	1	LS	$10,000	$10,000
10	Odor control system	1	LS	$100,000	$100,000
11	Standby generator	1	LS	$80,000	$80,000
12	Piping and hardware retrofit	1	LS	$50,000	$50,000
13	Electrical	1	LS	$215,000	$215,000
14	Instrumentation & Controls	1	LS	$161,000	$161,000
	Subtotal				$1,075,000
	Construction Contingencies (30%)				$323,000
	Subtotal				$1398,000
	Sales Tax (8.5%)				$119,000
	Total Estimated Construction Cost (rounded)				**$1,517,000**
	Engineering Services (13%)				$198,000
	Construction Adminstration (12%)				$183,000
	Legal, Administration, Permitting (5%)				$76,000
	Total Estimated Project Cost (rounded)				**$1,974,000**

CITY OF BURLINGTON
GENERAL SEWER / WASTEWATER FACILITIES PLAN
PLANNING LEVEL COST ESTIMATE
UPGRADES TO THE EFFLUENT PUMP STATION

Install new standby generator dedicated to the Effluent Pump Station. Replace obsolete electrical gear, including a PLC, I/O cards, and communication terminations.

NO.	DESCRIPTION	QUANTITY		PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$31,000	$31,000
2	Demolition	1	LS	$10,000	$10,000
3	PLC	1	EA	$50,000	$50,000
4	Input / output (I/O) cards, and communication terminations	1	LS	$30,000	$30,000
5	Standby generator	1	LS	$80,000	$80,000
6	Electrical	1	LS	$62,000	$62,000
7	Instrumentation & Controls	1	LS	$46,000	$46,000
	Subtotal				$309,000
	Construction Contingencies (30%)				$93,000
	Subtotal				$402,000
	Sales Tax (8.5%)				$34,000
	Total Estimated Construction Cost (rounded)				**$436,000**
	Engineering Services (13%)				$57,000
	Construction Adminstration (12%)				$53,000
	Legal, Administration, Permitting (5%)				$22,000
	Total Estimated Project Cost (rounded)				**$568,000**

CITY OF BURLINGTON
GENERAL SEWER / WASTEWATER FACILITIES PLAN
PLANNING LEVEL COST ESTIMATE
PH MONITORING

Install pH monitoring equipment at the Headworks; Aeration Basins 1A, 1B, 2, and 3; and the UV Disinfection Channel.

NO.	DESCRIPTION	QUANTITY		PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$25,000	$25,000
2	pH monitoring equipment	5	EA	$20,000	$100,000
3	Electrical	1	LS	$69,000	$69,000
4	Instrumentation & Controls	1	LS	$52,000	$52,000
	Subtotal				$246,000
	Construction Contingencies (30%)				$74,000
	Subtotal				$320,000
	Sales Tax (8.5%)				$27,000
	Total Estimated Construction Cost (rounded)				**$347,000**
	Engineering Services (13%)				$46,000
	Construction Adminstration (12%)				$42,000
	Legal, Administration, Permitting (5%)				$18,000
	Total Estimated Project Cost (rounded)				**$453,000**

CITY OF BURLINGTON
GENERAL SEWER / WASTEWATER FACILITIES PLAN
PLANNING LEVEL COST ESTIMATE
BLOWER BUILDING IMPROVEMENTS

Replace the existing centrifugal blowers and VFDs with new positive displacement blowers and VFDs. Replace all other VFDs in the blower building. Replace the PLCs, I/O cards, and communication terminations in the Blower Building Control Panel, Aeration Control Panel, and Generator Building Control Panel. Replace the communication terminations in the Blower Building motor control centers (MCCs). Install new isolation valves on the air supply pipes to Aeration Basin 2 and 3. Replace Grit Cyclone and Classifier. Miscellaneous surface preparation and painting of piping and hardware.

NO.	DESCRIPTION	QUANTITY		PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$147,000	$147,000
2	Demolition	1	LS	$30,000	$30,000
3	Positive displacement blowers and VFDs	3	EA	$60,000	$180,000
4	Blower Building VFDs	11	EA	$19,000	$206,000
5	PLCs	3	EA	$50,000	$150,000
6	Input / output (I/O) cards, and communication terminations	1	LS	$50,000	$50,000
7	Iisolation valves on the air supply pipes to Aeration Basin 2 and 3.	2	EA	$10,000	$20,000
8	Grit cyclone and classifier	1	LS	$120,000	$120,000
9	Surface preparation and painting of piping and hardware.	1	LS	$50,000	$50,000
13	Electrical	1	LS	$293,000	$293,000
14	Instrumentation & Controls	1	LS	$220,000	$220,000
	Subtotal				$1,466,000
	Construction Contingencies (30%)				$440,000
	Subtotal				$1906,000
	Sales Tax (8.5%)				$162,000
	Total Estimated Construction Cost (rounded)				**$2,068,000**
	Engineering Services (13%)				$269,000
	Construction Adminstration (12%)				$249,000
	Legal, Administration, Permitting (5%)				$104,000
	Total Estimated Project Cost (rounded)				**$2,690,000**

CITY OF BURLINGTON
GENERAL SEWER / WASTEWATER FACILITIES PLAN
PLANNING LEVEL COST ESTIMATE
SOLIDS BUILDING IMPROVEMENTS

Replace PLC, I/O cards and communications terminations in the MCCs and control panels. Replace waste activated sludge thickening and digested sludge dewatering polymer feed systems.

NO.	DESCRIPTION	QUANTITY		PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$43,000	$43,000
2	Demolition	1	LS	$30,000	$30,000
3	VFDs	4	EA	$19,000	$75,000
4	PLC	1	EA	$50,000	$50,000
5	Input / output (I/O) cards, and communication terminations	1	LS	$20,000	$20,000
6	Polymer feed systems	1	LS	$60,000	$60,000
7	Electrical	1	LS	$85,000	$85,000
8	Instrumentation & Controls	1	LS	$64,000	$64,000
	Subtotal				$427,000
	Construction Contingencies (30%)				$129,000
	Subtotal				$556,000
	Sales Tax (8.5%)				$47,000
	Total Estimated Construction Cost (rounded)				**$603,000**
	Engineering Services (13%)				$79,000
	Construction Adminstration (12%)				$73,000
	Legal, Administration, Permitting (5%)				$31,000
	Total Estimated Project Cost (rounded)				**$786,000**

CITY OF BURLINGTON
GENERAL SEWER / WASTEWATER FACILITIES PLAN
PLANNING LEVEL COST ESTIMATE
CONTROL BUILDING IMPROVEMENTS

Replace communications terminations.

NO.	DESCRIPTION	QUANTITY		PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$2,000	$2,000
2	Communication terminations	1	LS	$20,000	$20,000
	Subtotal				$22,000
	Construction Contingencies (30%)				$7,000
	Subtotal				$29,000
	Sales Tax (8.5%)				$3,000
	Total Estimated Construction Cost (rounded)				**$32,000**
	Engineering Services (13%)				$5,000
	Construction Adminstration (12%)				$4,000
	Legal, Administration, Permitting (5%)				$2,000
	Total Estimated Project Cost (rounded)				**$43,000**

CITY OF BURLINGTON
GENERAL SEWER / WASTEWATER FACILITIES PLAN
PLANNING LEVEL COST ESTIMATE
INSTALL ACCESS PLATFORM AROUND SECONDARY CLARIFIER 2

Install access platform around Secondary Clarifier 2

NO.	DESCRIPTION	QUANTITY		PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$11,000	$11,000
2	Access platform	1	LS	$100,000	$100,000
	Subtotal				$111,000
	Construction Contingencies (30%)				$34,000
	Subtotal				$145,000
	Sales Tax (8.5%)				$12,000
	Total Estimated Construction Cost (rounded)				**$157,000**
	Engineering Services (13%)				$21,000
	Construction Adminstration (12%)				$19,000
	Legal, Administration, Permitting (5%)				$8,000
	Total Estimated Project Cost (rounded)				**$205,000**

CITY OF BURLINGTON
GENERAL SEWER / WASTEWATER FACILITIES PLAN
PLANNING LEVEL COST ESTIMATE
UPGRADES TO THE DISINFECTION BUILDING

Replace the sodium hydroxide and sodium hypochlorite feed equipment. An evaluation to use magnesium hydroxide rather than sodium hydroxide for the control of pH would be conducted.

NO.	DESCRIPTION	QUANTITY		PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$19,000	$19,000
2	Demolition	1	LS	$30,000	$30,000
3	Sodium hydroxide Dual Drum scale with secondary containment	1	LS	$7,000	$7,000
4	Sodium hypochlorite Dual Drum scale with secondary containment	1	LS	$7,000	$7,000
5	Sodium hydroxide storage and feed system	1	LS	$26,000	$26,000
6	Sodium hypochlorite storage and feed system	1	LS	$26,000	$26,000
7	1/2" PVC chemical piping	300	LF	$13	$4,000
8	Chemical piping leak detection	1	LS	$3,000	$3,000
9	1" PVC carrier water/ washwater piping	40	LF	$40	$2,000
10	Electrical	1	LS	$38,000	$38,000
11	Instrumentation & Controls	1	LS	$29,000	$29,000
	Subtotal				$190,000
	Construction Contingencies (30%)				$57,000
	Subtotal				$247,000
	Sales Tax (8.5%)				$21,000
	Total Estimated Construction Cost (rounded)				**$268,000**
	Engineering Services (13%)				$35,000
	Construction Adminstration (12%)				$33,000
	Legal, Administration, Permitting (5%)				$14,000
	Total Estimated Project Cost (rounded)				**$350,000**

CITY OF BURLINGTON
GENERAL SEWER / WASTEWATER FACILITIES PLAN
PLANNING LEVEL COST ESTIMATE
DEDICATED NON-POTABLE WATER SUPPLY TO SLUDGE DRYER

Install a dedicated non-potable water supply line to the sludge dryer , which include the installation of a new 4" non-potable waterline from the non-potable water pumps to the sludge dryer, replacement of the existing non-potable water pump with larger pumps to provide adequate capacity to supply water to the dryer or the installation of a third non-potable water pump which would run when the sludge dryer is operating; Replace obsolete electrical gear, including a PLC, I/O cards, and communication terminations

NO.	DESCRIPTION	QUANTITY		PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$26,000	$26,000
2	Demolition	1	LS	$36,000	$36,000
3	Non-potable water pump	2	EA	$10,000	$19,000
4	4" non-potable water supply line	300	LF	$48	$14,000
5	PLC	1	EA	$50,000	$50,000
6	Input / output (I/O) cards, and communication terminations	1	LS	$24,000	$24,000
7	Electrical	1	LS	$52,000	$52,000
8	Instrumentation & Controls	1	LS	$39,000	$39,000
	Subtotal				**$261,000**
	Construction Contingencies (30%)				$79,000
	Subtotal				$340,000
	Sales Tax (8.5%)				$29,000
	Total Estimated Construction Cost (rounded)				**$369,000**
	Engineering Services (13%)				$48,000
	Construction Adminstration (12%)				$45,000
	Legal, Administration, Permitting (5%)				$19,000
	Total Estimated Project Cost (rounded)				**$481,000**

CITY OF BURLINGTON
GENERAL SEWER / WASTEWATER FACILITIES PLAN
PLANNING LEVEL COST ESTIMATE
WWTP NITROGEN REMOVAL ALT 1 - CONVERT AB 1A & 1B TO ANOXIC ZONE

NO.	DESCRIPTION	QUANTITY		PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$372,000	$372,000
2	Bypass Pumping	9	WK	$5,000	$45,000
3	Demolition	1	LS	$50,000	$50,000
4	Dewatering	9	WK	$4,000	$32,000
5	Excavation	3500	CY	$20	$70,000
6	Concrete for selectors	160	CY	$2,000	$320,000
7	Concrete for Aeartion Basin 4	350	CY	$2,000	$700,000
8	Backfill	1400	CY	$50	$70,000
9	Selector Walls	1	LS	$50,000	$50,000
10	Primary Effluent Piping (24")	150	LF	$1,000	$93,000
11	Anoxic Selector Effluent piping (36")	240	LF	$1,000	$274,000
12	Recirculation Piping (24")	200	LF	$1,000	$124,000
13	Recirculation Pumps	2	EA	$25,000	$50,000
14	Modifications to Secondary Clarifier Splitter Box	1	LS	$100,000	$100,000
15	Mixers for Selectors and Anoxic Basin	1	LS	$150,000	$150,000
16	Aeration System for Aeration Basin 4	1	LS	$300,000	$300,000
17	Modifications to Existing Aeration Systems	1	LS	$100,000	$100,000
18	Trench Excavation Saftey Systems	1	LS	$4,000	$4,000
19	Unsuitable Excavation	20	CY	$54	$1,000
20	Miscellaneous Structural Improvements	1	LS	$24,000	$24,000
21	Painting	1	LS	$6,000	$6,000
22	Electrical	1	LS	$743,000	$743,000
23	Instrumentation & Controls	1	LS	$167,000	$167,000
	Subtotal				$3,715,000
	Construction Contingencies (30%)				$1,115,000
	Subtotal				$4,830,000
	Sales Tax (8.5%)				$411,000
	Total Estimated Construction Cost				**$5,241,000**
	Engineering Services (15%)				$786,000
	Construction Adminstration (12%)				$629,000
	Legal, Administration, Permitting (5%)				$262,000
	Total Estimated Project Cost (rounded)				**$6,918,000**

CITY OF BURLINGTON
GENERAL SEWER / WASTEWATER FACILITIES PLAN
PLANNING LEVEL COST ESTIMATE
WWTP NITROGEN REMOVAL ALT 2 - 4 TREATMENT TRAINS

NO.	DESCRIPTION	QUANTITY		PRICE	AMOUNT
1	Mobilization/Demobilization	1	LS	$312,000	$312,000
2	Demolition	1	LS	$30,000	$30,000
3	Dewatering	9	WK	$4,000	$32,000
4	Excavation	2600	CY	$20	$52,000
5	Concrete for Aeartion Basin 4	350	CY	$2,000	$700,000
6	Backfill	1000	CY	$50	$50,000
7	Selector Walls	1	LS	$200,000	$200,000
8	Recirculation Piping (12")	320	LF	$,000	$90,000
9	Recirculation Pumps	5	EA	$12,000	$60,000
10	Modifications to Secondary Clarifier Splitter Box	1	LS	$100,000	$100,000
11	Mixers for Selectors and Anoxic Basins	1	LS	$350,000	$350,000
12	Aeration System for Aeration Basin 4	1	LS	$300,000	$300,000
13	Modifications to existing air diffuser systems	1	LS	$150,000	$150,000
14	Trench Excavation Saftey Systems	1	LS	$4,000	$4,000
15	Unsuitable Excavation	20	CY	$54	$1,000
16	Miscellaneous Structural Improvements	1	LS	$24,000	$24,000
17	Painting	1	LS	$6,000	$6,000
18	Electrical	1	LS	$623,000	$623,000
19	Instrumentation & Controls	1	LS	$140,000	$140,000
	Subtotal				$3,115,000
	Construction Contingencies (30%)				$935,000
	Subtotal				$4,049,500
	Sales Tax (8.5%)				$344,000
	Total Estimated Construction Cost				**$4,394,000**
	Engineering Services (15%)				$659,000
	Construction Adminstration (12%)				$527,000
	Legal, Administration, Permitting (5%)				$220,000
	Total Estimated Project Cost (rounded)				**$ 5,800,000**

APPENDIX J

GENERAL FACILITY CHARGE MEMORANDUM

KLJ Financial Consulting
Utility Financial Planning & Rates

Project Memorandum

Date: September 27, 2023

To: Don Erikson
Sewer Department Supervisor
City of Burlington

Submitted via email: derickson@burlingtonwa.gov

Cc: Jay Swift, Gray & Osborne: jswift@g-o.com

From: Karyn Johnson

RE: General Facilities Charges Update

The City of Burlington (City) contracted with Gray & Osborne, Inc. (G&O) to update the Wastewater Comprehensive Plan for the 20-year planning period (2020-2040). KLJ Financial Consulting (KLJ) prepared the Financial Program & Chapter for inclusion in the Plan and updated general facilities charges (GFCs) to reflect current infrastructure investment, planned capital expenditures and projected system capacity. This memorandum summarizes the methodology, assumptions, and proposed schedule of GFCs in support of the Plan.

A. BACKGROUND

The City imposes general facilities charges (GFCs) on new development or redevelopment as a condition of connection to the wastewater system or when increasing the capacity of an existing connection. Exhibit 1 presents the existing schedule of GFCs effective January 1, 2008 (Ord. 1641 / BMC 13.04.045).

Exhibit 1: Existing General Facilities Charges

Inside City Limits/Urban Growth Area		GFC
Residential (per unit)		
1-3 Units		$ 3,130
Over 3 units		$ 2,503
Light Commercial/Industrial (general retail)	(per fixture unit)	$ 156
Bulk Water - Low Strength	$3,130 / 138 gal/day	$22.68/gal/day
Outside City Limits/Western Service Area		
Residential (per unit)		
1-3 Units		$ 4,505
Over 3 units (per unit)		$ 3,604
Light Commercial/Industrial (general retail)	(per fixture unit)	$ 226
Bulk Water - Low Strength	$4,505 / 138 gal/day	$32.65/gal/day

[1] Commercial/industrial (other than general retail) per formula.

GFCs vary for new connections inside the City limits/Urban Growth Area (UGA) and the Western Service Area (WSA). Inside City/UGA residential connections up to 3 units pay a GFC of $3,130 per unit. Larger residential customers over 3 units pay a GFC of $2,503 per unit, which is 80% of the smaller residential charge to reflect that multi-family residential units typically discharge less wastewater per unit. Light commercial/industrial connections pay $156 per plumbing fixture unit, which is equivalent to 20 residential fixture units ($3,130/20 FXTUs = $156). The Bulk Water-low strength category pays $22.60 per gallon per day based on an equivalent residential discharge of 138 gallons per day. Connections in the WSA pay a GFC based on a multiplier of about 1.44 times inside City charges, which presumes a higher cost of capacity to serve on a per unit basis.

Certain facilities, such as restaurants, are considered high strength customers because of their high load production potential and are currently subject to a different GFC formula. GFCs for these customers are calculated by multiplying the number of seats in the facility by 2 pounds of BOD per day per seat, then multiplying that value by $2,057 per pound of BOD per day. Facilities with a well-maintained grease interceptor are eligible for a connection charge discount of 25 percent. This base charge is then added to the number of plumbing fixtures in the facility.

Sewer inspection/permit fees of $200 and the cost of main taps and side sewer connections needed to connect to the City system are not included in the GFCs.

B. GENERAL FACILITIES CHARGE (GFC) METHODOLOGY

RCW 35.92.025 authorizes the City to impose a connection charge (called a GFC by the City of Burlington) on new customers connecting to the system as a condition of service or when increasing the capacity of an existing connection. The underlying premise of this charge is that customers placing new demands on system capacity should pay a "pro rata share" of the cost of providing system capacity – both the historical cost of existing assets in service and the planned cost of future capital improvements over a defined planning period.

GFCs serve two main purposes: to provide equity between existing and future customers, and to provide a source of capital funding. To avoid dilution of investment of existing customers, new customers are required to buy into the system commensurate with the cost of assets needed to serve them. GFCs can be used to pay for capital projects or to pay debt service incurred to fund eligible projects but cannot be used to pay operating and maintenance expenses.

Given that the RCW does not explicitly define a "pro rata share," the City has flexibility in defining an equitable share of sewer system costs. That said, it is important to follow a rational approach to consistently determine cost based GFCs. The calculated charges represent the maximum allowable charge. The City may choose to charge less but cannot charge more than the calculated charge.

There are several documented methods used in the industry to establish connection charges. Within the range of legally defensible approaches, the choice of method is a matter of policy.

The basic approach to the GFC calculation is illustrated below:

GFC = Eligible Capital Costs divided by Applicable Customer Base

Three key elements are evaluated in the determination of GFCs:

1) Existing System Cost Basis
2) Future System Cost Basis
3) Customer Base

Legal interpretations of Washington State connection charge statutes have provided the following guidelines:

- Charges should reflect the actual original cost of the existing utility system net of donated facilities and other sources of outside funding (e.g., grants and direct assessments).
- The existing cost basis can include accumulated interest on the net original costs at the rate of interest applicable at the time of construction (up to a 10-year period but not to exceed 100% of construction costs). Conceptually, this interest provision accounts for opportunity costs that the City's customers incurred by supporting investments in sewer system infrastructure rather than funding other needs.
- The existing cost basis should reflect a net-debt adjustment if applicable. The amount of outstanding debt represents assets that existing customers have acquired but not yet fully paid. Instead, those assets will be paid for in future years as debt service payments are made. New customers will pay rates in the future including a share of any debt service payments. To avoid double-counting of debt costs, new customers should not be charged for outstanding debt in the GFC. However, there is an appropriate offset to the debt deduction - the cash that has been accumulated by existing customers. Cash represents an asset that current customers have funded even though that cash has not yet been used to acquire new assets and/or retire outstanding debt. The net-debt deduction is calculated as outstanding debt principal minus cash balances but not less than zero. The City does not have outstanding sewer debt.
- Future capital costs should be expressed in current-day dollars and include capital projects identified in an adopted system plan.

B1. DATA SOURCES

The following data sources were used for the GFC analysis:

- City of Burlington Wastewater Facilities Plan (G&O) dated July 1997, Table13-14.
- Wastewater Capital Improvement Projects since 1995 in G&O's Records, provided by G&O August 30, 2022.
- Capital Improvement Program per Don Erickson's email dated 3/1/2023. G&O email "Copy of 2023 CIP 2-27-23 DE jls 3-1".
- Allocation of CIP projects to upgrade/expansion and repair/replacement per CIP provided by G&O, email dated January 31, 2023.
- Historical interest rates per Bond Buyer Index – 20 Year Bonds.
- ERU definition and growth projections per 2022 Wastewater Comprehensive Plan, Chapter 5, Table 5-25. Burlington UGA + WSA ERUs.
- Current GFCs provided by City (BMC 13.04.045); (Ord 1641).
- Meeting notes from January 31, 2023 (KLJ, G&O, and City) regarding proposed GFC structure changes.

The City's GFCs were updated following a common approach referred to as the "average integrated approach." Under this method, eligible existing system costs and future capital costs that improve or expand the system are included in the cost basis. As a result, all relevant capital costs (excluding R&R) are divided by the entire projected customer base (existing plus projected growth). The main policy emphasis under this method is on intergenerational equity. There is no cost advantage for either existing or new customers. The resulting GFC is stable over time and not overly sensitive to population forecasting assumptions.

Exhibit 2 summarizes the proposed GFC calculation, followed by additional methodology detail.

Exhibit 2: GFC Summary Calculation

Existing Cost Basis		Notes
Plant-in-Service		
Total System Capital Assets, Net of Contributions [1]	$ 32,574,095	Estimated original cost of plant-in-service as of 2021
plus: Interest on Assets Included in GFC Cost Basis	13,630,002	Interest on assets up to a maximum 10-year period
less: Net Debt Principal Outstanding	-	No outstanding debt as of 2021
Total Existing Cost Basis	**$ 46,204,097**	
Future Cost Basis		
Capital Improvement Program (Current Day $)		
Total Future Projects	$ 14,539,000	CIP (Years 2023 - 2028)
Less: Future Projects Ineligible for Recovery through GFCs	(5,200,000)	Excludes Intangibles, repair & replacements
Less: Contributed Future Upgrade & Expansion Assets	-	Excludes costs not incurred by the utility
Total Future Cost Basis	**$ 9,339,000**	
Customer Base		
No. of Equivalent Residential Units (ERUs) [2]		
Existing ERUs	7,686	No. of ERUs as of 2021
Future ERUs (Incremental)	1,659	Projected Incremental ERUs
Total Customer Base	**9,345**	No. of ERUs (2032)
Resulting Charge		
Existing Cost Basis	$ 46,204,097	
Future Cost Basis	9,339,000	
Total Cost Basis	$ 55,543,097	
Total Customer Base	9,345	
Maximum Allowable GFC per ERU	**$ 5,943**	

[1] Excludes assets funded through ULIDs/outside contributions.

[2] One (1) ERU is equal to 126.5 gallons per day.

B2. EXISTING SYSTEM COSTS

Existing system costs represent the original cost of investment in assets that are currently in service on the premise that these assets will serve or otherwise benefit new customers. As of December 31, 2021, the estimated original cost of total sewer system assets is $32.6 million. Assets funded by developers and other sources of outside funding such as grants and ULID assessments are excluded from the cost basis since GFCs should only recover costs actually incurred by the City.

Note: A historical record of the original cost and purchase date for individual sewer system assets prior to 1995 was not available for this analysis. The following approach was used to derive a reasonable estimate of the original cost of assets in service:

- *Assets Prior to 1995* - The 1997 Wastewater Facilities Plan (prepared by G&O) included a calculation of general facilities charges. Table 13-14 of that Plan documents the original cost of system assets at the end of 1994 of $5.2 million (excluding ULID funded projects and portions of the system that were at capacity). For the current update, this cost basis was reduced to just under $1.0 million to reflect a provision for estimated asset retirements since then of $4.3 million (82%). The average age of the system at that time was assumed to be 15 years. Adding the 26 incremental years from 1995 to the current baseline year of 2021 derives a current average system age of 41 years. Assuming an average useful life of 50 years for sewer system assets, it is estimated that 82% (41/50 = 82%) of the stated asset costs through 1994 have reached the end of asset life and are no longer in service.
- *Assets 1995 to 2021* - The City provided annual records of new assets for the years 1995 through 2021 totaling $31.6 million for total assets of $32.6 million ($1.0m + $31.6m).

Using historical interest rates from the Bond Buyer Index for 20-year bonds, interest is accumulated for a maximum of 10 years from the date of construction for individual assets. The provision for accumulated interest of $13.6 million is added to the original cost for a total existing cost basis for inclusion in the GFC of $46.2 million. The City does not have outstanding debt, so no net-debt adjustment is required.

B3. FUTURE CAPITAL COSTS

Future system costs refer to the planned capital improvement program (CIP) identified in the Wastewater Comprehensive Plan for execution within the six-year planning period (2023-2028).

Capital projects typically fall into three categories depending on the reason for the capital expenditure:

- **Repair & Replacement (R&R) projects** – Replace existing infrastructure due to wear and tear over time. These projects do not increase system capacity and are not updates to functionality or regulatory compliance. R&R costs are most often excluded from GFCs since they are assumed to be replacing assets that are already accounted for within the existing system cost basis.
- **Upgrade Projects** – Broadly benefit both existing and future customers without increasing system capacity. Examples include construction of an operations facility, improving system securing, projects driven by new regulations, and a portion of pipe upsizing projects.
- **Expansion Projects** – Primarily increase capacity to serve additional customers.

A single capital project may have components in more than one of these groups. In that case, an estimate is made of the percentage of the total project cost applicable to each category.

Exhibit 3 presents the detailed list of capital projects identified in the CIP for the current Wastewater Comprehensive Plan. A total of $14.5 million (current day dollars) in capital projects have been identified for execution over the six-year planning period (2023-2028). For each project, G&O provided the allocation of those costs between upgrades/expansions and repair/replacement projects to determine eligible project costs for inclusion in the GFC. An estimated $5.2 million of those costs are for repair and replacement projects which are excluded from the GFC calculation. The remaining $9.3 million in project costs forms the future cost basis of the GFC calculation.

Exhibit 3: Capital Improvement Program Detail

No.	Year	Capital Project Description	Upgrade/ Expansion	Repair/ Replacement	Total Cost (2022 $)
PW-SS-10-2018	2023	Pump Station 8 Generator Replacement	0%	100%	$ 175,000
PW-SS-1-2018	2023	Wastewater Line I&I Mitigation	0%	100%	$ 150,000
PW-SS-2-2018	2023	WWTP Annual Equipment Replacement	0%	100%	$ 250,000
PW-SS-3-2018	2023	Wastewater Line Replacement Program	0%	100%	$ 300,000
PW-SS-16-2018	2023	Pump Station Pump Replacement	0%	100%	$ 85,000
N/A	2023	Digester Struvite Mitigation	100%	0%	$ 50,000
PW-SS-1-2018	2024	Wastewater Line I&I Mitigation	0%	100%	$ 150,000
PW-SS-2-2018	2024	WWTP Annual Equipment Replacement	0%	100%	$ 250,000
PW-SS-3-2018	2024	Wastewater Line Replacement Program	0%	100%	$ 300,000
PW-SS-13-2018	2024	Pump Station Generators	100%	0%	$ 100,000
PW-SS-15-2018	2024	Digester Boiler Replacement	0%	100%	$ 65,000
PW-SS-16-2018	2024	Pump Station Pump Replacement	0%	100%	$ 85,000
PW-SS-17-2018	2024	Primary Digester Design Report	100%	0%	$ 40,000
N/A	2024	Upgrades to Influent Pump Station	100%	0%	$ 1,974,000
N/A	2024	Upgrades to Effluent Pump Station	100%	0%	$ 568,000
PW-SS-1-2018	2025	Wastewater Line I&I Mitigation	0%	100%	$ 150,000
PW-SS-2-2018	2025	WWTP Annual Equipment Replacement	0%	100%	$ 250,000
PW-SS-3-2018	2025	Wastewater Line Replacement Program	0%	100%	$ 300,000
PW-SS-16-2018	2025	Pump Station Pump Replacement	0%	100%	$ 65,000
N/A	2025	Upgrades to HVAC Systems	50%	50%	$ 500,000
N/A	2025	Blower Building Improvements	100%	0%	$ 2,690,000
N/A	2026	Pump Station 11 Flow Meter	100%	0%	$ 55,000
N/A	2026	Pump Station 13 Flow Meter	100%	0%	$ 50,000
PW-SS-1-2018	2026	Wastewater Line I&I Mitigation	0%	100%	$ 150,000
PW-SS-2-2018	2026	WWTP Annual Equipment Replacement	0%	100%	$ 250,000
PW-SS-3-2018	2026	Wastewater Line Replacement Program	0%	100%	$ 300,000
PW-SS-16-2018	2026	Pump Station Pump Replacement	0%	100%	$ 65,000
N/A	2027	pH Monitoring	100%	0%	$ 453,000
N/A	2027	Solids Building Improvements	100%	0%	$ 786,000
N/A	2027	Control Building Improvements	100%	0%	$ 43,000
N/A	2027	Disinfection Building Upgrades	100%	0%	$ 350,000
PW-SS-1-2018	2027	Wastewater Line I&I Mitigation	0%	100%	$ 150,000
PW-SS-2-2018	2027	WWTP Annual Equipment Replacement	0%	100%	$ 250,000
PW-SS-3-2018	2027	Wastewater Line Replacement Program	0%	100%	$ 300,000
PW-SS-16-2018	2027	Pump Station Pump Replacement	0%	100%	$ 65,000
N/A	2028	Smoke Testing	0%	100%	$ 80,000
N/A	2028	Secondary Clarifier 2 Access Platform	100%	0%	$ 205,000
N/A	2028	New Gravity Sewer across the Umbarger Elementary School Property	100%	0%	$ 1,725,000
PW-SS-1-2018	2028	Wastewater Line I&I Mitigation	0%	100%	$ 150,000
PW-SS-2-2018	2028	WWTP Annual Equipment Replacement	0%	100%	$ 250,000
PW-SS-3-2018	2028	Wastewater Line Replacement Program	0%	100%	$ 300,000
PW-SS-16-2018	2028	Pump Station Pump Replacement	0%	100%	$ 65,000
Total Projects Cost (2022-2028)			**$ 9,339,000**	**$ 5,200,000**	**$ 14,539,000**
Percent by Category			**64%**	**36%**	**100%**

[1] Capital Improvements, per Don Erickson's email, dated 3/1/2023 (per direction, excludes 2022 projects).
Updated direction per G&O email dated 3/1/2023 "Copy of 2023 CIP 2-27-23 DE jls 3-1".

[2] Allocation to upgrade/expansion and repair/replacement per CIP provided provided by G&O, email dated January 31, 2023.

B4. CUSTOMER BASE

For purposes of the GFC, the customer base is defined in terms of the number of equivalent residential units (ERUs) the system can serve once the capital plan has been executed. The Wastewater Comprehensive Plan defines one (1) ERU as 126.5 gallons per day of sewer flow. This is down from the ERU definition of 138.0 gallons per day applied in the current GFC structure.

The Wastewater Comprehensive Plan evaluated growth projections for both inside City/UGA and the WSA for 5-10-15-and 20-year periods. Exhibit 5 presents the combined number of ERUs and growth rates for both service areas of the sewer system. Growth is extrapolated for the in between years and assumes average annual growth of about 2.0% over the 20 years.

An important consideration in the determination of the customer base is which year over the 20-year planning period best represents the number of ERUs that can be served with existing asset capacity and new asset capacity following completion of the six-year CIP (2023-2028). It is likely that these assets can serve additional customers beyond those connected during the six-year period. To be conservative, the associated capacity of the sewer system is assumed to serve the projected number of ERUs through the 10-year planning period (2032), for a total customer base of 9,345 ERUs. This ERU basis serves as the denominator in the GFC calculation.

Exhibit 4: Current and Projected ERUs

Year	Growth [1]	ERUs [2]
2020		7,540
2021	1.94%	7,686
2022	1.94%	7,835
2023	1.94%	7,987
2024	1.94%	8,142
2025	1.94%	8,300
2026	1.52%	8,426
2027	1.52%	8,554
2028	1.52%	8,684
2029	1.52%	8,816
2030	1.52%	8,950
2031	2.18%	9,145
2032	***2.18%***	***9,345***
2033	2.18%	9,549
2034	2.18%	9,757
2035	2.18%	9,970
2036	2.48%	10,217
2037	2.48%	10,471
2038	2.48%	10,731
2039	2.48%	10,997
2040	2.48%	11,270

[1] Back-calculated from ERUs.

[2] 2022 WWCP, Table 5-25. Burlington UGA + WSA ERUs. One (1) ERU = 126.5 gpd.

B5. CALCULATED MAXIMUM GFC

The calculated maximum GFC of $5,943 per ERU is derived by dividing the total cost basis of $55.5 million (existing + future) by the total customer base (existing + new) of 9,345 ERUs. This represents the maximum charge per ERU that the City can impose under the proposed methodology.

B6. PROPOSED SCHEDULE OF GFCS

Based on discussion with City staff, the following simplifications were made to the existing structure of GFCs:

- Eliminate the cost multiplier applied to GFCs for the WSA and calculate a system-wide schedule of GFCs applicable to both inside City/UGA and the WSA. This suggestion is based on the finding of the Wastewater Comprehensive Plan that there is no material difference assumed in the wastewater flow characteristics between the two service areas. A system-wide GFC approach also mitigates potential issues regarding how GFC are collected and what projects are prioritized and funded in any given year.
- Eliminate the additional wastewater strength component for restaurants and other high strength customers and apply the GFC for all commercial/industrial customers per fixture unit based on current uniform plumbing codes. The City's pretreatment program includes requirements for installation and maintenance of grease traps for restaurants and other industrial or commercial establishments that may discharge fats, oils, and grease (FOG) to the sanitary sewer system. The current ordinance language gives the Public Works Director authority to calculate separate charges for high strength industrial customers (also refer to the Pretreatment Program Requirements).
- Rename the Bulk Water-Low Strength classification to Process Wastewater Discharge for clarification.
- The percentage discount applied to the GFC for residential connections over 3 units was adjusted downward from 80% to 70% based on the findings of the Wastewater Comprehensive Plan for demand per unit for residential (R-3) customers.

Exhibit 5 presents the proposed schedule of GFCs incorporating the calculated maximum charge of $5,943 per ERU and the proposed changes to the GFC structure.

Exhibit 5: Proposed Schedule of GFCs

System-Wide (Inside City/UGA and WSA)		GFC
Residential (per unit)		
1-3 Units		$ 5,943
Over 3 units (70% of 1-3 unit)		$ 4,160
Commercial/Industrial	(per fixture unit)	$ 297
Process Wastewater Discharge	$5,943 / 126.5 gal/day	$ 46.98 / gal/day

[1] One ERU = 20 fixture units or 126.5 gallons per day.

The City may choose to charge the full GFC, less than the full GFC, or phase-in to the full GFC over a period of years. For the City's consideration, Exhibit 6 presents an alternative for phasing in to the full GFC over 3 years.

Exhibit 6: Proposed Schedule of GFCs (3-Year Phase-in)

System-Wide (Inside City/UGA and WSA)		Year 1
Residential (per unit)		
1-3 Units		$ 4,067
Over 3 units (70% of 1-3 unit)		$ 2,847
Commercial/Industrial	(per fixture unit)	$ 203
Process Wastewater Discharge	$4,067	$ 32.15
	126.5 gal/day	gal/day

[1] One ERU = 20 fixture units or 126.5 gallons per day.

System-Wide (Inside City/UGA and WSA)		Year 2
Residential (per unit)		
1-3 Units		$ 5,004
Over 3 units (70% of 1-3 unit)		$ 3,503
Commercial/Industrial	(per fixture unit)	$ 250
Process Wastewater Discharge	$5,004	$ 39.56
	126.5 gal/day	gal/day

[1] One ERU = 20 fixture units or 126.5 gallons per day.

System-Wide (Inside City/UGA and WSA)		Year 3
Residential (per unit)		
1-3 Units		$ 5,943
Over 3 units (70% of 1-3 unit)		$ 4,160
Commercial/Industrial	(per fixture unit)	$ 297
Process Wastewater Discharge	$5,943	$ 46.98
	126.5 gal/day	gal/day

[1] One ERU = 20 fixture units or 126.5 gallons per day.

B7. IMPLEMENTATION

Assuming the proposed GFCs are to be adopted, it is suggested that the City review all relevant ordinances, resolutions, regulatory documents (such as the Pretreatment Program) and other documents as warranted to ensure clear and consistent language for implementation of the revised GFC structure and proposed charges for each customer category.

It is further suggested that the City maintain a detailed listing of all capital assets added to the system or retired in service on an annual basis to assist with future GFC updates.

C. GENERAL FACILITIES CHARGE SURVEY

For informational purposes, Exhibit 7 presents a comparison of single-family residential GFCs for neighboring sewer service providers.

Exhibit 7: Survey of Single-Family Residential Sewer GFCs

Sewer Service Provider	Inside City
Anacortes	$ 10,830
Mount Vernon	$ 9,258
Sedro-Woolley	$ 9,256
Burlington-Proposed	**$ 5,943**
Concrete	$ 4,492
Burlington-Existing	**$ 3,130**
La Conner	$ 2,432

[1] Per Website information as of January 1, 2023.