Fact Sheet for NPDES Permit WA0029556

Birch Bay Water and Sewer District

Public Notice of Draft Date: June 10, 2020

Purpose of this fact sheet

This fact sheet explains and documents the decisions the Department of Ecology (Ecology) made in drafting the proposed National Pollutant Discharge Elimination System (NPDES) permit for Birch Bay Water and Sewer District (Birch Bay).

This fact sheet complies with Section 173-220-060 of the Washington Administrative Code (WAC), which requires Ecology to prepare a draft permit and accompanying fact sheet for public evaluation before issuing an NPDES permit.

Ecology makes the draft permit and fact sheet available for public review and comment at least thirty (30) days before issuing the final permit. Copies of the fact sheet and draft permit for Birch Bay NPDES permit WA0029556, are available for public review and comment from June 10, 2020 until July 24, 2020. For more details on preparing and filing comments about these documents, please see **Appendix A - Public Involvement Information**.

Birch Bay reviewed the draft permit and fact sheet for factual accuracy. Ecology corrected any errors or omissions regarding the facility's location, history, wastewater discharges, or receiving water prior to publishing this draft fact sheet for public notice.

After the public comment period closed, Ecology summarized substantive comments and provided responses to them. Ecology included the summary and responses to comments in this fact sheet as **Appendix E** - **Response to Comments**, and published it when issuing the final NPDES permit. Ecology generally will not revise the rest of the fact sheet. The full document will become part of the legal history contained in the facility's permit file.

Summary

Birch Bay Water and Sewer District operates an activated sludge wastewater treatment plant that discharges to Georgia Strait. Ecology issued the previous permit for this facility on July 20, 2014. The permit was modified on May 7, 2015, and on November 30, 2015.

The proposed permit contains effluent limits that are the same as the previous permit for BOD, TSS, Fecal Coliform Bacteria, pH, and total residual chlorine. The new permit will add an annual cap on total inorganic nitrogen (ammonia and nitrate + nitrite in pounds per year) and a requirement to optimize operations for nitrogen removal.

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I. Introduction

The Federal Clean Water Act (FCWA, 1972, and later amendments in 1977, 1981, and 1987) established water quality goals for the navigable (surface) waters of the United States. One mechanism for achieving the goals of the Clean Water Act is the National Pollutant Discharge Elimination System (NPDES), administered by the federal Environmental Protection Agency (EPA). The EPA authorized the state of Washington to manage the NPDES permit program in our state. Our State Legislature accepted the delegation and assigned the power and duty for conducting NPDES permitting and enforcement to Ecology. The Legislature defined Ecology's authority and obligations for the wastewater discharge permit program in 90.48 RCW (Revised Code of Washington).

The following regulations apply to domestic wastewater NPDES permits:

- Procedures Ecology follows for issuing NPDES permits (chapter 173-220 WAC).
- Technical criteria for discharges from municipal wastewater treatment facilities (chapter 173-221 WAC).
- Water quality criteria for surface waters (chapter 173-201A WAC).
- Water quality criteria for groundwaters (chapter 173-200 WAC).
- Whole effluent toxicity testing and limits (chapter 173-205 WAC).
- Sediment management standards (chapter 173-204 WAC).
- Submission of plans and reports for construction of wastewater facilities (chapter 173-240 WAC).

These rules require any treatment facility owner/operator to obtain an NPDES permit before discharging wastewater to state waters. They also help define the basis for limits on each discharge and for requirements imposed by the permit.

Under the NPDES permit program and in response to a complete and accepted permit application, Ecology must prepare a draft permit and accompanying fact sheet, and make them available for public review before final issuance. Ecology must also publish an announcement (public notice) telling people where they can read the draft permit, and where to send their comments, during a period of thirty days (WAC 173-220-050). (See **Appendix A - Public Involvement Information** for more detail about the public notice and comment procedures). After the public comment period ends, Ecology may make changes to the draft NPDES permit in response to comment(s). Ecology will summarize the responses to comments and any changes to the permit in **Appendix E**.

II. Background Information

Table 1: General Facility Information

Facility Information	
Applicant	Birch Bay Water and Sewer District
Facility Name and Address	Birch Bay Water and Sewer District Wastewater Treatment Plant 7096 Point Whitehorn Road, Birch Bay, WA 98230
Contact at Facility	Mike Sowers (360) 371-7100
Responsible Official	Dan Eisses, General Manager 7096 Point Whitehorn Road, Birch Bay, WA 98230 (360) 371-7100 FAX #:(360) 371-2806
Type of Treatment	Conventional Activated Sludge with Secondary Treatment
Facility Location (NAD83/WGS84 reference datum)	Latitude: 48.89954° Longitude: -122.76909°
Discharge Waterbody Name and Location (NAD83/WGS84 reference datum)	Strait of Georgia Latitude: 48.8925° Longitude: -122.80138889°

Permit Status	
Renewal Date of Previous Permit	June 20, 2014 Modified October 15, 2014, May 7, 2015, November 30, 2016
Application for Permit Renewal Submittal Date	September 17, 2018
Date of Ecology Acceptance of Application	December 7, 2018

Inspection Status	
Date of Last Non-sampling Inspection Date	December 13, 2017

Figure 1: Facility Location Map

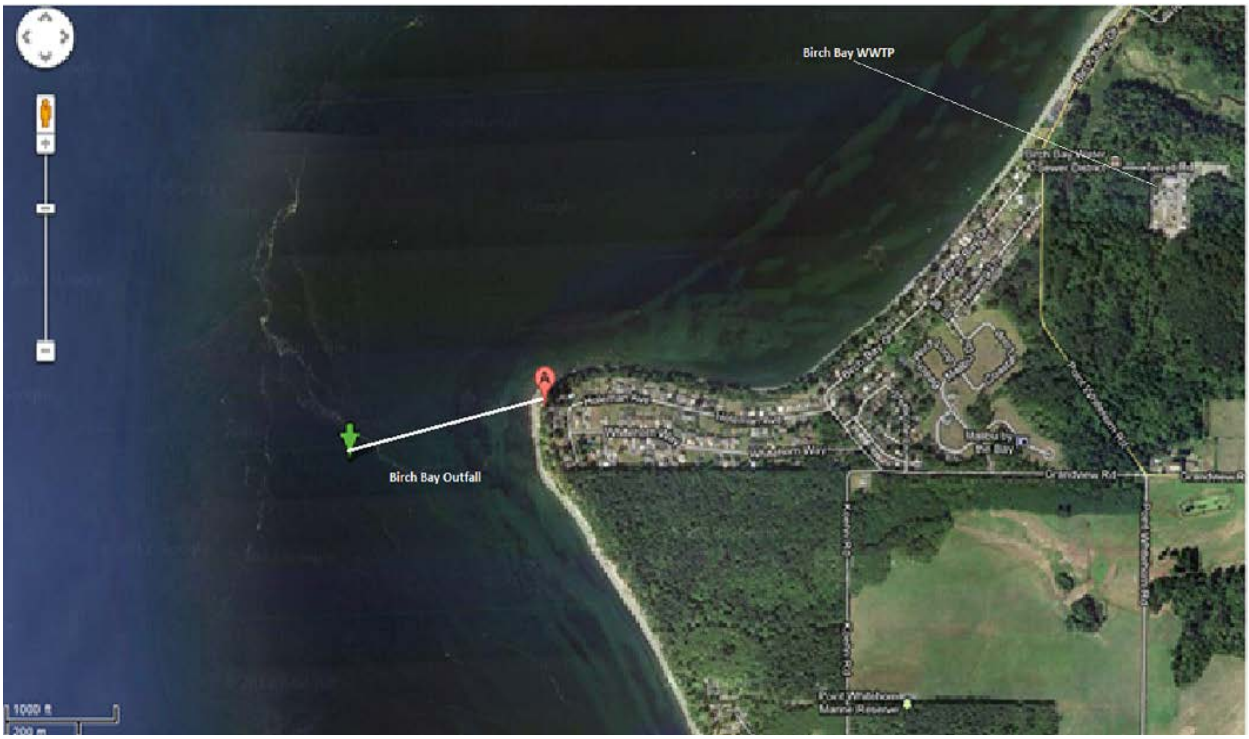


Figure 2: Aerial Snip of Plant

A. Facility description

History

The Birch Bay Water and Sewer District (District) was initially formed in 1968 as Whatcom County Water District No. 8. The first engineering report regarding wastewater was completed in 1970, and the treatment facilities became active in December 1976. The District is a municipal corporation in the form of a special purpose district as defined under RCW 57, and provides public water and sewer services to residents in the Birch Bay vicinity. Since 1975, a majority of sewer construction has been on newly developed land under the developer extension policy. Under this policy a developer constructs the sewer lines in accordance with the District's rules and regulations. When construction is complete, the lines have been tested, and the District accepts the results, the developer deeds the newly completed lines to the District, which takes responsibility for operation and maintenance of the lines. According to the U.S. Census Bureau, the area served by the District is approximately 16 square miles with a year around population of 8,413. The population of the District changes seasonally, and the population can rise to approximately 15,000 in the summer months.

The facility expanded its treatment system during the summer of 2000 by adding a clarifier, an ultraviolet light (UV) disinfection system. The facility was upgraded again in 2016 with new headworks that included new rotary screens and grit chamber, as well as retro-fitting aeration basins by raising the effluent weir, increasing the surrounding wall height, and adding fine diffusers for more efficient aeration.

Collection system status

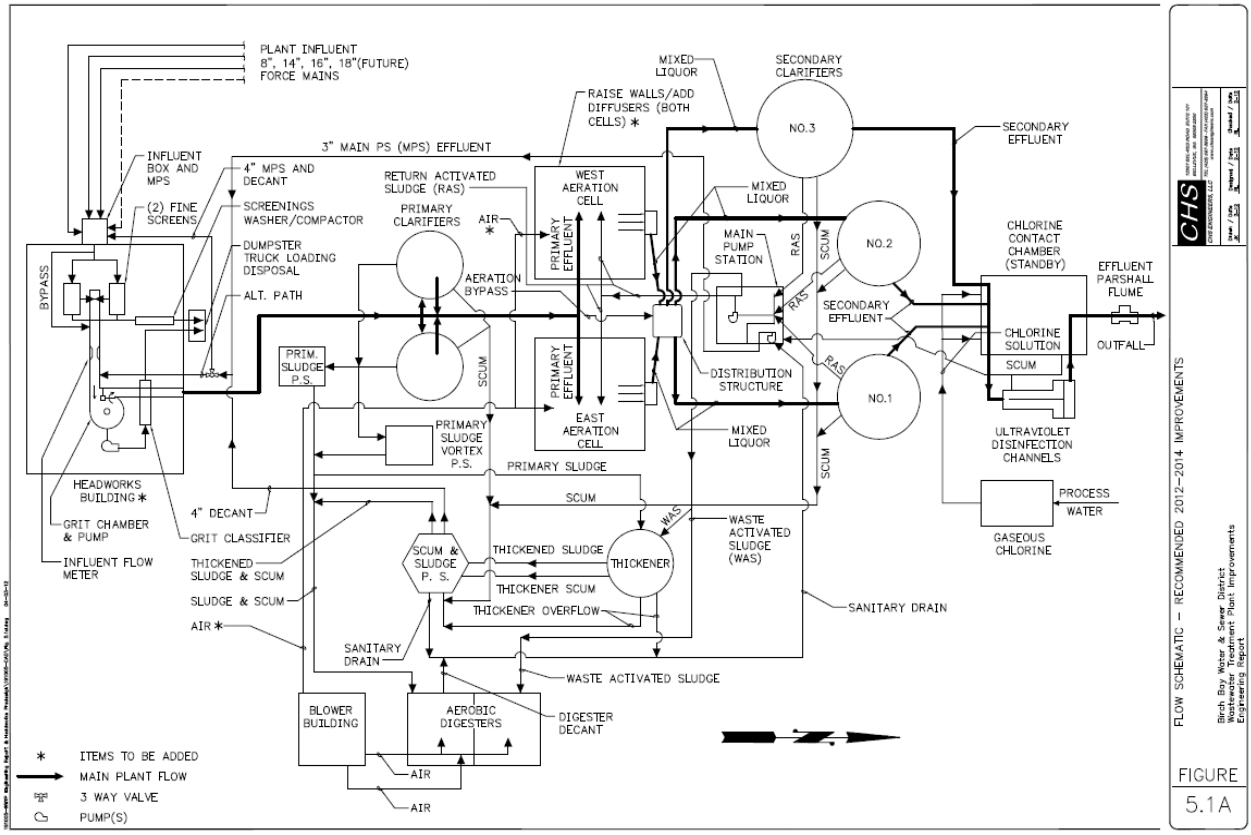
The District operates a total of eleven pump stations, seven of which follow the outline of the beach. The lift stations along Birch Bay Drive provide the major interceptor of the collection system which has approximately 63 miles of piping, both gravity-fed and force main. Force main piping from Lift Station 3 to the WWTP was installed in 2009.

Infiltration is the addition of ground water into a collection system through joints, the sewer pipe material, cracks, and other defects. Inflow is the addition of precipitation-caused drainage from roof drains, yard drains, basement drains, street catch basins, etc. into a sewer. Excessive inflow and infiltration (I&I) can lead to system backups and overflows, acceleration of structural instability of collection pipes, and inflate capacity needs when planning for future collection and treatment infrastructure. The District's I/I report from 2011 calculated the average dry weather flow as 123 gallons per capita per day (gpcd). The EPA national guideline is 120 gpcd, so infiltration was marginally excessive. Average wet weather flow was 206 gpcd (gallons per capita per day), which is below EPA's national threshold of 275 gpcd. The District's 2018 I&I report shows dry-weather flow to be 84 gpcd and wet-weather flow to be 112 gpcd.

The District is continually evaluating the collection system using smoke testing, video inspection, manhole inspection, and flow monitoring. A percentage of the collection system is systematically cleaned every year. Sewer lift stations have had control and telemetry upgrades in the last couple of years allowing better remote monitoring and control.

Treatment processes

Figure 3: Treatment Plant Schematic



The plant is located on approximately five of a total of fifty-seven acres owned by the District near Point Whitehorn. Two pump stations pump influent to the headworks influent box where flow can be split to either or both fine rotary screens. A 3 mm rotary fine screen removes trash, rocks, and other solids which are removed via conveyor to a dumpster. After solids are screened, flow is measured by a magnetic flow meter. Wastewater then flows to a vortex grit removal chamber where sand and grit are extracted. Removed grit is disposed of at a local landfill. Flow is directed to a splitter box and divided between two 28-foot diameter primary clarifiers with sludge pumping capabilities. Sludge can be pumped to aeration basins immediately downstream or to the aerobic digester/sludge thickener. Flow is directed from the primary clarifiers to two activated sludge aeration basins.

The aeration basins were retrofitted during the winter of 2014 by raising the outlet weir by 1.9 feet and the walls by three feet to add capacity. New fine bubble diffuser systems have been installed in the bottom of the basins by 2015. During low flows and low loading periods, one aeration basin can be taken out of service for a period of time to facilitate cleaning, maintenance, and short-term process optimization. Three secondary clarifiers can accept flow from a splitter box just downstream of the two aeration basins. The two small secondary clarifiers, 33-foot diameter, are peripheral-fed; the remaining large secondary clarifier, 50-foot diameter, is center-fed. Often only the large secondary clarifier operates, during low flows and/or low loading, to prevent excessive solids redistribution from the basin(s) to the clarifier(s). Return activated sludge (RAS) is pumped back to the aeration basins to maintain the activated sludge process. A portion of the RAS can be wasted as waste activated sludge (WAS) by pumping to the sludge thickener or the digester. Clarified wastewater flows over a weir that encircles each clarifier and is directed to a separate basin with ultra violet (UV) disinfection channels. Disinfection is accomplished as clarified wastewater flows past UV lights which disrupt organisms DNA. Chlorine is used to treat water that is returned and reused within the plant for wash-down pumps, and occasional filamentous control within the treatment system. Chlorine is also used as an emergency backup disinfection, in the event that the UV system is off-line. Effluent then passes through an effluent flow meter, a Parshall flume equipped with an ultrasonic level sensor, then on to the outfall discharge in the Strait of Georgia. The plant is equipped with a process water system for facility washdown and irrigation.

Presently there are no industries that send industrial wastewater to Birch Bay's system. There are several commercial users that include two gas stations, the domestic flow from the British Petroleum refinery, and six restaurants. The refinery has verifiable separate waste systems for other waste flows. Wastewater from the refinery to Birch Bay is strictly limited to domestic wastewater, is sampled regularly, and monitored closely to ensure that it is within all parameters that would allow it to be characterized as domestic wastewater flow. The District relies on Whatcom County's building permit process to require grease trap installation at the restaurants.

Staff

Four certified operators work at the Class III wastewater plant. The plant manager currently has a Group 3 certification, and the three other operators have Group 2 certifications. The facility is open from 7:30 in the morning to 4:30 in the afternoon, Monday through Friday. The operators check the plant and take required samples on weekends and holidays. A telemetry system is in place to notify operators after hours of any system issues. Operators can access the control system at any time using computers and mobile devices to obtain real time information.

Solid wastes/Residual solids

The treatment facility removes solids during the treatment of the wastewater at the headworks (grit and screenings), and at the primary and secondary clarifiers, in addition to incidental solids (rags and other debris) removed as part of the routine maintenance of the equipment. Birch Bay drains grit, rags, and screenings and disposes these solid wastes at the local landfill. Solids removed from the primary and secondary clarifiers are sent through the facility's digester/gravity thickener to reduce volume, then transported to a permitted land disposal facility where the solids are land applied under a permit from the Whatcom County Health District. This facility has met the solid waste requirements for screening, as required by WAC 173-308-205.

Discharge outfall

The treated and disinfected effluent flows into the Strait of Georgia through approximately 2,000 feet of 24-inch outfall piping. The outfall pipe is equipped with a multi-port diffuser. The diffuser consists of six, 6-inch diffuser ports oriented in a rectangle at a depth of 43 feet, as measured at mean lower low water (MLLW).

B. Description of the receiving water

Birch Bay discharges to the Strait of Georgia. Other nearby point source outfalls include British Petroleum Refinery, and Intalco Aluminum Smelter approximately 3 miles to the south. Significant nearby non-point sources of pollutants include stormwater runoff from roads and residential roofs. Terrell Creek has been a seasonal source of fecal bacteria where it discharges at the mid-point of Birch Bay.

The ambient background data used for this permit (can be found at https://ecology.wa.gov/Research-Data/Monitoring-assessment/Puget-Sound-and-marine-monitoring) includes the following from Ecology's ambient monitoring station GRG002 at Patos Island from 1/2013 to 7/2016:

Table 2: Ambient Background Data

Parameter	Value Used
Temperature (highest annual 1-DMax)	13.5 ºC
pH (Maximum/Minimum)	8/7.1 standard units
Dissolved Oxygen (Minimum)	5.8 mg/L
Salinity (Minimum)	27.34 mg/L as CaCO3

C. Wastewater influent characterization

Birch Bay reported the concentration of influent pollutants in discharge monitoring reports from January 2014 to December 2018. The influent wastewater is characterized as follows:

Table 3: Wastewater Influent Characterization

Parameter	Units	Average Value	Maximum Value
Biochemical Oxygen Demand (BOD_5)	mg/L	**209**	**461**
Biochemical Oxygen Demand (BOD_5)	lbs/day	**1396**	**2826**
Total Suspended Solids (TSS)	mg/L	**233**	**550**
Total Suspended Solids (TSS)	lbs/day	**1587**	**1493**

D. Wastewater effluent characterization

Birch Bay reported the concentration of pollutants in the discharge in the permit application and in discharge monitoring reports. The tabulated data represents the quality of the wastewater effluent discharged from January 2014 to December 2018. The wastewater effluent is characterized as follows:

Table 4: Wastewater Effluent Characterization

Parameter	Units	Average Value	Maximum Value
Temperature (95th percentile)	℃		**22.4**
Biochemical Oxygen Demand (BOD_5)	mg/L	**15.9**	**37**
Total Suspended Solids (TSS)	mg/L	**13.4**	**44**
Ammonia	mg/L	**4.4**	**28.3**
Total Residual Chlorine	mg/L	**0.02**	**0.1**
Total Kjeldahl Nitrogen	mg/L	**8.5**	**38.2**
Nitrate/Nitrite	mg/L	**23.3**	**41.1**
Oil and Grease	mg/L	**<0.9**	**3.5**
Total Phosphorus	mg/L	**4.1**	**6.2**
Total Dissolved Solids	mg/L	**1035**	**1264**
Antimony	µg/L	**0.12**	**0.3**
Arsenic	µg/L	**2**	**2.5**
Beryllium	µg/L	**0.013**	**0.05**

Parameter	Units	Average Value	Maximum Value
Cadmium	µg/L	**0.018**	**0.07**
Chromium	mg/L	**0.00096**	**0.0018**
Copper	mg/L	**0.008**	**0.014**
Lead	mg/L	**0.00023**	**0.00045**
Mercury	ng/L	**1.68**	**2.68**
Nickel	mg/L	**0.002**	**0.003**
Selenium	mg/L	**0.0018**	**0.0026**
Thallium	mg/L	**0.00003**	**0.00004**
Zinc	mg/L	**0.04**	**0.061**
Cyanide	mg/L	**0.0068**	**0.014**
Total Phenolic Compounds	mg/L	**0.033**	**0.033**
Hardness (as CaCO3)	mg/L	**217.3**	**292.1**
Bis (2-ethylhexyl) Phthalate	µg/L	**NA**	**0.5**

Parameter	Units	Maximum Monthly Geometric Mean	Maximum Weekly Geometric Mean
Fecal Coliforms	#/100 CFU	**14**	**91**

Parameter	Units	Minimum Value	Maximum Value
pH	standard units	**6.0**	**7.7**

E. Summary of compliance with previous permit issued June 20, 2014

The previous permit placed effluent limits on BOD, TSS, total residual chlorine, fecal coliform bacteria, and pH.

Birch Bay has largely complied with the effluent limits and permit conditions throughout the duration of the permit issued on June 20, 2014. Ecology assessed compliance based on its review of the facility's information in the Ecology Permitting and Reporting Information System (PARIS), discharge monitoring reports (DMRs), and on inspections. The only effluent limit violation was in November 2016, achieving an 82% BOD_5 removal instead of the required 85% minimum.

F. State environmental policy act (SEPA) compliance

State law exempts the issuance, reissuance, or modification of any wastewater discharge permit from the SEPA process as long as the permit contains conditions that are no less stringent than federal and state rules and regulations (RCW 43.21C.0383). The exemption applies only to existing discharges, not to new discharges.

III. Proposed Permit Limits

Federal and state regulations require that effluent limits in an NPDES permit must be either technology- or water quality-based.

- Technology-based limits are based upon the treatment methods available to treat specific pollutants. Technology-based limits are set by the EPA and published as a regulation, or Ecology develops the limit on a case-by-case basis (40 CFR 125.3, and chapter 173-220 WAC).
- Water quality-based limits are calculated so that the effluent will comply with the Surface Water Quality Standards (chapter 173-201A WAC), Ground Water Standards (chapter 173-200 WAC), Sediment Quality Standards (chapter 173-204 WAC), or the National Toxics Rule (40 CFR 131.36).
- Ecology must apply the most stringent of these limits to each parameter of concern. These limits are described below.

The limits in this permit reflect information received in the application and from supporting reports (engineering, hydrogeology, etc.). Ecology evaluated the permit application and determined the limits needed to comply with the rules adopted by the state of Washington. Ecology does not develop effluent limits for all reported pollutants. Some pollutants are not treatable at the concentrations reported, are not controllable at the source, are not listed in regulation, and do not have a reasonable potential to cause a water quality violation.

Ecology does not usually develop limits for pollutants not reported in the permit application but may be present in the discharge. The permit does not authorize discharge of the non-reported pollutants. During the five-year permit term, the facility's effluent discharge conditions may change from those conditions reported in the permit application. The facility must notify Ecology if significant changes occur in any constituent [40 CFR 122.42(a)]. Until Ecology modifies the permit to reflect additional discharge of pollutants, a permitted facility could be violating its permit.

A. Design criteria

Under WAC 173-220-150 (1)(g), flows and waste loadings must not exceed approved design criteria. Ecology approved design criteria for this facility's treatment plant in the Headworks Replacement project dated August 2013 and prepared by CHS Engineers.

The table below includes design criteria from the referenced report.

Table 5: Design Criteria for Birch Bay WWTP

Parameter	Design Quantity
Maximum Month Design Flow (MMDF)	1.44 MGD
BOD_5 Loading for Maximum Month	2,500 lbs/day
TSS Loading for Maximum Month	2,400 lbs/day

B. Technology-based effluent limits

Federal and state regulations define technology-based effluent limits for domestic wastewater treatment plants. These effluent limits are given in 40 CFR Part 133 (federal) and in chapter 173-221 WAC (state). These regulations are performance standards that constitute all known, available, and reasonable methods of prevention, control, and treatment (AKART).

The table below identifies technology-based limits for pH, fecal coliform, BOD_5, and TSS, as listed in chapter 173-221 WAC. Section III.F of this fact sheet describes the potential for water quality-based limits.

Table 6: Technology-based Limits

Parameter	Average Monthly Limit	Average Weekly Limit
BOD_5 (concentration)	30 mg/L	45 mg/L
BOD_5 (concentration)	In addition, the BOD_5 effluent concentration must not exceed fifteen percent (15%) of the average influent concentration.	
TSS (concentration)	30 mg/L	45 mg/L
TSS (concentration)	In addition, the TSS effluent concentration must not exceed fifteen percent (15%) of the average influent concentration.	

Parameter	Monthly Geometric Mean Limit	Weekly Geometric Mean Limit
Fecal Coliform Bacteria	200 organisms/100 mL	400 organisms/100 mL

Parameter	Daily Minimum	Daily Maximum
pH	6.0 standard units	9.0 standard units
Chlorine	NA	0.5 mg/L

The existing permit has an average monthly chlorine limit of 0.35 mg/L and an average weekly chlorine limit of 0.5 mg/L. Birch Bay normally uses ultraviolet light (UV) for disinfection. Chlorine is used as a backup in the event that the UV system is inoperable. The chlorine limit will only apply when the facility is using chlorine for disinfection. Chlorine was not used during the previous permit term. Ecology proposes to implement the average weekly permit limit of 0.5 mg/L as a maximum daily limit. The proposed maximum daily chlorine limit is protective of water quality.

Technology-based mass limits are based on WAC 173-220-130(3)(b) and 173-221-030(11)(b). Ecology calculated the monthly and weekly average mass limits for BOD_5 and Total Suspended Solids as follows:

Mass Limit = CL x DF x CF

where:

CL = Technology-based concentration limits listed in the above table

DF = Maximum Monthly Average Design flow (MGD)

CF = Conversion factor of 8.34

30 X 1.44 X 8.34 = 360

45 X 1.44 X 8.34 = 540

Table 7: Technology-based Mass Limits

Parameter	Concentration Limit (mg/L)	Mass Limit (lbs/day)
BOD_5 Monthly Average	30	360
BOD_5 Weekly Average	45	540
TSS Monthly Average	30	360
TSS Weekly Average	45	540

C. Surface water quality-based effluent limits

The Washington State surface water quality standards (chapter 173-201A WAC) are designed to protect existing water quality and preserve the beneficial uses of Washington's surface waters. Waste discharge permits must include conditions that ensure the discharge will meet the surface water quality standards (WAC 173-201A-510). Water quality-based effluent limits may be based on an individual waste load allocation or on a waste load allocation developed during a basin wide total maximum daily load study (TMDL).

Numerical criteria for the protection of aquatic life and recreation

Numerical water quality criteria are listed in the water quality standards for surface waters (chapter 173-201A WAC). They specify the maximum levels of pollutants allowed in receiving water to protect aquatic life and recreation in and on the water. Ecology uses numerical criteria along with chemical and physical data for the wastewater and receiving water to derive the effluent limits in the discharge permit. When surface water quality-based limits are more stringent or potentially more stringent than technology-based limits, the discharge must meet the water quality-based limits.

Numerical criteria for the protection of human health

Effective numeric water quality criteria for the protection of human health are promulgated in Chapter 173-201A WAC and 40 CFR 131.45. These criteria are designed to protect humans from exposure to pollutants linked to cancer and other diseases, based on consuming fish and shellfish and drinking contaminated surface waters.

The water quality standards also include radionuclide criteria to protect humans from the effects of radioactive substances.

Narrative criteria

Narrative water quality criteria (e.g., WAC 173-201A-240(1); 2016) limit the toxic, radioactive, or other deleterious material concentrations that the facility may discharge to levels below those which have the potential to:

- Adversely affect designated water uses.
- Cause acute or chronic toxicity to biota.
- Impair aesthetic values.
- Adversely affect human health.

Narrative criteria protect the specific designated uses of all fresh waters (WAC 173-201A-200, 2016) and of all marine waters (WAC 173-201A-210, 2016) in the state of Washington.

Antidegradation

Description - The purpose of Washington's Antidegradation Policy (WAC 173-201A-300-330; 2016) is to:

- Restore and maintain the highest possible quality of the surface waters of Washington.
- Describe situations under which water quality may be lowered from its current condition.
- Apply to human activities that are likely to have an impact on the water quality of surface water.
- Ensure that all human activities likely to contribute to a lowering of water quality, at a minimum, apply all known, available, and reasonable methods of prevention, control, and treatment (AKART).

- Apply three tiers of protection (described below) for surface waters of the state.

  Tier I ensures existing and designated uses are maintained and protected and applies to all waters and all sources of pollutions. Tier II ensures that waters of a higher quality than the criteria assigned are not degraded unless such lowering of water quality is necessary and in the overriding public interest. Tier II applies only to a specific list of polluting activities. Tier III prevents the degradation of waters formally listed as "outstanding resource waters," and applies to all sources of pollution.

  A facility must prepare a Tier II analysis when all three of the following conditions are met:

  - The facility is planning a new or expanded action.
  - Ecology regulates or authorizes the action.
  - The action has the potential to cause measurable degradation to existing water quality at the edge of a chronic mixing zone.

  Facility Specific Requirements - This facility must meet Tier I requirements.

  - Dischargers must maintain and protect existing and designated uses. Ecology must not allow any degradation that will interfere with, or become injurious to, existing or designated uses, except as provided for in chapter 173-201A WAC.
  - For waters that do not meet assigned criteria, or protect existing or designated uses, Ecology will take appropriate and definitive steps to bring the water quality back into compliance with the water quality standards.

  Ecology's analysis described in this section of the fact sheet demonstrates that the proposed permit conditions will protect existing and designated uses of the receiving water.

  Ecology required a tier II analysis during the last permit cycle because Birch Bay was upgrading several portions of its treatment process. Birch Bay provided an antidegradation analysis that showed, through an engineering analysis, upgrades to the headworks and aeration basins would remove more BOD and TSS from the effluent. In addition, due to an increase in design flow, a new mixing study showed no reasonable potential for the effluent to to cause an exceedance of water quality standards at the edge of the mixing zone.

Mixing zones

A mixing zone is the defined area in the receiving water surrounding the discharge port(s), where wastewater mixes with receiving water. Within mixing zones the pollutant concentrations may exceed water quality numeric standards, so long as the discharge doesn't interfere with designated uses of the receiving water body (for example, recreation, water supply, and aquatic life and wildlife habitat, etc.). The pollutant concentrations outside of the mixing zones must meet water quality numeric standards.

State and federal rules allow mixing zones because the concentrations and effects of most pollutants diminish rapidly after discharge, due to dilution. Ecology defines mixing zone sizes to limit the amount of time any exposure to the end-of-pipe discharge could harm water quality, plants, or fish.

The state's water quality standards allow Ecology to authorize mixing zones for the facility's permitted wastewater discharges only if those discharges already receive all known, available, and reasonable methods of prevention, control, and treatment (AKART). Mixing zones typically require compliance with water quality criteria within a specified distance from the point of discharge and must not use more than 25% of the available width of the water body for dilution [WAC 173-201A-400 (7)(a)(i-iii) or WAC 173-201A-400(7)(b)(i-ii)].

Ecology uses modeling to estimate the amount of mixing within the mixing zone. Through modeling Ecology determines the potential for violating the water quality standards at the edge of the mixing zone and derives any necessary effluent limits. Steady-state models are the most frequently used tools for conducting mixing zone analyses. Ecology chooses values for each effluent and for receiving water variables that correspond to the time period when the most critical condition is likely to occur (see Ecology's *Permit Writer's Manual*).

Each critical condition parameter, by itself, has a low probability of occurrence and the resulting dilution factor is conservative. The term "reasonable worst-case" applies to these values.

The mixing zone analysis produces a numerical value called a dilution factor (DF). A dilution factor represents the amount of mixing of effluent and receiving water that occurs at the boundary of the mixing zone. For example, a dilution factor of 4 means the effluent is 25% and the receiving water is 75% of the total volume of water at the boundary of the mixing zone. Ecology uses dilution factors with the water quality criteria to calculate reasonable potentials and effluent limits. Water quality standards include both aquatic life-based criteria and human health-based criteria. The former are applied at both the acute and chronic mixing zone boundaries; the latter are applied only at the chronic boundary. The concentration of pollutants at the boundaries of any of these mixing zones may not exceed the numerical criteria for that zone.

Most aquatic life *acute* criteria are based on the assumption that organisms are not exposed to that concentration for more than one hour and more often than one exposure in three years. Most aquatic life *chronic* criteria are based on the assumption that organisms are not exposed to that concentration for more than four consecutive days and more often than once in three years.

The two types of human health-based water quality criteria distinguish between those pollutants linked to non-cancer effects (non-carcinogenic) and those linked to cancer effects (carcinogenic). The human health-based water quality criteria incorporate several exposure and risk assumptions.

These assumptions include:

- A 70-year lifetime of daily exposures.
- An ingestion rate for fish or shellfish measured in kg/day.
- An ingestion rate of two and four tenths (2.4) liters/day for drinking water (increased from two liters/day in the 2016 Water Quality Standards update).
- A one-in-one-million cancer risk for carcinogenic chemicals.

This permit authorizes a small acute mixing zone, surrounded by a chronic mixing zone around the point of discharge (WAC 173-201A-400). The water quality standards impose certain conditions before allowing the discharger a mixing zone:

1. **Ecology must specify both the allowed size and location in a permit.**

   The proposed permit specifies the size and location of the allowed mixing zone (as specified below).

2. **The facility must fully apply "all known, available, and reasonable methods of prevention, control and treatment" (AKART) to its discharge.**

   Ecology has determined that the treatment provided at Birch Bay WWTP meets the requirements of AKART (see "Technology-based Limits").

3. **Ecology must consider critical discharge conditions.**

   Surface water quality-based limits are derived for the water body's critical condition (the receiving water and waste discharge condition with the highest potential for adverse impact on the aquatic biota, human health, and existing or designated waterbody uses). The critical discharge condition is often pollutant-specific or waterbody-specific.

   Critical discharge conditions are those conditions that result in reduced dilution or increased effect of the pollutant. Factors affecting dilution include the depth of water, the density stratification in the water column, the currents, and the rate of discharge. Density stratification is determined by the salinity and temperature of the receiving water. Temperatures are warmer in the surface waters in summer. Therefore, density stratification is generally greatest during the summer months. Density stratification affects how far up in the water column a freshwater plume may rise. The rate of mixing is greatest when an effluent is rising. The effluent stops rising when the mixed effluent is the same density as the surrounding water. After the effluent stops rising, the rate of mixing is much more gradual. Water depth can affect dilution when a plume might rise to the surface when there is little or no stratification. Ecology uses the water depth at mean lower low water (MLLW) for marine waters. Ecology's *Permit Writer's Manual* describes additional guidance on criteria/design conditions for determining dilution factors. The manual can be obtained from Ecology's website at https://fortress.wa.gov/ecy/publications/documents/92109.pdf.

Table 8: Critical Conditions Used to Model the Discharge

Critical Condition	Value
Water depth at MLLW of 43 feet	43 feet
Density profile with a difference of 22.63 sigma-t units between MLLW(-43) feet and the surface	22.63 m/sec
90th percentile current speeds for acute mixing zone	0.54 m/sec
50th percentile current speeds for chronic and human health mixing zones	0.2 m/sec
Maximum average monthly effluent flow for chronic and human health non-carcinogen	1.5 MGD
Maximum daily flow for acute mixing zone	3.3 million gallons per day (MGD)

Ecology obtained ambient data at critical conditions in the vicinity of the outfall from the Effluent Mixing Study Report prepared by Cosmopolitan Engineering Group in September 2010.

4. **Supporting information must clearly indicate the mixing zone would not:**

   - Have a reasonable potential to cause the loss of sensitive or important habitat.
   - Substantially interfere with the existing or characteristic uses.
   - Result in damage to the ecosystem.
   - Adversely affect public health.

   Ecology established Washington State water quality criteria for toxic chemicals using EPA criteria. EPA developed the criteria using toxicity tests with numerous organisms and set the criteria to generally protect the species tested and to fully protect all commercially and recreationally important species.

   EPA sets acute criteria for toxic chemicals assuming organisms are exposed to the pollutant at the criteria concentration for one hour. They set chronic standards assuming organisms are exposed to the pollutant at the criteria concentration for four days. Dilution modeling under critical conditions generally shows that both acute and chronic criteria concentrations are reached within minutes of discharge.

   The discharge plume does not impact drifting and non-strong swimming organisms because they cannot stay in the plume close to the outfall long enough to be affected. Strong swimming fish could maintain a position within the plume, but they can also avoid the discharge by swimming away.

Mixing zones generally do not affect benthic organisms (bottom dwellers) because the buoyant plume rises in the water column. Ecology has additionally determined that the effluent will not exceed 33 degrees C for more than two seconds after discharge; and that the temperature of the water will not create lethal conditions or blockages to fish migration.

Ecology evaluates the cumulative toxicity of an effluent by testing the discharge with whole effluent toxicity (WET) testing.

Ecology reviewed the above information, the specific information on the characteristics of the discharge, the receiving water characteristics, and the discharge location. Based on this review, Ecology concluded that the discharge does not have a reasonable potential to cause the loss of sensitive or important habitat, substantially interfere with existing or characteristics uses, result in damage to the ecosystem, or adversely affect public health if the permit limits are met.

5. **The discharge/receiving water mixture must not exceed water quality criteria outside the boundary of a mixing zone.**

   Ecology conducted a reasonable potential analysis, using procedures established by the EPA and by Ecology, for each pollutant and concluded the discharge/receiving water mixture will not violate water quality criteria outside the boundary of the mixing zone if permit limits are met.

6. **The size of the mixing zone and the concentrations of the pollutants must be minimized.**

   At any given time, the effluent plume uses only a portion of the acute and chronic mixing zone, which minimizes the volume of water involved in mixing. Because tidal currents change direction, the plume orientation within the mixing zone changes. The plume mixes as it rises through the water column therefore much of the receiving water volume at lower depths in the mixing zone is not mixed with discharge.

   Similarly, because the discharge may stop rising at some depth due to density stratification, waters above that depth will not mix with the discharge. Ecology determined it is impractical to specify in the permit the actual, much more limited volume in which the dilution occurs as the plume rises and moves with the current.

   Ecology minimizes the size of mixing zones by requiring dischargers to install diffusers when they are appropriate to the discharge and the specific receiving waterbody. When a diffuser is installed, the discharge is more completely mixed with the receiving water in a shorter time. Ecology also minimizes the size of the mixing zone (in the form of the dilution factor) using design criteria with a low probability of occurrence. For example, Ecology uses the expected 95th percentile pollutant concentration, the 90th percentile background concentration, the centerline dilution factor, and the lowest flow occurring once in every ten years to perform the reasonable potential analysis.

Because of the above reasons, Ecology has effectively minimized the size of the mixing zone authorized in the proposed permit.

7. Maximum size of mixing zone.

The authorized mixing zone does not exceed the maximum size restriction.

8. Acute mixing zone.

- **The discharge/receiving water mixture must comply with acute criteria as near to the point of discharge as practicably attainable.**

Ecology determined the acute criteria will be met at 10% of the extent of the chronic mixing zone.

- **The pollutant concentration, duration, and frequency of exposure to the discharge will not create a barrier to migration or translocation of indigenous organisms to a degree that has the potential to cause damage to the ecosystem.**

  As described above, the toxicity of any pollutant depends upon the exposure, the pollutant concentration, and the time the organism is exposed to that concentration. Authorizing a limited acute mixing zone for this discharge assures that it will not create a barrier to migration. The effluent from this discharge will rise as it enters the receiving water, assuring that the rising effluent will not cause translocation of indigenous organisms near the point of discharge (below the rising effluent).

- **Comply with size restrictions.**

  The mixing zone authorized for this discharge complies with the size restrictions published in chapter 173-201A WAC.

9. Overlap of mixing zones.

This mixing zone does not overlap another mixing zone.

D. Designated uses and surface water quality criteria

Applicable designated uses and surface water quality criteria are defined in chapter 173-201A WAC. In addition, the U.S. EPA set human health criteria for toxic pollutants (EPA 1992). The tables included below summarize the criteria applicable to the receiving water's designated uses.

- Aquatic life uses are designated using the following general categories. All indigenous fish and non-fish aquatic species must be protected in waters of the state.

  a. Extraordinary quality salmonid and other fish migration, rearing, and spawning; clam, oyster, and mussel rearing and spawning; crustaceans and other shellfish (crabs, shrimp, crayfish, scallops, etc.) rearing and spawning.

b. Excellent quality salmonid and other fish migration, rearing, and spawning; clam, oyster, and mussel rearing and spawning; crustaceans and other shellfish (crabs, shrimp, crayfish, scallops, etc.) rearing and spawning.

c. Good quality salmonid migration and rearing; other fish migration, rearing, and spawning; clam, oyster, and mussel rearing and spawning; crustaceans and other shellfish (crabs, shrimp, crayfish, scallops, etc.) rearing and spawning.

d. Fair quality salmonid and other fish migration.

The *Aquatic Life Uses* and the associated criteria for this receiving water are identified below.

Marine Aquatic Life Uses and Associated Criteria

Table 9: Extraordinary Quality

Criteria	Limit
Temperature Criteria – Highest 1D MAX	13°C (55.4°F)
Dissolved Oxygen Criteria – Lowest 1-Day Minimum	7.0 mg/L
Turbidity Criteria	• 5 NTU over background when the background is 50 NTU or less; or • A 10 percent increase in turbidity when the background turbidity is more than 50 NTU.
pH Criteria	pH must be within the range of 7.0 to 8.5 with a human-caused variation within the above range of less than 0.2 units.

- To protect shellfish harvesting, fecal coliform organism levels must not exceed a geometric mean value of 14 colonies/100 mL, and not have more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 43 colonies/100 mL.
- The *recreational use* is primary contact recreation. After December 31, 2020, all marine waters will be designated for primary contact recreation. This redesignation of the recreational use includes a change in the bacteria indicator from fecal coliform to enterococci and elimination of the secondary contact enterococci standard.

The recreational uses for this receiving water are identified below.

Table 10: Recreational Uses

Recreational Use	Criteria
Primary Contact Recreation (effective 1/1/2021)	Enterococci organism levels within an averaging period must not exceed a geometric mean value of 30 CFU or MPN per 100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample values exist) obtained within the averaging period exceeding 110 CFU or MPN per 100 mL.
Primary Contact Recreation (expires 12/31/2020)	Fecal coliform organism levels must not exceed a geometric mean value of 14 colonies/100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 43 colonies /100 mL.

- The *miscellaneous marine water uses* are wildlife habitat, harvesting, commerce and navigation, boating, and aesthetics.

E. Water quality impairments

Ecology has not documented any water quality impairments in the receiving water in the vicinity of the outfall. There have been bacterial exceedances from Terrel Creek, just north of the outfall in Birch Bay, that closed shellfishing in the area. Those exceedances have ceased and shellfishing was reopened in January 2018.

Dissolved oxygen impairments in the Salish Sea are connected to total inorganic nitrogen (TIN) loading from diverse sources both near and distant. There are no local impairments. Birch Bay will receive a cap on TIN loading described in Section III.G.

F. Evaluation of surface water quality-based effluent limits for narrative criteria

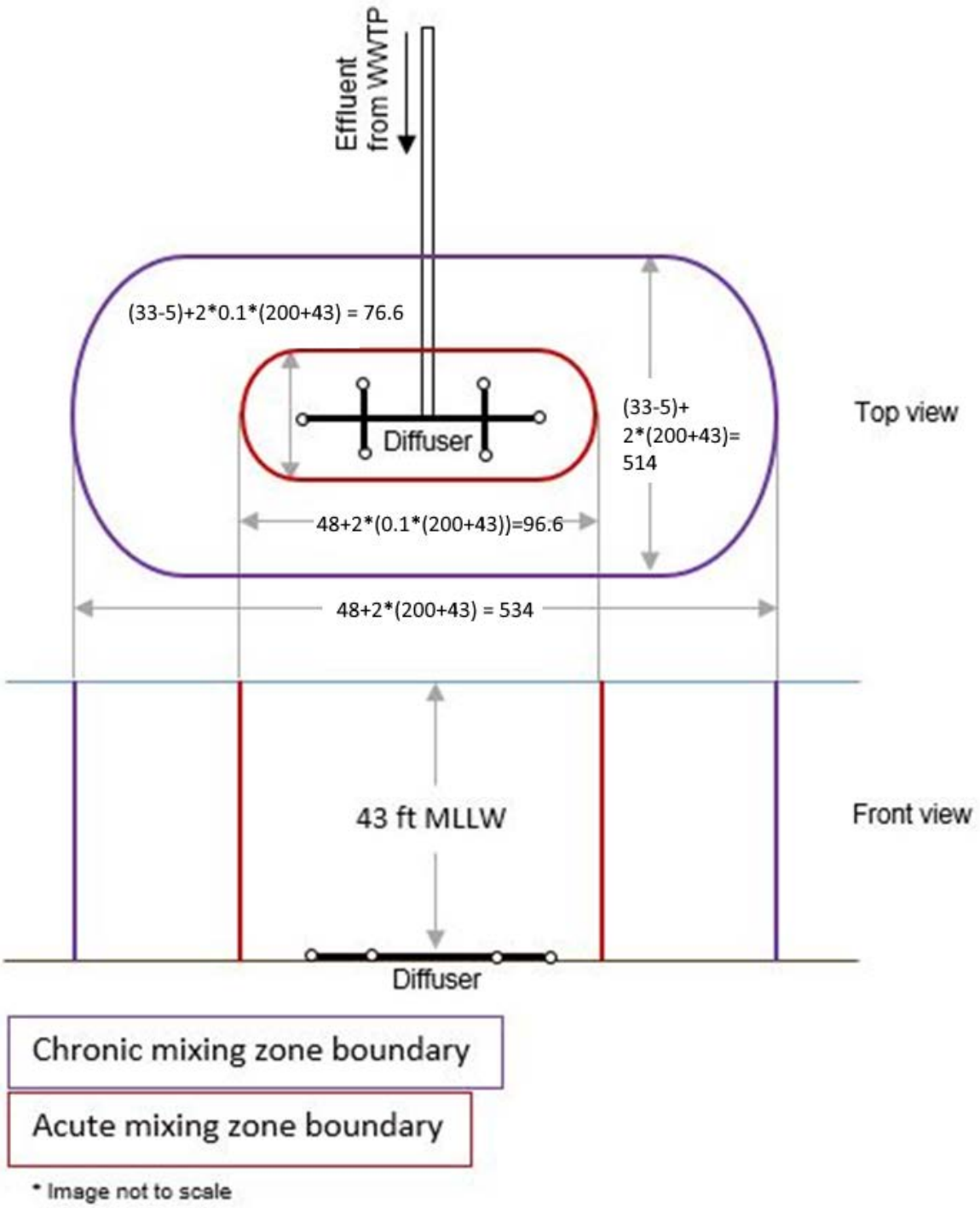
Ecology must consider the narrative criteria described in WAC 173-201A-260 when it determines permit limits and conditions. Narrative water quality criteria limit the toxic, radioactive, or other deleterious material concentrations that the facility may discharge which have the potential to adversely affect designated uses, cause acute or chronic toxicity to biota, impair aesthetic values, or adversely affect human health.

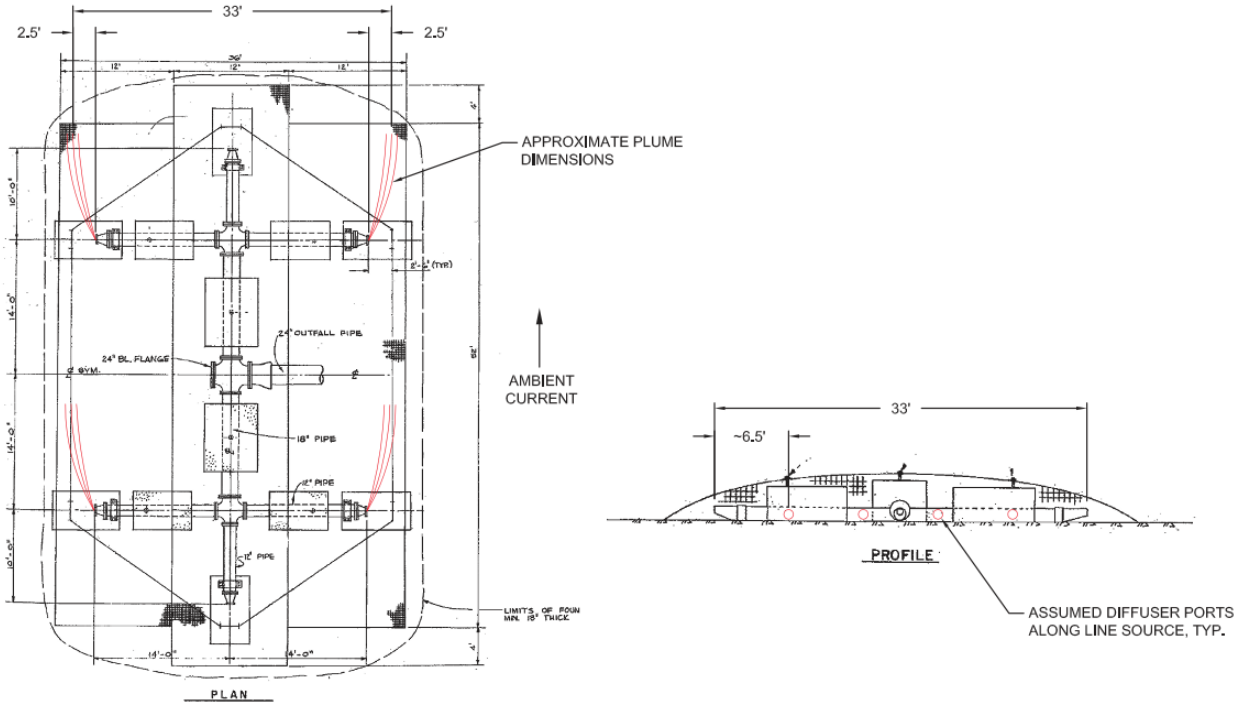
Ecology considers narrative criteria when it evaluates the characteristics of the wastewater and when it implements all known, available, and reasonable methods of treatment and prevention (AKART) as described above in the technology-based limits section. When Ecology determines if a facility is meeting AKART it considers the pollutants in the wastewater and the adequacy of the treatment to prevent the violation of narrative criteria.

In addition, Ecology considers the toxicity of the wastewater discharge by requiring whole effluent toxicity (WET) testing when there is a reasonable potential for the discharge to contain toxics. Ecology's analysis of the need for WET testing for this discharge is described later in the fact sheet.

G. Evaluation of surface water quality-based effluent limits for numeric criteria

Figure 4: Outfall Diffuser Diagram





Pollutants in an effluent may affect the aquatic environment near the point of discharge (near-field) or at a considerable distance from the point of discharge (far-field). Toxic pollutants, for example, are near-field pollutants; their adverse effects diminish rapidly with mixing in the receiving water. Conversely, a pollutant such as biochemical oxygen demand (BOD_5) is a far-field pollutant whose adverse effect occurs away from the discharge even after dilution has occurred. Thus, the method of calculating surface water quality-based effluent limits varies with the point at which the pollutant has its maximum effect.

With technology-based controls (AKART), predicted pollutant concentrations in the discharge exceed water quality criteria. Ecology therefore authorizes a mixing zone in accordance with the geometric configuration, flow restriction, and other restrictions imposed on mixing zones by chapter 173-201A WAC.

The diffuser at Outfall 001 (see illustration above) consists of six, 6-inch diffuser ports. The long axis is perpendicular to the outfall pipe. It is 48 feet long with ports at each end. Along each side of the main axis are two perpendicular stubs with ports 14 feet from the centerline on each side. The average depth of the structure is 43 feet MLLW. Ecology obtained this information from the Dilution Ratio Study Report submitted on September 12, 2010.

Chronic Mixing Zone - WAC 173-201A-400(7)(b)(ii) defines an estuary as, "…areas east of a line from Green Point (Fidalgo Island) to Lawrence Point (Orcas Island) are considered estuarine, as are all of the Strait of Georgia and the San Juan Islands north of Orcas Island." Section 173-201A-400(7)(b)(i) specifies that mixing zones, "shall not extend in any horizontal direction from the discharge ports for a distance greater than 200 feet plus the depth of water over the discharge ports as measured during mean lower low water."

The horizontal distance of the chronic mixing zone in plan view is a spherocylinder consisting of overlapping circles with a radius of 243 feet as measured in any direction from the center of each discharge port. The mixing zone extends from the bottom to the top of the water column.

Acute Mixing Zone - WAC 173-201A-400(8)(b) specifies that in estuarine waters a zone where acute criteria may be exceeded must not extend beyond 10% of the distance established for the chronic zone. The acute mixing zone for Outfall 001 extends 24.3 feet measured from the center of each discharge port. The mixing zone extends from the bottom to the top of the water column.

A dilution analysis prepared by Cosmopolitan Engineering Group, dated September 2010, includes dilution ratios that occur within the acute and chronic zones at the critical condition. The analysis used the UM3 model. The dilution ratios are conservative because they are calculated for a flow greater than the design criteria of 1.44 mgd for the upgraded plant. Ecology accepted the dilution factors calculated by Cosmopolitan Engineering Group within these zones at the critical condition using the UM3 model. The dilution factors are listed below.

Table 11: Dilution Factors (DF)

Criteria	Acute	Chronic
Aquatic Life	50:1	213:1
Human Health, Carcinogen		213:1
Human Health, Non-carcinogen		213:1

Ecology determined the impacts of dissolved oxygen deficiency, nutrients, pH, fecal coliform, chlorine, ammonia, metals, other toxics, and temperature as described below, using the dilution factors in the above table at the edge of the appropriate mixing zone. The derivation of surface water quality-based limits also takes into account the variability of pollutant concentrations in both the effluent and the receiving water.

Nutrients - Ecology has not completed a TMDL or established a wasteload allocation for nutrients. The Salish Sea Model (Ahmed et al, 2019) has shown that the nutrients discharged from wastewater treatment plants contribute to low dissolved oxygen (D.O.) levels, below state water quality criteria, in the Salish Sea. Nitrogen is the limiting nutrient in the Salish Sea waters (Howarth and Marino, 2006; Newton and Van Voorhis, 2002).

More specifically, total inorganic nitrogen (TIN), the sum of nitrate-nitrite and total ammonia, is the form of nitrogen more available for algal growth that drives eutrophication and the dissolved oxygen impairment.

Early model runs ("Bounding Scenarios") also confirmed that circulation within the inner basins of the Salish Sea distributes a portion of pollutants throughout the waters of the the Sea. Discharges in one basin can affect the water quality in other basins. Thus, all wastewater discharges to the Salish Sea containing inorganic nitrogen contribute to the D.O. impairment.

The Permittee's discharge contains inorganic nitrogen. Therefore, this permit must require the Permittee to control nutrients consistent with the Clean Water Act and Washington's Water Pollution Control Act. Water quality based effluent limits (WQBELs) are required for wastewater treatment plants discharging to surface waters when the discharge has reasonable potential to cause or contribute to an in-stream excursion above a narrative or numeric State water quality criteria (40 CFR 122.44(d)(1)(iii)).

Ecology continues to work on refining inputs and outputs of the Salish Sea Model to determine water quality impacts from both discrete point sources and watersheds entering Puget Sound. Because of the broad, far-field impacts TIN has on the Salish Sea, spreadsheet tools designed for toxic pollutants (such as "Permit Calc") cannot be used for the development of a numeric inorganic nitrogen WQBEL.

Washington State has numeric criteria for D.O. but not for nitrogen which further limits use of existing limit development spreadsheet tools. Ecology uses inorganic nitrogen as an indicator parameter for D.O., as allowed in 40 CFR 122.44(d)(vi)(C). Use of this indicator parameter requires modeling to demonstrate water quality impacts from a discharge.

Even without use of an indicator parameter, nutrients have a longer averaging period than toxics and drive both near-field and far-field effects. Modeling is necessary to quantify these far-field impacts and to derive applicable numeric WQBELs. In a receiving water as complex as the Salish Sea, the modeling work necessary to develop numeric WQBELs for each discharge is comprehensive and requires extensive internal and external review.

The inorganic nitrogen in the Permittee's discharge has reasonable potential to contribute to far-field water quality impacts. For this permit cycle, implementing a numeric WQBEL for nitrogen is infeasible.

This is due to the additional modeling scenarios necessary to quantify both the Permittee's far-field water quality effect and the corresponding effluent limit necessary to prevent an exceedance of the D.O. standard.

Federal rule at 40 CFR 122.44 (d)(vi)(C) requires permits that use indicator parameters to: identify the pollutants intended to be controlled, require appropriate monitoring, and include a reopener clause. This permit meets those requirements. The rule also requires documentation here in the fact sheet on how limiting the indicator parameter will result in control of the pollutant of concern sufficiently to attain and maintain water quality standards.

The Puget Sound Nutrient Source Reduction Project, is the process for developing nutrient load allocations for human sources that are contributing to the depletion of dissolved oxygen beyond what is allowable in the state water quality standard (WAC 173-201A-210-(1)(d)). The Salish Sea Model, along with representative monitoring data, is used to evaluate the improvement from reductions of these sources as described in Ahmed, et al (2019).

As of 2020, the project is in the second year of modeling. Model runs are used to understand the significance of the far- and near-field effects of wastewater discharges to marine waters along with the anthropogenic nutrient loads from the Salish Sea watersheds. With the completed model results and other best-available science and monitoring data, Ecology will establish a loading capacity for nutrients that will meet D.O. criteria in the marine waters of the Salish Sea. Then Ecology will allocate the overall nutrient loading capacity amongst the wastewater discharges and watersheds.

Ecology will continue to engage stakeholders on the framework for establishing nutrient load and wasteload allocations at the Puget Sound Nutrient Forum. Permittees may also participate in the process focused on WQBEL development from the nutrient wasteload allocations. Ecology currently plans on running a third year of modeling in 2021. The need for any additional computer modeling to support the development of WQBELs beyond the current project timeline will be evaluated in 2020-2021. Ecology anticipates finalizing numeric point source nutrient load reductions that will support WQBELs by the end of 2024.

While Ecology actively pursues the necessary modeling to make development of numeric WQBELs feasible, 40 CFR 122.44(k) states that best management practices (BMPs) to control or abate the discharge of pollutants are acceptable when numeric effluent limitations are infeasible. Ecology believes that a combination of a nutrient load cap, and treatment efficiency optimization constitutes a suite of BMPs that meets the intent of 40 CFR 122.44(k). Ecology will reevaluate this limit during development of the next permit iteration, or sooner using the reopener clause if appropriate.

Treatment efficiency optimization is an adaptive management strategy the Permittee must use to limit the discharge of TIN to the maximum extent practicable and stay below the annual average load cap. Ecology expects these facility specific operational efforts to be initiated following permit issuance.

The proposed permit requires the permittee to develop, implement, and maintain a Nutrient Optimization Plan due 12 months following the permit effective date.

The Permittee must use the Nutrient Optimizatin Plan to evaluate existing treatment processes for nutrient reduction. This must include identifying opportunities through operational adjustments designed to enhance nitrification and denitrification, minor retrofits such as the incorporation of anoxic zones, review of septage receiving policies and procedures, side-stream management opportunities, and minor upgrades. Minor upgrades are those that have a cost for equiptment not exceeding 5% if annual budget for equipment and supplies.

The Nutrient Optimization Plan must also include describing changes already made, and changes that are not possible without a major upgrade, and estimates in nutrient load reductions related to any process changes. The Permittee must update the plan annually to evaluate effectivenss of adopted strategies. Any significant process optimization must be reflected in an update to the standard operating procedures in the Permittee's Operation and Maintenance manual per proposed permit Section S5.G. A formal engineering evaluation meeting requirements in WAC 173-240 will be required as part of a compliance schedule once Ecology develops numeric WQBELs for the facility.

Ecology used effluent data collected during the previous permit cycle to develop the annual numeric nutrient- loading cap for total inorganic nitrogen (TIN). Sixty-seven months of loading data were available for Birch Bay for calculation of the TIN cap. The last 36 months were used as representative of existing loading. All of the data used is available at the end of Appendix D. The numeric cap was calculated so that there is no more than a one percent chance of exceedance when annual load remain similar to historic loads. The calculation uses a bootstrap method to estimate the distribution of possible means over a year. The size of the resample used in the bootstrap analysis was equal to the number of samples in the compliance period. This method randomly resamples the data with replacement. The mean of the resample represents one possible average from historic data. The 99th percentile of the means of the resampled data is the average daily cap expressed in pounds per day. The annual cap is 365 times the average daily cap and expressed in pounds per year. Ecology will assess compliance with the cap annually on the anniversary of permit effective date.

Dissolved Oxygen--BOD_5 and Ammonia Effects - Natural decomposition of organic material in wastewater effluent impacts dissolved oxygen in the receiving water at distances far outside of the regulated mixing zone. The 5-day Biochemical Oxygen Demand (BOD_5) of an effluent sample indicates the amount of biodegradable material in the wastewater and estimates the magnitude of oxygen consumption the wastewater will generate in the receiving water. The amount of ammonia-based nitrogen in the wastewater also provides an indication of oxygen demand potential in the receiving water.

Ecology modeled the near-field impact of BOD_5 on the receiving water using Ecology's PermitCalc spreadsheet, at critical condition and with the technology-based effluent limit for BOD_5 described under "Technology-Based Effluent Limits" above. The calculations to determine dissolved oxygen impacts are shown in Appendix D.

Ecology predicted no violation of the surface water quality standards for dissolved oxygen within the mixing zone due to the impacts of biochemical oxygen demand (BOD_5) under critical conditions. Therefore, the proposed permit contains the technology-based effluent limit for BOD_5. The permit also does not contain a limit on ammonia based on dissolved oxygen impacts (ammonia toxicity is examined elsewhere in this fact sheet). Future permitting actions, still under development, will address nutrient capping and planning conditions.

pH - Compliance with the technology-based limits of 6.0 to 9.0 will assure compliance with the water quality standards of surface waters because of the high buffering capacity of marine water.

Fecal Coliform - Ecology modeled the numbers of fecal coliform by simple mixing analysis using the technology-based limit of 400 organisms per 100 ml and a dilution factor of 213.

Under critical conditions, modeling predicts no violation of the water quality criterion for fecal coliform, see Appendix D. Therefore, the proposed permit includes the technology-based effluent limit for fecal coliform bacteria.

During this permit term, the water quality fecal coliform bacteria criterion will change from fecal coliform to enterococci. Technology-based effluent limits listed in WAC 173-221 were not modified with the recreational water quality standards update. The effective date of the proposed permit starts before the sunset date (12/31/2020) of the existing fecal coliform recreational standard. Because modeling under critical conditions showed no violation of current water quality criteria and the transition is a change in bacterial indicator not more or less stringent than the current standards, the effluent limits will remain unchanged throughout the duration of the permit term. Enterococci monitoring will be a be required starting January 1, 2021. Ecology will use this data to assess the reasonable potential to exceed the applicable water quality criterion in the next iteration of this permit.

Turbidity - Ecology evaluated the impact of turbidity based on the range of total suspended solids in the effluent and turbidity of the receiving water. Ecology expects no violations of the turbidity criteria outside the designated mixing zone provided the facility meets its technology-based total suspended solids permit limits.

Toxic Pollutants - Federal regulations (40 CFR 122.44) require Ecology to place limits in NPDES permits on toxic chemicals in an effluent whenever there is a reasonable potential for those chemicals to exceed the surface water quality criteria. Ecology does not exempt facilities with technology-based effluent limits from meeting the surface water quality standards.

The following toxic pollutants are present in the discharge: ammonia, arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, zinc, and cyanide. Ecology conducted a reasonable potential analysis (See Appendix D) on these parameters to determine whether it would require effluent limits in this permit.

Ammonia's toxicity depends on that portion which is available in the unionized form. The amount of unionized ammonia depends on the temperature, pH, and salinity of the receiving marine water. To evaluate ammonia toxicity, Ecology used the available receiving water information for ambient station GRG002 (Patos Island), see Table 2, and Ecology spreadsheet tools.

Valid ambient background data were available for salinity, temperature, dissolved oxygen, and pH. Ecology used all applicable data to evaluate reasonable potential for this discharge to cause a violation of water quality standards.

Ecology determined that ammonia, arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, zinc, and cyanide pose no reasonable potential to exceed the water quality criteria at the critical condition using procedures given in EPA, 1991 (Appendix D) and as described above. Ecology's determination assumes that this facility meets the other effluent limits of this permit.

Temperature - The state temperature standards [WAC 173-201A-200-210 and 600-612] include multiple elements:

- Annual summer maximum threshold criteria (June 15 to September 15)
- Incremental warming restrictions
- Protections against acute effects

Ecology evaluates each criterion independently to determine reasonable potential and derive permit limits.

- Annual 1-Day maximum criteria

  Each marine water body has an annual maximum temperature criterion [WAC 173-201A-210(1)(c)(i)-(ii) and WAC 173-201A-612]. These threshold criteria (e.g., 13, 16, 19, 22°C) protect specific categories of aquatic life by controlling the effect of human actions on water column temperatures. The threshold criteria apply at the edge of the chronic mixing zone. Criteria for marine waters and some fresh waters are expressed at the highest 1-Day annual maximum temperature (1-DMax). Ecology concludes that there is no reasonable potential to exceed the temperature standard when the mixture of ambient water and effluent at the edge of the chronic mixing zone is less than the criteria of 13°C.

- Incremental warming criteria
- The water quality standards limit the amount of warming human sources can cause under specific situations [WAC 173-201A-210(1)(c)(i)-(ii)]. The incremental warming criteria apply at the edge of the chronic mixing zone.

At locations and times when background temperatures are cooler than the assigned threshold criterion, point sources are permitted to warm the water by only a defined increment (T_i), calculated as:

$$T_i = \frac{12}{(T_{amb} - 2)}$$

- This increment is permitted only to the extent doing so does not cause temperatures to exceed the annual maximum criteria.
- At locations and times when a threshold criterion is being exceeded due to natural conditions, all human sources, considered cumulatively, must not warm the water more than 0.3°C above the naturally warm condition.

  When Ecology has not yet completed a TMDL to address documented temperature impairments, our policy allows each point source to warm water at the edge of the chronic mixing zone by 0.3°C. This is true regardless of the background temperature and even if doing so would cause the temperature at the edge of a mixing zone to exceed the numeric threshold criteria. Allowing a 0.3°C warming for each point source is reasonable and protective where the dilution factor is based on 25% or less of the critical flow. This is because the fully mixed effect on temperature will only be a fraction of the 0.3°C cumulative allowance (0.075°C or less) for all human sources combined.

- Protections for temperature acute effects

  Instantaneous lethality to passing fish: The upper 99th percentile daily maximum effluent temperature must not exceed 33°C, unless a dilution analysis indicates ambient temperatures will not exceed 33°C two seconds after discharge.

  General lethality and migration blockage: Measurable (0.3°C) increases in temperature at the edge of a chronic mixing zone are not allowed when the receiving water temperature exceeds either a 1DMax of 23°C or a 7DADMax of 22°C.

  Lethality to incubating fish: Human actions must not cause a measurable (0.3°C) warming above 17.5°C at locations where eggs are incubating.

Reasonable potential analysis

Annual summer maximum and incremental warming criteria: Ecology calculated the reasonable potential for the discharge to exceed the annual summer maximum and the incremental warming criteria at the edge of the chronic mixing zone during critical condition(s). No reasonable potential exists to exceed the temperature criterion where:

(Criterion + 0.3) > [Criterion + (Teffluent95 – Criterion)/DF].

(13 + 0.3) > (13 + (22.4– 13)/213)

13.3 > 13.04

Therefore, the proposed permit does not include a temperature limit. The permit requires additional monitoring of effluent temperatures. Ecology will reevaluate the reasonable potential during the next permit renewal.

H. Human health

Washington's water quality standards include numeric human health-based criteria for priority pollutants that Ecology must consider when writing NPDES permits.

Ecology determined the effluent contains chemicals of concern for human health-based on data indicating the discharge contains regulated chemicals.

The following pollutants are present in the discharge: antimony, mercury, nickel, selenium, thallium, zinc, cyanide, phenol, and bis (2-ethylhexyl) phthalate. Ecology evaluated the discharge's potential to violate the water quality standards as required by 40 CFR 122.44(d) by following the procedures published in the *Technical Support Document for Water Quality-Based Toxics Control* (EPA/505/2-90-001) and Ecology's *Permit Writer's Manual* to make a reasonable potential determination. The evaluation showed that the discharge has no reasonable potential to cause a violation of water quality standards, and effluent limits are not needed.

I. Sediment quality

The aquatic sediment standards (chapter 173-204 WAC) protect aquatic biota and human health. Under these standards, Ecology may require a facility to evaluate the potential for its discharge to cause a violation of sediment standards (WAC 173-204-400). You can obtain additional information about sediments at the Aquatic Lands Cleanup Unit website.at https://ecology.wa.gov/Spills-Cleanup/Contamination-cleanup/Sediment-cleanups.

Through a review of the discharger characteristics and of the effluent characteristics, Ecology determined that this discharge has no reasonable potential to violate the sediment management standards.

J. Whole effluent toxicity

The water quality standards for surface waters forbid discharge of effluent that has the potential to cause toxic effects in the receiving waters. Many toxic pollutants cannot be measured by commonly available detection methods. However, laboratory tests can measure toxicity directly by exposing living organisms to the wastewater and measuring their responses. These tests measure the aggregate toxicity of the whole effluent, so this approach is called whole effluent toxicity (WET) testing. Some WET tests measure acute toxicity and other WET tests measure chronic toxicity.

- *Acute toxicity tests measure mortality as the significant response* to the toxicity of the effluent. Dischargers who monitor their wastewater with acute toxicity tests find early indications of any potential lethal effect of the effluent on organisms in the receiving water.
- *Chronic toxicity tests measure various sublethal toxic responses*, such as reduced growth or reproduction. Chronic toxicity tests often involve either a complete life cycle test on an organism with an extremely short life cycle, or a partial life cycle test during a critical stage of a test organism's life. Some chronic toxicity tests also measure organism survival.

Laboratories accredited by Ecology for WET testing know how to use the proper WET testing protocols, fulfill the data requirements, and submit results in the correct reporting format. Accredited laboratory staff know about WET testing and how to calculate an NOEC, LC50, EC50, IC25, etc.

Ecology gives all accredited labs the most recent version of Ecology Publication No. WQ-R-95-80, *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*, which is referenced in the permit and is located at https://fortress.wa.gov/ecy/publications/documents/9580.pdf. Ecology recommends that Birch Bay send a copy of the acute or chronic toxicity sections(s) of its NPDES permit to the laboratory.

WET testing conducted during effluent characterization showed no reasonable potential for effluent discharges to cause receiving water acute or chronic toxicity. The proposed permit will not include an acute or chronic WET limit. Birch Bay must retest the effluent before submitting an application for permit renewal.

- If this facility makes process or material changes which, in Ecology's opinion, increase the potential for effluent toxicity, then Ecology may (in a regulatory order, by permit modification, or in the permit renewal) require the facility to conduct additional effluent characterization. Birch Bay may demonstrate to Ecology that effluent toxicity has not increased by performing additional WET testing and/or chemical analyses after the process or material changes have been made. Ecology recommends that the Permittee check with it first to make sure that Ecology will consider the demonstration adequate to support a decision to not require an additional effluent characterization.
- If WET testing conducted for submittal with a permit application fails to meet the performance standards in WAC 173-205-020, Ecology will assume that effluent toxicity has increased.

K. Groundwater quality limits

The groundwater quality standards (chapter 173-200 WAC) protect beneficial uses of groundwater. Permits issued by Ecology must not allow violations of those standards (WAC 173-200-100).

Birch Bay does not discharge wastewater to the ground. No permit limits are required to protect groundwater.

L. Comparison of effluent limits with the previous permit issued June 20, 2014 and modified on November 30, 2015

Table 12: Comparison of Previous and Proposed Effluent Limits

		Previous Effluent Limits: Outfall # 001		Proposed Effluent Limits: Outfall # 001	
Parameter	**Basis of Limit**	**Average Monthly**	**Average Weekly**	**Average Monthly**	**Average Weekly**
Biochemical Oxygen Demand (5-day)	Technology	30 mg/L 360 lbs/day 85% removal	45 mg/L 540 lbs/day	30 mg/L 360 lbs/day 85% removal	45 mg/L 540 lbs/day
Total Suspended Solids	Technology	30 mg/L 360 lbs/day 85% removal	45 mg/L 540 lbs/day	30 mg/L 360 lbs/day 85% removal	45 mg/L 540 lbs/day

Parameter	**Basis of Limit**	**Monthly Geometric Mean Limit**	**Weekly Geometric Mean Limit**	**Monthly Geometric Mean Limit**	**Weekly Geometric Mean Limit**
Fecal Coliform Bacteria	Technology	200 #/100 mg/L	400 #/100 mg/L	200 #/100 mg/L	400 #/100 mg/L

Parameter	**Basis of Limit**	**Limit**	**Limit**
pH	Technology	Minimum 6.0/Maximum 9.0	Minimum 6.0/Maximum 9.0

Parameter	**Basis of Limit**	**Average Monthly**	**Average Weekly**	**Average Monthly**	**Maximum Daily**
Total Residual Chlorine	Water Quality	0.35 mg/L	0.5 mg/L	NA	0.5 mg/L

Parameter	**Basis of Limit**	**Average Monthly**	**Average Weekly**	**Average Monthly**	**Maximum Annual**
Total Inorganic Nitrogen	Water Quality	NA	NA	NA	74,900 lbs/year

IV. Monitoring Requirements

Ecology requires monitoring, recording, and reporting (WAC 173-220-210 and 40 CFR 122.41) to verify that the treatment process is functioning correctly and that the discharge complies with the permit's effluent limits.

If a facility uses a contract laboratory to monitor wastewater, it must ensure that the laboratory uses the methods and meets or exceeds the method detection levels required by the permit. The permit describes when facilities may use alternative methods. It also describes what to do in certain situations when the laboratory encounters matrix effects. When a facility uses an alternative method as allowed by the permit, it must report the test method, detection level (DL), and quantitation level (QL) on the discharge monitoring report or in the required report.

A. Wastewater monitoring

The monitoring schedule is detailed in the proposed permit under Special Condition S2. Specified monitoring frequencies take into account the quantity and variability of the discharge, the treatment method, past compliance, significance of pollutants, and cost of monitoring. The required monitoring frequency is consistent with agency guidance given in the current version of Ecology's *Permit Writer's Manual* (Publication Number 92-109) for Conventional Activated Sludge with Secondary Treatment.

Monitoring of sludge quantity and quality is necessary to determine the appropriate uses of the sludge. Biosolids monitoring is required by the current state and local solid waste management program and also by EPA under 40 CFR 503.

Ecology updated the water contact recreation bacteria criteria in January 2019. This change will be effective January 1, 2021 and eliminated all recreational uses except for primary contact criteria in both fresh and marine waters. Primary contact criteria changed to *E.coli* for freshwater and to enterococci for marine water. Fecal coliform was retained as the indicator for protection of shellfish harvest. Because Birch Bay has a fecal coliform effluent limits based on current indicators for recreation and shellfish. This permit requires monitoring of fecal coliform for compliance, based on the indicator at the time of issuance. Monitoring for enterococci will begin January 1, 2021. Ecology will reevaluate the bacteria limit based on the new indicator during the next permit cycle.

B. Lab accreditation

Ecology requires that facilities must use a laboratory registered or accredited under the provisions of chapter 173-50 WAC, Accreditation of Environmental Laboratories, to prepare all monitoring data (with the exception of certain parameters). Ecology accredited the laboratory at this facility for:

Table 13: Accredited Parameters

Parameter Name	Category	Method Name	Matrix Description
Total Suspended Solids	General Chemistry	SM 2540 D-2011	Non-Potable Water
Total Residual Chlorine	General Chemistry	SM 4500-CI G-2011	Non-Potable Water
pH	General Chemistry	SM 4500-H+ B-2011	Non-Potable Water
Dissolved Oxygen	General Chemistry	SM 4500-O G-2011	Non-Potable Water

Parameter Name	Category	Method Name	Matrix Description
Biochemical Oxygen Demand (BOD)	General Chemistry	SM 5210 B-2011	Non-Potable Water
Fecal Coliform	Microbiology	SM 9222 D (mfC)-06	Non-Potable Water

V. Other Permit Conditions

A. Reporting and record keeping

Ecology based Special Condition S3 on its authority to specify any appropriate reporting and record keeping requirements to prevent and control waste discharges (WAC 173-220-210).

B. Prevention of facility overloading

Overloading of the treatment plant is a violation of the terms and conditions of the permit. To prevent this from occurring, RCW 90.48.110 and WAC 173-220-150 require Birch Bay to:

- Take the actions detailed in proposed permit Special Condition S4.
- Design and construct expansions or modifications before the treatment plant reaches existing capacity.
- Report and correct conditions that could result in new or increased discharges of pollutants.

Special Condition S4 restricts the amount of flow.

C. Operation and maintenance

The proposed permit contains Special Condition S.5 as authorized under RCW 90.48.110, WAC 173-220-150, chapter 173-230 WAC, and WAC 173-240-080. Ecology included it to ensure proper operation and regular maintenance of equipment, and to ensure that Birch Bay takes adequate safeguards so that it uses constructed facilities to their optimum potential in terms of pollutant capture and treatment.

D. Pretreatment

Duty to enforce discharge prohibitions

This provision prohibits the publicly owned treatment works (POTW) from authorizing or permitting an industrial discharger to discharge certain types of waste into the sanitary sewer.

- The first section of the pretreatment requirements prohibits the POTW from accepting pollutants which causes “pass-through” or “interference”. This general prohibition is from 40 CFR §403.5(a). Appendix C of this fact sheet defines these terms.

- The second section reinforces a number of specific state and federal pretreatment prohibitions found in WAC 173-216-060 and 40 CFR §403.5(b). These reinforce that the POTW may not accept certain wastes, which:

  a. Are prohibited due to dangerous waste rules.

  b. Are explosive or flammable.

  c. Have too high or low of a pH (too corrosive, acidic or basic).

  d. May cause a blockage such as grease, sand, rocks, or viscous materials.

  e. Are hot enough to cause a problem.

  f. Are of sufficient strength or volume to interfere with treatment.

  g. Contain too much petroleum-based oils, mineral oil, or cutting fluid.

  h. Create noxious or toxic gases at any point.

  40 CFR Part 403 contains the regulatory basis for these prohibitions, with the exception of the pH provisions which are based on WAC 173-216-060.

- The third section of pretreatment conditions reflects state prohibitions on the POTW accepting certain types of discharges unless the discharge has received prior written authorization from Ecology.

  These discharges include:

  a. Cooling water in significant volumes.

  b. Stormwater and other direct inflow sources.

  c. Wastewaters significantly affecting system hydraulic loading, which do not require treatment.

Federal and state pretreatment program requirements

Ecology administers the Pretreatment Program under the terms of the addendum to the "Memorandum of Understanding between Washington Department of Ecology and the United States Environmental Protection Agency, Region 10" (1986) and 40 CFR, part 403. Under this delegation of authority, Ecology issues wastewater discharge permits for significant industrial users (SIUs) discharging to POTWs which have not been delegated authority to issue wastewater discharge permits. Ecology must approve, condition, or deny new discharges or a significant increase in the discharge for existing significant industrial users (SIUs) [40 CFR 403.8 (f)(1)(i) and(iii)].

Industrial dischargers must obtain a permit from Ecology before discharging waste to the Birch Bay WWTP [WAC 173-216-110(5)]. Industries discharging wastewater that is similar in character to domestic wastewater do not require a permit.

Routine identification and reporting of industrial users

The permit requires non-delegated POTWs to take "continuous, routine measures to identify all existing, new, and proposed significant industrial users (SIUs) and potential significant industrial users (PSIUs)" discharging to their sewer system. Examples of such routine measures include regular review of water and sewer billing records, business license and building permit applications, advertisements, and personal reconnaissance. System maintenance personnel should be trained on what to look for so they can identify and report new industrial dischargers in the course of performing their jobs. The POTW may not allow SIUs to discharge prior to receiving a permit, and must notify all industrial dischargers (significant or not) in writing of their responsibility to apply for a State Waste Discharge Permit. The POTW must send a copy of this notification to Ecology.

E. Solid wastes

To prevent water quality problems, the facility is required in permit Special Condition S7 to store and handle all residual solids (grit, screenings, scum, sludge, and other solid waste) in accordance with the requirements of RCW 90.48.080 and state water quality standards.

The final use and disposal of sewage sludge from this facility is regulated by U.S. EPA under 40 CFR 503, and by Ecology under chapter 70.95J RCW, chapter 173-308 WAC "Biosolids Management," and chapter 173-350 WAC "Solid Waste Handling Standards." The disposal of other solid waste is under the jurisdiction of the Whatcom County Health Department.

Requirements for monitoring sewage sludge and record keeping are included in this permit. Ecology will use this information, required under 40 CFR 503, to develop or update local limits.

F. General conditions

Ecology bases the standardized General Conditions on state and federal law and regulations. They are included in all individual domestic wastewater NPDES permits issued by Ecology.

VI. Permit Issuance Procedures

A. Permit modifications

Ecology may modify this permit to impose numerical limits, if necessary, to comply with water quality standards for surface waters, with sediment quality standards, or with water quality standards for groundwaters, based on new information from sources such as inspections, effluent monitoring, outfall studies, and effluent mixing studies.

Ecology may also modify this permit to comply with new or amended state or federal regulations.

B. Proposed permit issuance

This proposed permit meets all statutory requirements for Ecology to authorize a wastewater discharge. The permit includes limits and conditions to protect human health and aquatic life, and the beneficial uses of waters of the state of Washington. Ecology proposes to issue this permit for a term of 5 years.

References for Text and Appendices

Environmental Protection Agency (EPA)

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1979. *In-stream Deoxygenation Rate Prediction*. Journal Environmental Engineering Division, ASCE. 105(EE2). (Cited in EPA 1985 op.cit.)

Appendix A - Public Involvement Information

Ecology proposes to reissue a permit to Birch Bay Water and Sewer District. The permit includes wastewater discharge limits and other conditions. This fact sheet describes the facility and Ecology's reasons for requiring permit conditions.

Ecology will place a Public Notice of Draft on June 10, 2020 in the Bellingham Herald to inform the public and to invite comment on the proposed draft National Pollutant Discharge Elimination System permit and fact sheet.

The notice:

- Told where copies of the draft permit and fact sheet were available for public evaluation (a local public library, the closest regional or field office, posted on our website).
- Offered to provide the documents in an alternate format to accommodate special needs.
- Asked people to tell us how well the proposed permit would protect the receiving water.
- Invited people to suggest fairer conditions, limits, and requirements for the permit.
- Invited comments on Ecology's determination of compliance with antidegradation rules.
- Urged people to submit their comments, in writing, before the end of the comment period.
- Told how to request a public hearing about the proposed NPDES permit.
- Explained the next step(s) in the permitting process.

Ecology has published a document entitled *Frequently Asked Questions about Effective Public Commenting*, which is available on our website at https://fortress.wa.gov/ecy/publications/documents/0307023.pdf

You may obtain further information from Ecology by telephone at (360) 255-4392, or by writing to the address listed below.

Water Quality Permit Coordinator
Department of Ecology
Bellingham Field Office
913 Squallcum Way, #101
Bellingham, WA 98225

The primary author of this permit and fact sheet is Mark Henderson.

Appendix B--Your Right to Appeal

You have a right to appeal this permit to the Pollution Control Hearing Board (PCHB) within 30 days of the date of receipt of the final permit. The appeal process is governed by chapter 43.21B RCW and chapter 371-08 WAC. "Date of receipt" is defined in RCW 43.21B.001(2) (see glossary).

To appeal, you must do the following within 30 days of the date of receipt of this permit:

- File your appeal and a copy of this permit with the PCHB (see addresses below). Filing means actual receipt by the PCHB during regular business hours.
- Serve a copy of your appeal and this permit on Ecology in paper form - by mail or in person. (See addresses below). E-mail is not accepted.

You must also comply with other applicable requirements in chapter 43.21B RCW and chapter 371-08 WAC.

Table 14: Address and Location Information

Street Addresses	Mailing Addresses
Department of Ecology Attn: Appeals Processing Desk 300 Desmond Drive SE Lacey, WA 98503	**Department of Ecology** Attn: Appeals Processing Desk PO Box 47608 Olympia, WA 98504-7608
Pollution Control Hearings Board 1111 Israel RD SW STE 301 Tumwater, WA 98501	**Pollution Control Hearings Board** PO Box 40903 Olympia, WA 98504-0903

Appendix C - Glossary

1-DMax or 1-day maximum temperature -- The highest water temperature reached on any given day. This measure can be obtained using calibrated maximum/minimum thermometers or continuous monitoring probes having sampling intervals of thirty minutes or less.

7-DADMax or 7-day average of the daily maximum temperatures -- The arithmetic average of seven consecutive measures of daily maximum temperatures. The 7-DADMax for any individual day is calculated by averaging that day's daily maximum temperature with the daily maximum temperatures of the three days prior and the three days after that date.

Acute toxicity -- The lethal effect of a compound on an organism that occurs in a short time period, usually 48 to 96 hours.

AKART -- The acronym for "all known, available, and reasonable methods of prevention, control and treatment." AKART is a technology-based approach to limiting pollutants from wastewater discharges, which requires an engineering judgment and an economic judgment. AKART must be applied to all wastes and contaminants prior to entry into waters of the state in accordance with RCW 90.48.010 and 520, WAC 173-200-030(2)(c)(ii), and WAC 173-216-110(1)(a).

Alternate point of compliance -- An alternative location in the groundwater from the point of compliance where compliance with the groundwater standards is measured. It may be established in the groundwater at locations some distance from the discharge source, up to, but not exceeding the property boundary and is determined on a site specific basis following an AKART analysis. An "early warning value" must be used when an alternate point is established. An alternate point of compliance must be determined and approved in accordance with WAC 173-200-060(2).

Ambient water quality -- The existing environmental condition of the water in a receiving water body.

Ammonia -- Ammonia is produced by the breakdown of nitrogenous materials in wastewater. Ammonia is toxic to aquatic organisms, exerts an oxygen demand, and contributes to eutrophication. It also increases the amount of chlorine needed to disinfect wastewater.

Annual average design flow (AADF) -- The average of the daily flow volumes anticipated to occur over a calendar year.

Average monthly (intermittent) discharge limit -- The average of the measured values obtained over a calendar month's time taking into account zero discharge days.

Average monthly discharge limit -- The average of the measured values obtained over a calendar month's time.

Background water quality -- The concentrations of chemical, physical, biological or radiological constituents or other characteristics in or of groundwater at a particular point in time upgradient of an activity that has not been affected by that activity [WAC 173-200-020(3)]. Background water quality for any parameter is statistically defined as the 95% upper tolerance interval with a 95% confidence based on at least eight hydraulically upgradient water quality samples. The eight samples are collected over a period of at least one year, with no more than one sample collected during any month in a single calendar year.

Best management practices (BMPs) -- Schedules of activities, prohibitions of practices, maintenance procedures, and other physical, structural and/or managerial practices to prevent or reduce the pollution of waters of the state. BMPs include treatment systems, operating procedures, and practices to control: plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. BMPs may be further categorized as operational, source control, erosion and sediment control, and treatment BMPs.

BOD5 -- Determining the five-day Biochemical Oxygen Demand of an effluent is an indirect way of measuring the quantity of organic material present in an effluent that is utilized by bacteria. The BOD5 is used in modeling to measure the reduction of dissolved oxygen in receiving waters after effluent is discharged. Stress caused by reduced dissolved oxygen levels makes organisms less competitive and less able to sustain their species in the aquatic environment. Although BOD_5 is not a specific compound, it is defined as a conventional pollutant under the federal Clean Water Act.

Bypass -- The intentional diversion of waste streams from any portion of a treatment facility.

Categorical pretreatment standards -- National pretreatment standards specifying quantities or concentrations of pollutants or pollutant properties, which may be discharged to a POTW by existing or new industrial users in specific industrial subcategories.

Chlorine -- A chemical used to disinfect wastewaters of pathogens harmful to human health. It is also extremely toxic to aquatic life.

Chronic toxicity -- The effect of a compound on an organism over a relatively long time, often 1/10 of an organism's lifespan or more. Chronic toxicity can measure survival, reproduction or growth rates, or other parameters to measure the toxic effects of a compound or combination of compounds.

Clean water act (CWA) -- The federal Water Pollution Control Act enacted by Public Law 92-500, as amended by Public Laws 95-217, 95-576, 96-483, 97-117; USC 1251 et seq.

Compliance inspection-without sampling -- A site visit for the purpose of determining the compliance of a facility with the terms and conditions of its permit or with applicable statutes and regulations.

Compliance inspection-with sampling -- A site visit for the purpose of determining the compliance of a facility with the terms and conditions of its permit or with applicable statutes and regulations. In addition it includes as a minimum, sampling and analysis for all parameters with limits in the permit to ascertain compliance with those limits; and, for

municipal facilities, sampling of influent to ascertain compliance with the 85 percent removal requirement. Ecology may conduct additional sampling.

Composite sample -- A mixture of grab samples collected at the same sampling point at different times, formed either by continuous sampling or by mixing discrete samples. May be "time-composite" (collected at constant time intervals) or "flow-proportional" (collected either as a constant sample volume at time intervals proportional to stream flow, or collected by increasing the volume of each aliquot as the flow increased while maintaining a constant time interval between the aliquots).

Construction activity -- Clearing, grading, excavation, and any other activity, which disturbs the surface of the land. Such activities may include road building; construction of residential houses, office buildings, or industrial buildings; and demolition activity.

Continuous monitoring -- Uninterrupted, unless otherwise noted in the permit.

Critical condition -- The time during which the combination of receiving water and waste discharge conditions have the highest potential for causing toxicity in the receiving water environment. This situation usually occurs when the flow within a water body is low, thus, its ability to dilute effluent is reduced.

Date of receipt -- This is defined in RCW 43.21B.001(2) as five business days after the date of mailing; or the date of actual receipt, when the actual receipt date can be proven by a preponderance of the evidence. The recipient's sworn affidavit or declaration indicating the date of receipt, which is unchallenged by the agency, constitutes sufficient evidence of actual receipt. The date of actual receipt, however, may not exceed forty-five days from the date of mailing.

Detection limit -- The minimum concentration of a substance that can be measured and reported with 99 percent confidence that the pollutant concentration is above zero and is determined from analysis of a sample in a given matrix containing the pollutant.

Dilution factor (DF) -- A measure of the amount of mixing of effluent and receiving water that occurs at the boundary of the mixing zone. Expressed as the inverse of the percent effluent fraction, for example, a dilution factor of 10 means the effluent comprises 10% by volume and the receiving water 90%.

Distribution uniformity -- The uniformity of infiltration (or application in the case of sprinkle or trickle irrigation) throughout the field expressed as a percent relating to the average depth infiltrated in the lowest one-quarter of the area to the average depth of water infiltrated.

Early warning value -- The concentration of a pollutant set in accordance with WAC 173-200-070 that is a percentage of an enforcement limit. It may be established in the effluent, groundwater, surface water, the vadose zone or within the treatment process. This value acts as a trigger to detect and respond to increasing contaminant concentrations prior to the degradation of a beneficial use.

Enforcement limit -- The concentration assigned to a contaminant in the groundwater at the point of compliance for the purpose of regulation [WAC 173-200-020(11)]. This limit assures

that a groundwater criterion will not be exceeded and that background water quality will be protected.

Engineering report -- A document that thoroughly examines the engineering and administrative aspects of a particular domestic or industrial wastewater facility. The report must contain the appropriate information required in WAC 173-240-060 or 173-240-130.

Fecal coliform bacteria -- Fecal coliform bacteria are used as indicators of pathogenic bacteria in the effluent that are harmful to humans. Pathogenic bacteria in wastewater discharges are controlled by disinfecting the wastewater. The presence of high numbers of fecal coliform bacteria in a water body can indicate the recent release of untreated wastewater and/or the presence of animal feces.

Grab sample -- A single sample or measurement taken at a specific time or over as short a period of time as is feasible.

Groundwater -- Water in a saturated zone or stratum beneath the surface of land or below a surface water body.

Industrial user -- A discharger of wastewater to the sanitary sewer that is not sanitary wastewater or is not equivalent to sanitary wastewater in character.

Industrial wastewater -- Water or liquid-carried waste from industrial or commercial processes, as distinct from domestic wastewater. These wastes may result from any process or activity of industry, manufacture, trade or business; from the development of any natural resource; or from animal operations such as feed lots, poultry houses, or dairies. The term includes contaminated stormwater and, also, leachate from solid waste facilities.

Interference -- A discharge which, alone or in conjunction with a discharge or discharges from other sources, both:

- Inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal; and
- Therefore is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued thereunder (or more stringent State or local regulations): Section 405 of the Clean Water Act, the Solid Waste Disposal Act (SWDA) (including title II, more commonly referred to as the Resource Conservation and Recovery Act (RCRA), and including State regulations contained in any State sludge management plan prepared pursuant to subtitle D of the SWDA), sludge regulations appearing in 40 CFR Part 507, the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection, Research and Sanctuaries Act.

Local limits -- Specific prohibitions or limits on pollutants or pollutant parameters developed by a POTW.

Major facility -- A facility discharging to surface water with an EPA rating score of > 80 points based on such factors as flow volume, toxic pollutant potential, and public health impact.

Maximum daily discharge limit -- The highest allowable daily discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. The daily discharge is calculated as the average measurement of the pollutant over the day.

Maximum day design flow (MDDF) -- The largest volume of flow anticipated to occur during a one-day period, expressed as a daily average.

Maximum month design flow (MMDF) -- The largest volume of flow anticipated to occur during a continuous 30-day period, expressed as a daily average.

Maximum week design flow (MWDF) -- The largest volume of flow anticipated to occur during a continuous 7-day period, expressed as a daily average.

Method detection level (MDL) -- See Detection Limit.

Minor facility -- A facility discharging to surface water with an EPA rating score of < 80 points based on such factors as flow volume, toxic pollutant potential, and public health impact.

Mixing zone -- An area that surrounds an effluent discharge within which water quality criteria may be exceeded. The permit specifies the area of the authorized mixing zone that Ecology defines following procedures outlined in state regulations (chapter 173-201A WAC).

National pollutant discharge elimination system (NPDES) -- The NPDES (Section 402 of the Clean Water Act) is the federal wastewater permitting system for discharges to navigable waters of the United States. Many states, including the state of Washington, have been delegated the authority to issue these permits. NPDES permits issued by Washington State permit writers are joint NPDES/State permits issued under both state and federal laws.

pH -- The pH of a liquid measures its acidity or alkalinity. It is the negative logarithm of the hydrogen ion concentration. A pH of 7 is defined as neutral and large variations above or below this value are considered harmful to most aquatic life.

Pass-through -- A discharge which exits the POTW into waters of the State in quantities or concentrations which, alone or in conjunction with a discharge or discharges from other sources, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation), or which is a cause of a violation of State water quality standards.

Peak hour design flow (PHDF) -- The largest volume of flow anticipated to occur during a one-hour period, expressed as a daily or hourly average.

Peak instantaneous design flow (PIDF) -- The maximum anticipated instantaneous flow.

Point of compliance -- The location in the groundwater where the enforcement limit must not be exceeded and a facility must comply with the Ground Water Quality Standards. Ecology determines this limit on a site-specific basis. Ecology locates the point of compliance in the groundwater as near and directly downgradient from the pollutant source as technically, hydrogeologically, and geographically feasible, unless it approves an alternative point of compliance.

Potential significant industrial user (PSIU) --A potential significant industrial user is defined as an Industrial User that does not meet the criteria for a Significant Industrial User, but which discharges wastewater meeting one or more of the following criteria:

a. Exceeds 0.5 % of treatment plant design capacity criteria and discharges <25,000 gallons per day; or

b. Is a member of a group of similar industrial users which, taken together, have the potential to cause pass through or interference at the POTW (e.g. facilities which develop photographic film or paper, and car washes).

Ecology may determine that a discharger initially classified as a potential significant industrial user should be managed as a significant industrial user.

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).

Reasonable potential -- A reasonable potential to cause a water quality violation, or loss of sensitive and/or important habitat.

Responsible corporate officer -- 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 employing more than 250 persons or have gross annual sales or expenditures exceeding $25 million (in second quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures (40 CFR 122.22).

Sample Maximum -- No sample may exceed this value.

Significant industrial user (SIU) --

1) All industrial users subject to Categorical Pretreatment Standards under 40 CFR 403.6 and 40 CFR Chapter I, Subchapter N; and

2) Any other industrial user that: discharges an average of 25,000 gallons per day or more of process wastewater to the POTW (excluding sanitary, noncontact cooling, and boiler blow-down wastewater); contributes a process wastestream that makes up 5 percent or more of the average dry weather hydraulic or organic capacity of the POTW treatment plant; or is designated as such by the Control Authority* on the basis that the industrial user has a reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement [in accordance with 40 CFR 403.8(f)(6)].

   Upon finding that the industrial user meeting the criteria in paragraph 2, above, has no reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement, the Control Authority* may at any time, on its own initiative or in response to a petition received from an industrial user or POTW, and in accordance with 40 CFR 403.8(f)(6), determine that such industrial user is not a significant industrial user.

   *The term "Control Authority" refers to the Washington State Department of Ecology in the case of non-delegated POTWs or to the POTW in the case of delegated POTWs.

Slug discharge -- Any discharge of a non-routine, episodic nature, including but not limited to an accidental spill or a non-customary batch discharge to the POTW. This may include any pollutant released at a flow rate that may cause interference or pass through with the POTW or in any way violate the permit conditions or the POTW's regulations and local limits.

Soil scientist -- An individual who is registered as a Certified or Registered Professional Soil Scientist or as a Certified Professional Soil Specialist by the American Registry of Certified Professionals in Agronomy, Crops, and Soils or by the National Society of Consulting Scientists or who has the credentials for membership. Minimum requirements for eligibility are: possession of a baccalaureate, masters, or doctorate degree from a U.S. or Canadian institution with a minimum of 30 semester hours or 45 quarter hours professional core courses in agronomy, crops or soils, and have 5, 3, or 1 year(s), respectively, of professional experience working in the area of agronomy, crops, or soils.

Solid waste -- All putrescible and non-putrescible solid and semisolid wastes including, but not limited to, garbage, rubbish, ashes, industrial wastes, swill, sewage sludge, demolition and construction wastes, abandoned vehicles or parts thereof, contaminated soils and contaminated dredged material, and recyclable materials.

Soluble BOD_5 -- Determining the soluble fraction of Biochemical Oxygen Demand of an effluent is an indirect way of measuring the quantity of soluble organic material present in an effluent that is utilized by bacteria. Although the soluble BOD_5 test is not specifically described in Standard Methods, filtering the raw sample through at least a 1.2 um filter prior to running the standard BOD_5 test is sufficient to remove the particulate organic fraction.

State waters -- Lakes, rivers, ponds, streams, inland waters, underground waters, salt waters, and all other surface waters and watercourses within the jurisdiction of the state of Washington.

Stormwater -- That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes, and other features of a stormwater drainage system into a defined surface water body, or a constructed infiltration facility.

Technology-based effluent limit -- A permit limit based on the ability of a treatment method to reduce the pollutant.

Total coliform bacteria -- A microbiological test, which detects and enumerates the total coliform group of bacteria in water samples.

Total dissolved solids -- That portion of total solids in water or wastewater that passes through a specific filter.

Total maximum daily load (TMDL) -- A determination of the amount of pollutant that a water body can receive and still meet water quality standards.

Total suspended solids (TSS) -- Total suspended solids is the particulate material in an effluent. Large quantities of TSS discharged to a receiving water may result in solids accumulation. Apart from any toxic effects attributable to substances leached out by water, suspended solids may kill fish, shellfish, and other aquatic organisms by causing abrasive injuries and by clogging the gills and respiratory passages of various aquatic fauna. Indirectly, suspended solids can screen out light and can promote and maintain the development of noxious conditions through oxygen depletion.

Upset -- 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, lack of preventative maintenance, or careless or improper operation.

Water quality-based effluent limit -- A limit imposed on the concentration of an effluent parameter to prevent the concentration of that parameter from exceeding its water quality criterion after discharge into receiving waters.

Appendix D - Technical Calculations

Several of the Excel® spreadsheet tools used to evaluate a discharger's ability to meet Washington State water quality standards can be found in the PermitCalc workbook on Ecology's webpage at https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Water-quality-permits-guidance.

Simple Mixing:

Ecology uses simple mixing calculations to assess the impacts of certain conservative pollutants, such as the expected increase in fecal coliform bacteria at the edge of the chronic mixing zone boundary. Simple mixing uses a mass balance approach to proportionally distribute a pollutant load from a discharge into the authorized mixing zone. The approach assumes no decay or generation of the pollutant of concern within the mixing zone. The predicted concentration at the edge of a mixing zone (C_{mz}) is based on the following calculation:

$$C_{mz} = Ca + \frac{(Ce - Ca)}{DF}$$

where:

Ce = Effluent Concentration

Ca = Ambient Concentration

DF = Dilution Factor

Reasonable Potential Analysis:

The spreadsheets Input 2 – Reasonable Potential, and LimitCalc in Ecology's PermitCalc Workbook determine reasonable potential (to violate the aquatic life and human health water quality standards) and calculate effluent limits. The process and formulas for determining reasonable potential and effluent limits in these spreadsheets are taken directly from the *Technical Support Document for Water Quality-based Toxics Control*, (EPA 505/2-90-001). The adjustment for autocorrelation is from EPA (1996a), and EPA (1996b).

Table D1: Reasonable Potential Calculation

													Human Health Non-Carcinogenic	213.0
Pollutant, CAS No. & NPDES Application Ref. No.			AMMONIA, Criteria as Total NH3	CHLORINE (Total Residual) 7782505	NITRATE/NITRITE (N)	OIL AND GREASE	SOLIDS,DISSOLVED AND SALINITY	ANTIMONY (INORGANIC) 7440360 1M	ARSENIC (dissolved) 7440382 2M	BERYLLIUM 7440417 3M	CADMIUM - 7440439 4M Hardness dependent	CHROMIUM(HEX) 18540299 - Dissolved	COPPER - 744058 6M Hardness dependent	
Effluent Data	# of Samples (n)		18	546	56	18	18	4	4	4	4	4	4	
	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)		28,300	100	41160	3500	1264000	0.3	2.5	0.05	0.07	0.0018	0.014	
	Calculated 50th percentile Effluent Conc. (when n>10)													
Receiving Water Data	90th Percentile Conc., ug/L		10						2.25		0.063	0.00162	0.0126	
	Geo Mean, ug/L													
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	9,491	13	-	-	-	-	69	-	42	1100	4.8	
		Chronic	1,426	7.5	-	-	-	-	36	-	9.3	50	3.1	
	WQ Criteria for Protection of Human Health, ug/L		-	-	-	-	-	90	-	-	-	-	-	
	Metal Criteria Translator, decimal	Acute	-	-	-	-	-	-	1	-	0.994	-	0.83	
		Chronic	-	-	-	-	-	-	-	-	0.994	-	0.83	
	Carcinogen?		N	N	N	N	N	N	Y	Y	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)$^{1/n}$		0.847	0.995					0.473		0.473	0.473	0.473	
Multiplier			1.41	1.00					2.59		2.59	2.59	2.59	
Max concentration (ug/L) at edge of…		Acute	810	2.000					2.334		0.065	0.002	0.013	
		Chronic	198	0.469					2.270		0.064	0.002	0.013	
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	$s^2=\ln(CV^2+1)$	0.554513
Pn	Pn=(1-confidence level)1/n	0.473
Multiplier		1.038459
Dilution Factor		213
Max Conc. at edge of Chronic Zone, ug/L		1.5E-03
Reasonable Potential? Limit Required?		**NO**

Reasonable Potential Calculation - Page 2

Facility	Birch Bay Water & Sewer Dist
Water Body Type	Marine

Dilution Factors:	Acute	Chronic
Aquatic Life	50.0	213.0
Human Health Carcinogenic		213.0
Human Health Non-Carcinogenic		213.0

Pollutant, CAS No. & NPDES Application Ref. No.			LEAD - 7439921 7M Dependent on hardness	MERCURY 7439976 8M	NICKEL - 7440020 9M - Dependent on hardness	SELENIUM 7782492 10M	SILVER - 7740224 11M dependent on hardness.	THALLIUM 7440280 12M	ZINC - 7440666 13M hardness dependent	CYANIDE 57125 14M	PHENOL 108952 10A	BIS(2-ETHYLHEXYL) PHTHALATE 117817 13B	
Effluent Data	# of Samples (n)		4	4	4	4	4	4	4	4	4	4	
	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)		0.0005	0.00268	3	2.6	2.27E-05	0.4	61	10	3.3	0.5	
	Calculated 50th percentile Effluent Conc. (when n>10)												
Receiving Water Data	90th Percentile Conc., ug/L		0.00045	0.00241	2.7	2.34	2.04E-05		54.9				
	Geo Mean, ug/L												
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	210	1.8	74	290	1.9	-	90	2.8	-	-	
		Chronic	8.1	0.025	8.2	71	-	-	81	9.1	-	-	
	WQ Criteria for Protection of Human Health, ug/L		-	0.15	100	200	-	6.3	1000	100	70000	0.046	
	Metal Criteria Translator, decimal	Acute	0.951	0.85	0.99	-	0.85	-	0.946	-	-	-	
		Chronic	0.951	-	0.99	-	-	-	0.946	-	-	-	
	Carcinogen?		N	N	N	N	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	$s^2=\ln(CV^2+1)$		0.555	0.555	0.555	0.555	0.555		0.555	0.555			
Pn	$Pn=(1\text{-confidence level})^{1/n}$		0.473	0.473	0.473	0.473	0.473		0.473	0.473			
Multiplier			2.59	2.59	2.59	2.59	2.59		2.59	2.59			
Max concentration (ug/L) at edge of…		Acute	0.000	0.002	2.800	2.428	0.000		56.786	0.517			
		Chronic	0.000	0.002	2.723	2.361	0.000		55.343	0.121			
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	0.554513	0.55451		0.554513	0.554513	0.55451	0.55451	0.55451	
Pn	Pn=(1-confidence level)1/n			0.473	0.473	0.473		0.473	0.473	0.473	0.473	0.473	
Multiplier				1.03846	1.038459	1.03846		1.038459	1.038459	1.03846	1.03846	1.03846	
Dilution Factor				213	213	213		213	213	213	213	213	
Max Conc. at edge of Chronic Zone, ug/L				1.3E-05	0.014626	0.01268		2.0E-03	3.0E-01	0.04875	0.01609	0.00244	
Reasonable Potential? Limit Required?				**NO**	**NO**	**NO**		**NO**	**NO**	**NO**	**NO**	**NO**	

Table D2: Calculation of Fecal Coliform at Chronic Mixing Zone

Calculation of Fecal Coliform at Chronic Mixing Zone

INPUT	
Chronic Dilution Factor	213.0
Receiving Water Fecal Coliform, #/100 ml	2
Effluent Fecal Coliform - worst case, #/100 ml	400
Surface Water Criteria, #/100 ml	*14*
OUTPUT	
Fecal Coliform at Mixing Zone Boundary, #/100 ml	**4**
Difference between mixed and ambient, #/100 ml	2

Conclusion: At design flow, the discharge has no reasonable potential to violate water quality standards for fecal coliform.

Table D3: Calculation of BOD5 Oxidation with Temperature Adjustment

Calculation of BOD_5 Oxidation with Temperature Adjustment

INPUT	
Effluent BOD_5 (mg/L)	45
Effluent Dissolved Oxygen (DO) (mg/L)	4
Receiving Water Temperature (deg C)	15
Receiving Water DO (mg/L)	8.5
DO WQ Standards (mg/L)	7
Chronic Mixing Dilution Factor	213.0
Time for effluent to travel from outfall to chronic mixing boundary (days)	0.016
Oxidation rate of BOD, base e at 20 deg C, k_1 (day^-1)*	0.23
OUTPUT	
Effluent Ultimate BOD (mg/L)	65.85
Oxidation rate of BOD at ambient temperature, base e (day^-1)	0.18
BOD oxidized between outfall and chronic mixing zone (mg/L)	0.19
RESULTS	
DO at chronic mixing zone	8.48
Difference between ambient DO and DO at chronic mixing boundary	0.02
There is no reasonable potential of not meeting the DO criteria under these conditions.	

Table D4: Marine Un-ionized Ammonia Criteria Calculation

Marine Un-ionized Ammonia Criteria Calculation

Calculation of seawater fraction of un-ionized ammonia from Hampson (1977). Un-ionized ammonia criteria for salt water are from EPA 440/5-88-004. Revised 19-Oct-93.

INPUT	
1. Receiving Water Temperature, deg C (90th percentile):	13.3
2. Receiving Water pH, (90th percentile):	8.0
3. Receiving Water Salinity, g/kg (10th percentile):	27.3
4. Pressure, atm (EPA criteria assumes 1 atm):	1.0
5. Unionized ammonia criteria (mg un-ionized NH_3 per liter) from EPA 440/5-88-004:	
Acute:	0.233
Chronic:	0.035
OUTPUT	
Using mixed temp and pH at mixing zone boundaries?	No
1. Molal Ionic Strength (not valid if >0.85):	0.560
2. pKa8 at 25 deg C (Whitfield model "B"):	9.310
3. Percent of Total Ammonia Present as Unionized:	2.0%
4. Total Ammonia Criteria (mg/L as NH_3):	
Acute:	11.54
Chronic:	1.73
RESULTS	
Total Ammonia Criteria (mg/L as N)	
Acute:	**9.49**
Chronic:	**1.43**

Total Inorganic Nitrogen Loading

Below is the output from https://steve-hood.shinyapps.io/TINcap/. Below that is the data that was uploaded. Yellow hightlighted data is the data used to calculate the TIN cap. The calculated annual cap is 74,900 lbs per year.

Table D5: TIN Cap Calculation

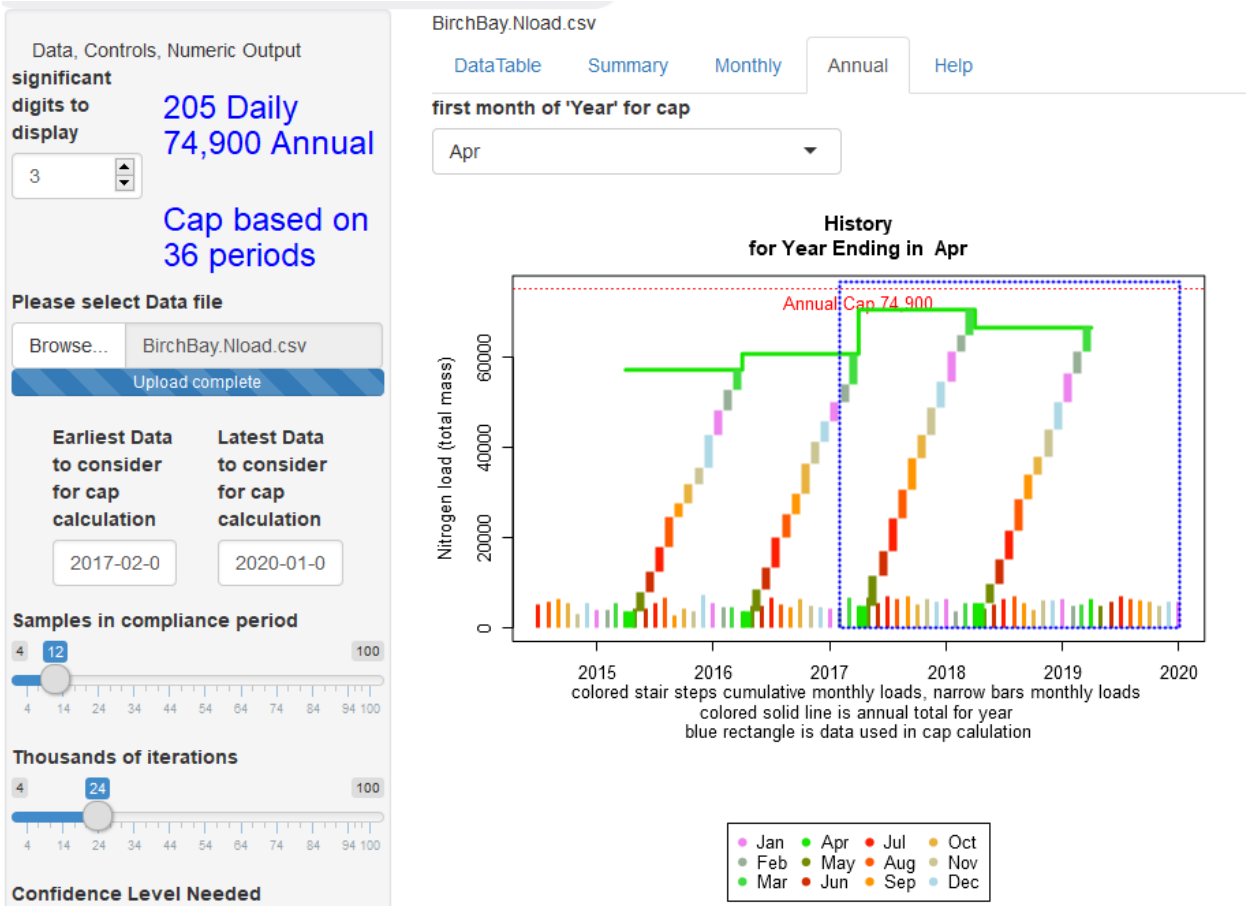

Table D6: Annual TIN Loads Compared to Annual Cap

Average Daily Loads used in Cap Calculation

Calculated Load	Begin Date of Month
163.2173815296	2014-07-01
182.7008772	2014-08-01
218.023901781	2014-09-01
177.147338337	2014-10-01
105.0442362144	2014-11-01
178.745768976	2014-12-01
127.205931732	2015-01-01
137.1765526026	2015-02-01
179.4843091692	2015-03-01
121.2148738836	2015-04-01
142.3551215628	2015-05-01
145.699713681	2015-06-01
178.168510872	2015-07-01
217.6242629922	2015-08-01
93.32903688	2015-09-01
139.5678645396	2015-10-01
118.8010926522	2015-11-01
234.410712	2015-12-01
177.7189249074	2016-01-01
159.624877824	2016-02-01
144.479886516	2016-03-01
127.2416987394	2016-04-01
155.074969974	2016-05-01
158.6213684916	2016-06-01
214.522892796	2016-07-01
166.5145931904	2016-08-01
151.83260232	2016-09-01
208.7366093028	2016-10-01
164.05143624	2016-11-01
146.11616616	2016-12-01
134.2629805248	2017-01-01
147.62695716	2017-02-01
215.371999872	2017-03-01
159.27641928	2017-04-01
214.2914074224	2017-05-01
187.79596668	2017-06-01
229.96183908	2017-07-01
203.20066809	2017-08-01
231.9210275112	2017-09-01
165.084214302	2017-10-01
208.8027013842	2017-11-01
184.303418208	2017-12-01
210.106395756	2018-01-01
135.838751634	2018-02-01
179.4788016	2018-03-01

Calculated Load	Begin Date of Month
179.1864771774	2018-04-01
141.9394447872	2018-05-01
177.6208138146	2018-06-01
204.3749237436	2018-07-01
227.867268096	2018-08-01
181.8137097	2018-09-01
124.1653568832	2018-10-01
202.15814724	2018-11-01
193.27420827	2018-12-01
208.00833615	2019-01-01
172.2833197326	2019-02-01
171.69519219	2019-03-01
209.2059379239	2019-04-01
159.2167829424	2019-05-01
196.34875344	2019-06-01
221.668141092	2019-07-01
203.1893844036	2019-08-01
204.30633942	2019-09-01
184.8196165032	2019-10-01
161.25967128	2019-11-01
190.944353376	2019-12-01
187.615268904	2020-01-01

Appendix E - Response to Comments

No comments were submitted to the Department of Ecology during the intial public notice of draft period.

Ecology revised the permit before issuance to include a cap on total inorganic nitrogen. A comment period on that revision began on June 10, 2020 and the response to comments will be summarized here after the comment period closes on XXXX.