Gulf Islands and Port Renfrew Wastewater Facilities Environmental Monitoring Program 2021 Report

Capital Regional District | Parks & Environmental Services, Environmental Protection

Prepared by:
Marine Programs

Capital Regional District
625 Fisgard Street, Victoria, BC V8W 2S6
T: 250.360.3000 F: 250.360.3079
www.crd.bc.ca

July 2022

GULF ISLANDS AND PORT RENFREW WASTEWATER FACILITIES
ENVIRONMENTAL MONITORING PROGRAM
2021 REPORT

EXECUTIVE SUMMARY

This report summarizes the 2021 results of the Wastewater and Marine Environment Program (WMEP) for the wastewater treatment plants (WWTP) operated by the Capital Regional District (CRD) in the Gulf Islands and Port Renfrew. Two of these WWTPs (Ganges and Schooner) discharge ultraviolet disinfected, secondary treated effluent; two WWTPs (Cannon and Port Renfrew) discharge secondary treated effluent; and one (Maliview) discharges secondary treated effluent mixed with fine-screened effluent during high flows. The program includes regular monitoring, as stipulated by the BC Ministry of Environment and Climate Change Strategy (ENV), either through permits or registrations under the Municipal Wastewater Regulation (*Environmental Management Act*). In addition, there are monitoring requirements under the federal Wastewater Systems Effluent Regulations (*WSER*) for the Ganges and Schooner treatment plants, as their average daily flow volumes exceed minimum thresholds.

The CRD also monitors all five WWTP influents and effluents on a monthly basis to assess treatment plant performance and predict risk to aquatic life and human health. Staff also monitor sludge (mixed liquor) from the Ganges WWTP facility to provide data to assist the CRD's Regional Source Control Program (RSCP). Finally, marine environment surface water monitoring is required every four years for these facilities to assess outfall performance and potential for impacts to human health. Surface water sampling is also required in the event of emergency or planned bypass/overflow.

GANGES WWTP

Final Effluent

The CRD analyzed wastewater influent and effluent for conventional and priority substances, plus effluent for acute toxicity. In 2021, none of the daily effluent flows from the Ganges WWTP exceeded the allowable maximum. Effluent quality met provincial and federal regulatory requirements for all carbonaceous biochemical oxygen demand (CBOD), total suspended solids (TSS), unionized ammonia, total residual chlorine and fecal coliform bacteria results. Similar to previous years, concentrations of total residual chlorine (used in washing the membranes) exceeded the permitted level in a number of samples, but this was most likely an artefact of taking the measurements using a relatively insensitive field-based test kit.

Of the 195 priority substances analyzed in effluent, 72 parameters were detected at standard detection limits (conventionals, nutrients, metals, acenaphthylene, phenanthrene, diethyl phthalate, alpha-terpineol). Effluent concentrations were within similar ranges relative to previous years. Most priority substances in the effluent were below the BC Water Quality Guidelines (BC WQG) before the predicted minimum receiving water dilution of 419:1. Only copper and zinc exceeded BC WQG in undiluted effluent. All substances were below BC WQG after the minimum dilution calculation was applied (the predicted concentration of effluent in the marine water column within the initial dilution zone [IDZ, the area up to 100 metres (m) away from the outfall].

Toxicity Testing

The effluent sample from July 2021 passed the 96-hour Rainbow trout acute toxicity test. This is consistent with previous years, with the exception of 2019 when the processes at the newly upgraded plant were still being optimized. The Daphnia acute toxicity test also passed, consistent with previous testing conducted from 2011-2020.

Sludge (Mixed Liquor)

Ganges WWTP sludge (mixed liquor) met the criteria for BC Organic Matter Recycling Regulations (OMRR) Class A Biosolids in 2021 for all regulated parameters except for copper, which slightly exceeded the criteria in March and April.

Receiving Water

Routine receiving water monitoring was last conducted at the Ganges WWTP in 2020. Monitoring is scheduled to be repeated next in 2024, unless there are planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter or one day duration in the summer.

Non-routine emergency receiving environment sampling was conducted following an extreme rain event in November 2021. Most results were above the single sample Enterococci limit of 70 CF/100mL, excepting the upstream control location. Because the upstream control location results from before the treatment plant were above the threshold, the impact of the overland spill could not be differentiated from already elevated levels.

Next Steps

Continue to share priority pollutant and sludge (mixed liquor) results with the RSCP.

MALIVIEW WWTP

Wastewater

The Maliview WWTP produces secondary treated effluent when instantaneous flows are equivalent to or less than 60 m^3/d. For instantaneous flows equivalent to or greater than 60 m^3/d, the plant produces a final effluent that is a blend of secondary treated and fine-screened effluents. As such, there are different regulatory limits for this facility depending on whether the flows are above or below 60 m^3/day. The flow-splitting process responds to instantaneous peak flows, rather than daily flows, and bypass events can occur despite total daily flows of less than 60 m^3/d. Bypass events occurred, despite flow being less than 60 m^3/d on 36% of the days in 2021. Flow also bypassed the secondary treatment process and received screening on days where the total flow was greater than 60 m^3/d, but the flow to the secondary treatment process was less than 60 m^3/d on 11% of the days. Exceedance of the allowable maximum of 250 m^3/d for total combined daily flows occurred on 1.1% of the days in 2021. Flow to the secondary treatment plant exceeded 60 m^3/d on 46% of the days in 2021, resulting in a portion of the effluent bypassing the secondary treatment process of the plant to be treated solely by fine screening.

The combined final effluent did not exceed low flow (<60 m^3/d) registration limits for TSS. CBOD exceeded limits in two monthly samples, representing 25% of the low flow sampling events. The combined final effluent did not exceed high flow (>60 m^3/d) registration limits for TSS and CBOD in any monthly samples. The remaining wastewater parameters were in compliance.

Toxicity Testing

Effluent from July 2021 failed the 96-hour trout acute toxicity test. As this is only the first time toxicity testing has been conducted on Maliview WWTP wastewater, further data will be required prior to drawing any conclusions.

Receiving Water

Routine receiving water monitoring was last conducted at the Maliview WWTP in 2020. Monitoring is scheduled to be repeated next in 2024, unless there are planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter or one day duration in the summer.

Non-routine emergency receiving environment sampling was not required in 2021.

Next Steps

Investigate ways to eliminate regulatory compliance violations. Staff and consultants are currently preparing a detailed design for a new treatment plant that will resolve flow and effluent quality issues. Grant funding or borrowing will be required to undertake these upgrades.

SCHOONER WWTP

Wastewater

The Schooner WWTP exceeded regulatory limits for flow 19 times in 2021, representing 5% of the year. All other regular, monthly effluent compliance parameters met regulatory criteria in 2021 during regular flow events. Field analyzed samples collected to confirm impact to treatment processes during overflow events were non-compliant for TSS.

Toxicity Testing

Effluent from July 2021 passed the 96-hour trout acute toxicity test.

Receiving Water

Routine receiving water monitoring was last conducted at the Schooner WWTP in 2020. Monitoring is scheduled to be repeated next in 2024, unless there are planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter or one day duration in the summer.

Non-routine emergency receiving environment sampling was conducted twice in 2021 following heavy rain events. All results were below regulatory guidelines.

Next Steps

Substantial upgrades to the Schooner WWTP and collection system are required to eliminate regulatory compliance violations for this facility. The CRD held a referendum in 2019 to borrow funds to complete the upgrades. The referendum was successful and design work is being undertaken for the overall upgrade to the Magic Lake wastewater system.

CANNON WWTP

Wastewater

The Cannon WWTP exceeded regulatory limits for flow 52 times in 2021, representing 14% of the year. All other effluent compliance parameters met regulatory criteria in 2021.

Toxicity Testing

Effluent from July 2021 passed the 96-hour trout acute toxicity test.

Receiving Water

Routine receiving water monitoring was last conducted at the Cannon WWTP in 2020. Monitoring is scheduled to be repeated next in 2024, unless there are planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter or one day duration in the summer.

Non-routine emergency receiving environment sampling was required twice in 2021, following two series of plant overflows occurring over three or more days. All results were well below monitoring guidelines.

Next Steps

As with the Schooner WWTP, the condition assessment conducted in 2011 noted several assets are nearing the end of their life and require upgrades. The CRD held a referendum in 2019 to borrow funds to complete the upgrades. The referendum was successful and design work for the upgrades to the overall Magic Lakes wastewater system is being undertaken.

PORT RENFREW WWTP

Wastewater

The Port Renfrew WWTP exceeded regulatory limits for flow four times in 2021, representing 1.1% of the year. All other effluent compliance parameters met regulatory criteria in 2021.

Toxicity Testing

Effluent from July 2021 passed the 96-hour trout acute toxicity test.

Receiving Water

Routine receiving water monitoring was scheduled at the Port Renfrew WWTP in 2020. However, due to extenuating circumstances (staffing availability), sampling was delayed. The receiving environment water sampling was conducted from the shoreline in spring/summer 2021. All results were below regulatory guidelines.

Non-routine emergency receiving environment sampling was not required in 2021.

Next Steps

CRD staff and consultants completed a feasibility study in 2015 to improve/increase the treatment plant capacity and ensure ongoing effective operation of the treatment plant and conveyance system into the future. Grant funding will be required in order to complete any upgrades to this system. Updates to the facility asset management plans are underway, and a phased implementation plan is anticipated pending funding.

GULF ISLANDS AND PORT RENFREW WASTEWATER FACILITIES
ENVIRONMENTAL MONITORING PROGRAM
2021 REPORT

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

GULF ISLANDS AND PORT RENFREW
WASTEWATER AND MARINE ENVIRONMENT PROGRAM
2021 REPORT

1.0 INTRODUCTION

This report summarizes the 2021 results of the Wastewater and Marine Environment Program (WMEP) for the wastewater treatment plants (WWTP) operated by the Capital Regional District (CRD) in the Gulf Islands and Port Renfrew. Two of these WWTPs (Ganges and Schooner) discharge ultraviolet disinfected, secondary treated effluent; two plants (Cannon and Port Renfrew) discharge undisinfected, secondary treated effluent; and one plant (Maliview) discharges undisinfected, secondary treated effluent combined with fine-screened effluent during high flows. The locations of these five facilities are presented in Figure 1.1. The WMEP includes regular monitoring, as stipulated by the BC Ministry of Environment and Climate Change Strategy (ENV) either through a permit or registrations under the Municipal Wastewater Regulation (MWR)[1]. In addition, effective January 1, 2013, new monitoring requirements came into effect under the federal Wastewater Systems Effluent Regulations (WSER) for the Ganges WWTP and Schooner WWTP facilities. The three remaining facilities (Maliview, Cannon and Port Renfrew WWTPs) do not require monitoring under the federal WSER, due to their low volumes of discharge. Monitoring is also conducted to assess treatment plant performance and potential for impacts to the marine environment, aquatic life and human health.

1.1 Wastewater Monitoring

Wastewater monitoring components are summarized in Table 1.1. WWTP-specific regulatory compliance limits for applicable parameters, and associated sampling and analytical methodologies, are discussed in the individual sections of this report.

1.1.1 Compliance and Treatment Plant Performance Monitoring

All wastewater discharges (effluents) were monitored for flow, total suspended solids (TSS), biochemical oxygen demand (BOD), carbonaceous biochemical oxygen demand (CBOD) and fecal coliform (FC) bacteria. All treatment plant influents were monitored for TSS, BOD and FC bacteria. Two plants (Schooner and Ganges) were monitored for additional parameters, such as ammonia (NH_3), pH and total residual chlorine.

1.1.2 Toxicity Testing

Annual toxicity testing is a requirement under the MWR registrations for the Ganges and Schooner WWTPs and was initiated on a voluntary basis for the remaining facilities beginning in 2021. Effluent from each treatment plant was collected in July 2021 and analyzed for toxicity to Rainbow trout (96-h LC50 test).

1.1.3 Priority Substances

Wastewater influent and effluent from the Ganges WWTP were analyzed for a list of priority substances, as stipulated in the MWR registration for this facility. Priority substance results were compared to water quality guidelines (WQG) set to protect aquatic life (BCMoE&CCS, 2017; 2019a). These data were also used to assess the quality of the final effluent and the effectiveness of the CRD's Regional Source Control Program (RSCP).

1.1.4 Treatment Plant Sludge (Mixed Liquor)

The Ganges WWTP produces sludge (mixed liquor) with the objective of meeting Class A Biosolids guidelines, in accordance with the pathogen reduction and vector attraction reduction processes in the BC Organic Matter Recycling Regulations (OMRR) (BCMoE&CCS, 2017b). Ganges WWTP sludge (mixed liquor) is a by-product of sewage treatment, which is de-watered prior to monitoring.

[1] formerly the Municipal Sewage Regulation of the *Environmental Management Act*

The intent of this mixed liquor monitoring was originally to assess suitability for land application. However, Ganges WWTP mixed liquor is currently transferred to a septage treatment facility on Vancouver Island and no land application takes place. Mixed liquor sampling (at a reduced frequency) is still of benefit to the RSCP to help assess the effectiveness of their various campaigns by providing partitioning information between the solid and liquid fractions of the treatment process.

Figure 1.1 - Ganges, Maliview Estates, Schooner Way, Cannon Crescent and Port Renfrew Outfall Locations

Outfall Pipe

N

CAPITAL REGIONAL DISTRICT
Environmental Services

Projection: Universal Transverse Mercator Zone 10 North
North American Datum 1983

December 22, 2005
Technologist: SR
Gan_Mal_Bck_Mag_PR_Outfalls.mxd

Ganges and Maliview

Galiano Island
Porlier Pass Dr
Maliview Outfall
Walkers Hook Rd
North End Rd
Stark Rd
Robinson Rd
Bullocks Lake
Lower Ganges Rd
Upper Ganges Rd
Mansell Rd
Long Harbour Rd
Rainbow Rd
GANGES
Nose Point Rd
Scott Point Dr
Fulford-Ganges Rd
Cranberry Rd
Ganges Outfall
Salt Spring Island
Cusheon Lake Rd
Cusheon Lake
Stewart Rd

0 0.5 1 2 3 4 5 Kilometers

Schooner Way and Cannon Crescent

North Pender Island
Galleon Way
Shoal Rd
Schooner Way
Buck Lake
Bosun Way
Bedwell Harbour Rd
Scarff Rd
Ketch Rd
Privateers Rd
Schooner Outfall
Magic Lake
Pirates Rd
Cannon Outfall

0 250 500 1,000 1,500 2,000 Meters

Port Renfrew

Deering Rd
Port Renfrew Outfall
Pacheena First Nation Reserve
PORT RENFREW
Parkinson Rd
Juan de Fuca Electoral Area

0 50 100 200 300 400 500 Meters

Table 1.1 Summary of 2021 Wastewater and Surface Water Components of the Gulf Islands and Port Renfrew WMEP

Component	Parameter	Frequency and Stations
Wastewater	Flow	Daily: **Ganges**, **Maliview**, **Schooner**, **Cannon**, **Port Renfrew**
	Provincial compliance and treatment plant performance monitoring: • Influent: TSS, BOD, fecal coliform • Secondary Effluent: TSS, fecal coliform • Disinfected Secondary Effluent: TSS, BOD, CBOD, fecal coliform, NH_3, pH	Once per month: **Ganges**, **Schooner**
	Provincial compliance and treatment plant performance monitoring: • Influent: TSS, BOD, fecal coliform • Secondary Effluent: TSS, BOD, CBOD, fecal coliform, NH_3, pH • Combined Final Effluent (Secondary + Fine-screened): TSS, BOD, CBOD, fecal coliform, NH_3, pH	Once per month: **Maliview**
	Provincial compliance and treatment plant performance monitoring: • Influent: TSS, BOD • Secondary Effluent: TSS, BOD, CBOD, fecal coliform, NH_3, pH	Once per month: **Ganges, Maliview, Schooner, Cannon**, **Port Renfrew**
	Federal compliance monitoring: • Final Effluent: TSS, CBOD, unionized ammonia @ 15ºC, total residual chlorine	Once per month (reported quarterly): **Ganges, Schooner**
	Influent and effluent priority substances	Once per year: **Ganges**
	Effluent toxicity	Once per year: **Ganges Harbour**, **Schooner**
	Sludge (mixed liquor)	Once per month: **Ganges**
Receiving Water	Surface water indicator bacteria (fecal coliform and enterococci)	**Ganges WWTP** five days of sampling in a 30-day period* **Maliview WWTP** five days of sampling in a 30-day period* **Schooner WWTP** five days of sampling in a 30-day period* **Cannon WWTP** five days of sampling in a 30-day period* **Port Renfrew WWTP** five days of sampling in a 30-day period* (delayed to 2021 due to staffing availability limitations)

Notes:
*Receiving water sampling was conducted in 2020, and is next required in 2024, unless there are planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter and one day duration in the summer. Port Renfrew receiving water was sampled in 2021 in lieu of 2020.

1.2 Receiving Water Monitoring

Receiving environment monitoring was not historically undertaken routinely for all five of the small CRD wastewater facilities. In 2010, discussions with ENV led to the requirement for such monitoring, with the inter-year frequency of monitoring dependent on the size of the facility. In addition, intra-year sampling frequency was changed from monthly to five sets of daily samples collected over a 30-day period (5-in-30) to allow for a more direct comparison of bacterial indicators to relevant human health protection criteria. In addition, enterococci are now analyzed as well as fecal coliforms, as enterococci persist longer in the marine environment and have a more direct link to human health impacts.

For the five small facilities that are the subject of this report, the monitoring programs were added and/or revised to comprise a 5-in-30 sampling program once every four years. Emergency sampling is also required after planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter or one day duration in the summer. If the results from a single day of emergency sampling indicate no impact to the receiving environment (i.e., results less than human health guidelines), then no repeat emergency sampling is required for similar events of the same duration or less during that same wet weather season. If impacts are observed during the emergency sampling (i.e., results higher than human health guidelines), then sampling must repeat every few days until all results are below human health guidelines.

Pre-2010 monitoring programs sampled surface water only (0.5 to 1 m below the surface). The receiving water sampling programs now include sampling of near-surface stations at a depth mid-way between the surface and seafloor, in addition to surface samples, at stations at the edge of the initial dilution zone (IDZ). The IDZ is defined as the area 100 m around the outfall and is where BC WQG must be met. In addition to the IDZ sampling stations, surface samples are collected at two stations approximately 200 m up-current and down-current from the outfalls.

The 2021 sampling year represents year one of the current round of this four-year monitoring cycle, and routine receiving environment monitoring was not required for any facilities, with the exception of the Port Renfrew WWTP. Sampling at Port Renfrew WWTP was originally scheduled for 2020, consistent with the other facilities. This receiving environment sampling was delayed from 2020 to 2021 due to staffing and boat availability limitations, and in 2021 was conducted as shoreline marine monitoring. The next routine 5-in-30 sampling, as per the four-year cycle, will be required in 2024.

Emergency or non-routine sampling was required at the Ganges, Schooner, and Cannon WWTPs in 2021. The samples were analyzed for enterococci and results were compared to Health Canada (Health Canada, 2012) and ENV (MoE&CCS, 2019b) regulatory requirements for enterococci, which state the geomean should not exceed 35 CFU/100mL, while no single sample should exceed 70 CFU/100 mL.

2.0 METHODOLOGY

2.1 Wastewater Monitoring

COMPLIANCE AND TREATMENT PLANT PERFORMANCE MONITORING

Influent and effluent samples from all five facilities were collected as grab samples at the frequency noted in Table 1.1.

Laboratory analyses were conducted at the McLoughlin Point WWTP laboratory, the Saanich Peninsula WWTP laboratory or Bureau Veritas Laboratories (BV Labs, Burnaby, BC) (formerly Maxxam Analytics Ltd.). TSS was determined gravimetrically using glass fiber filters dried at 105°C (APHA, 1998). BOD was determined by five-day oxygen depletion at 20°C using an oxygen meter (APHA, 1998). CBOD was determined by five-day oxygen depletion at 20°C with TCMP [2-chloro-6-(trichloro methyl) pyridine] as a nitrification inhibitor and using an oxygen meter (APHA, 1998). Fecal coliforms were enumerated using 0.45 µm membrane filters incubated on mFC medium at 44.5°C for 24 hours (APHA, 1998). Enterococci spp. was determined by membrane-filtration technique, followed by incubation on mEI agar (an enzyme substrate medium) for 24 hours at 41°C. Nitrite was determined by diazotization colourimetry. Nitrate was determined by cadmium reduction, followed by diazotization colourimetry. The concentration of unionized ammonia was calculated using the measured concentration of total ammonia and the pH corrected to 15ºC.

Means reported for fecal coliform and enterococci are geometric (logarithmic) means. Means for all other parameters are arithmetic. Mean daily loadings were calculated from mean concentrations and mean daily flows. Annual loadings were calculated from mean concentrations and total annual flows. Values of half the detection limit were used for non-detect results.

TOXICITY TESTING

Effluent toxicity samples for each of the WWTPs were collected by grab sampling. Testing was conducted using standardized and approved protocols by Nautilus Environmental (Burnaby, BC). Effluent toxicity was determined using the 96-hour acute toxicity test (EPS 1/RM/13) with juvenile Rainbow trout (*Oncorhynchus mykiss*). Five effluent concentrations plus one control were tested, with 10 test organisms per concentration. The number of organisms surviving over the testing period was recorded.

An additional toxicity test was conducted at the Ganges WWTP only. Effluent toxicity was further assessed using the 48-hour acute toxicity test (EPS 1/RM/14 with 2016 amendments) with <24-hour old neonate *Daphnia magna*. Five effluent concentrations plus one control were tested, with 10 test organisms per concentration. The number of organisms surviving over the testing period was recorded.

PRIORITY SUBSTANCES

At Ganges WWTP, influent and effluent samples were collected as composite samples for priority substance analysis at routine detection limits. The composite samples were collected by an ISCO automated sampler, with 400 mL of wastewater collected every 30 minutes over a 24-hour period. The composite samples were then split into smaller sample bottles for individual analyses and preserved before shipping to BV Labs. An additional grab sample was collected for those parameters not suited for composite collection. Analytical detection limits were chosen to allow for comparison to BC WQG.

SLUDGE (MIXED LIQUOR)

Dewatered sludge (mixed liquor) at Ganges WWTP was sampled on a monthly basis and analyzed for 29 metals and moisture content by CARO Analytical Services (Richmond, BC). Results were compared to the BC OMRR (BCMoE&CCS, 2017b) biosolids limits. These regulations stipulate the land uses that are acceptable for the tested biosolids according to the concentrations of a select group of substances. The regulations are set to protect human and environmental health.

2.2 Receiving Water Monitoring

RECEIVING WATER SURFACE WATER MONITORING

Routine receiving environment sampling was undertaken in 2020, as agreed upon with ENV, for all facilities except the Port Renfrew WWTP, which was delayed due to staffing issues. Routine receiving environment 5-in-30 sampling at this facility was conducted in 2021 as marine shoreline sampling.

Non-routine emergency shoreline sampling was conducted at the Ganges WWTP following extreme rain events at the stations indicated on Figure 2.1.

Non-routine emergency marine sampling was conducted in 2021 after wet weather overflows that exceeded three days' duration in the winter at the Schooner Cove WWTP and at the Cannon Crescent WWTP. On each sampling date, receiving water samples were collected at six offshore stations around each outfall (Figure 2.2 and Figure 2.3):

- Four stations located at the edge of the IDZ (i.e., 100 m from the end of the outfall) to the SW, NW, NE and SE, and sampled at two depths: 1 m below the surface and mid-way between the surface and the seafloor.
- Two stations located 200 m from the end of the outfall and sampled at 1 m below the surface only.

Surface samples were collected in sterile, wide-mouth bottles by rapidly submerging open, upright bottles attached to a pole. Subsurface samples were collected using a vertically oriented Niskin bottle and then decanted into sterile, wide-mouth bottles.

Bacteriology (enterococci) was analyzed at the Bureau Veritas laboratory using the same methods as those used for wastewater. Values of half the detection limit were used for each non-detect result.

Results were compared to the values specified by ENV (BCMoE&CCS, 2019a) and by Health Canada (Health Canada, 2012), as a means to assess potential human health risks (Section 1.2).

Routine 5-in-30 marine shoreline sampling at the Port Renfrew WWTP (Figure 2.4) and non-routine emergency shoreline sampling at the Ganges WWTP (Figure 2.1) was conducted using the same method described above, but sampling stations were located within reach of the shoreline, and samples were collected by hand by a technician.

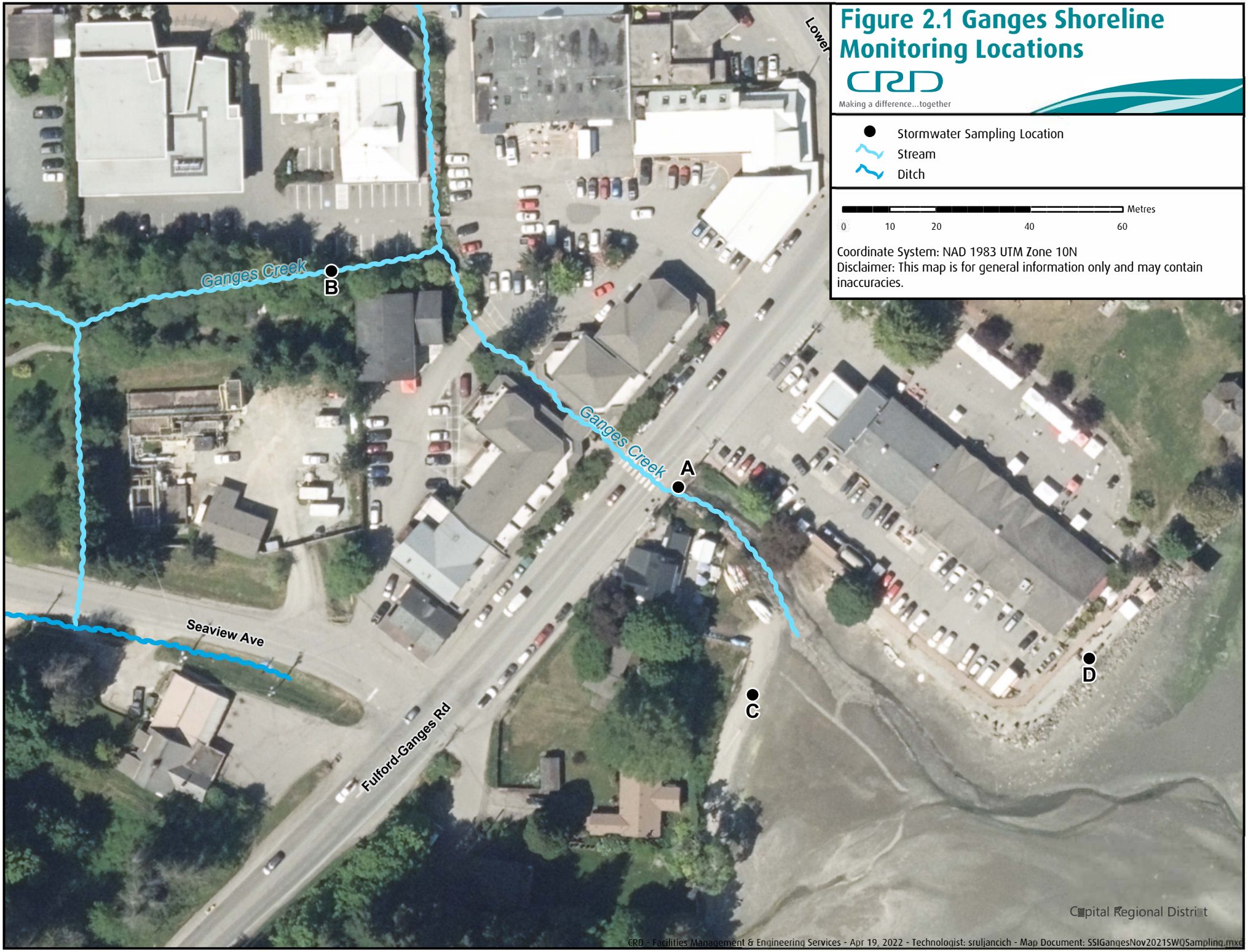


Figure 2.1 Ganges Shoreline Monitoring Locations
CRD
Making a difference...together
Stormwater Sampling Location
Stream
Ditch
Metres
0
10
20
40
60
Coordinate System: NAD 1983 UTM Zone 10N
Disclaimer: This map is for general information only and may contain inaccuracies.
Lower
Ganges Creek
Ganges Creek
Ganges Creek
A
B
C
D
Seaview Ave
Fulford-Ganges Rd
Capital Regional District
CRD - Facilities Management & Engineering Services - Apr 19, 2022 - Technologist: sruljancich - Map Document: SSIGangesNov2021SWQSampling.mxd

Figure 2.2 Schooner Way Surface Water Monitoring Locations

Outfall Pipe

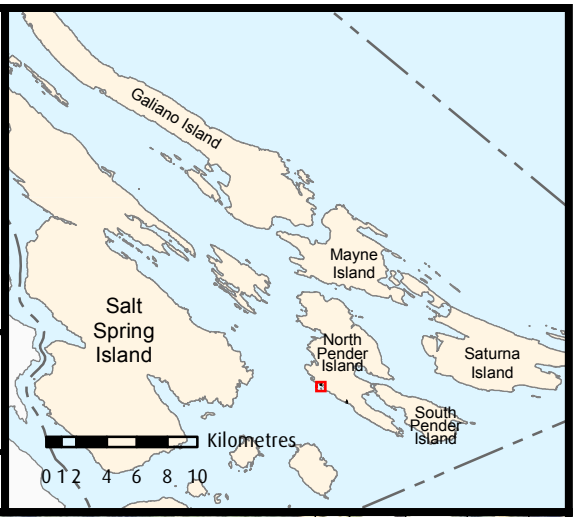
01 = Sampling Station

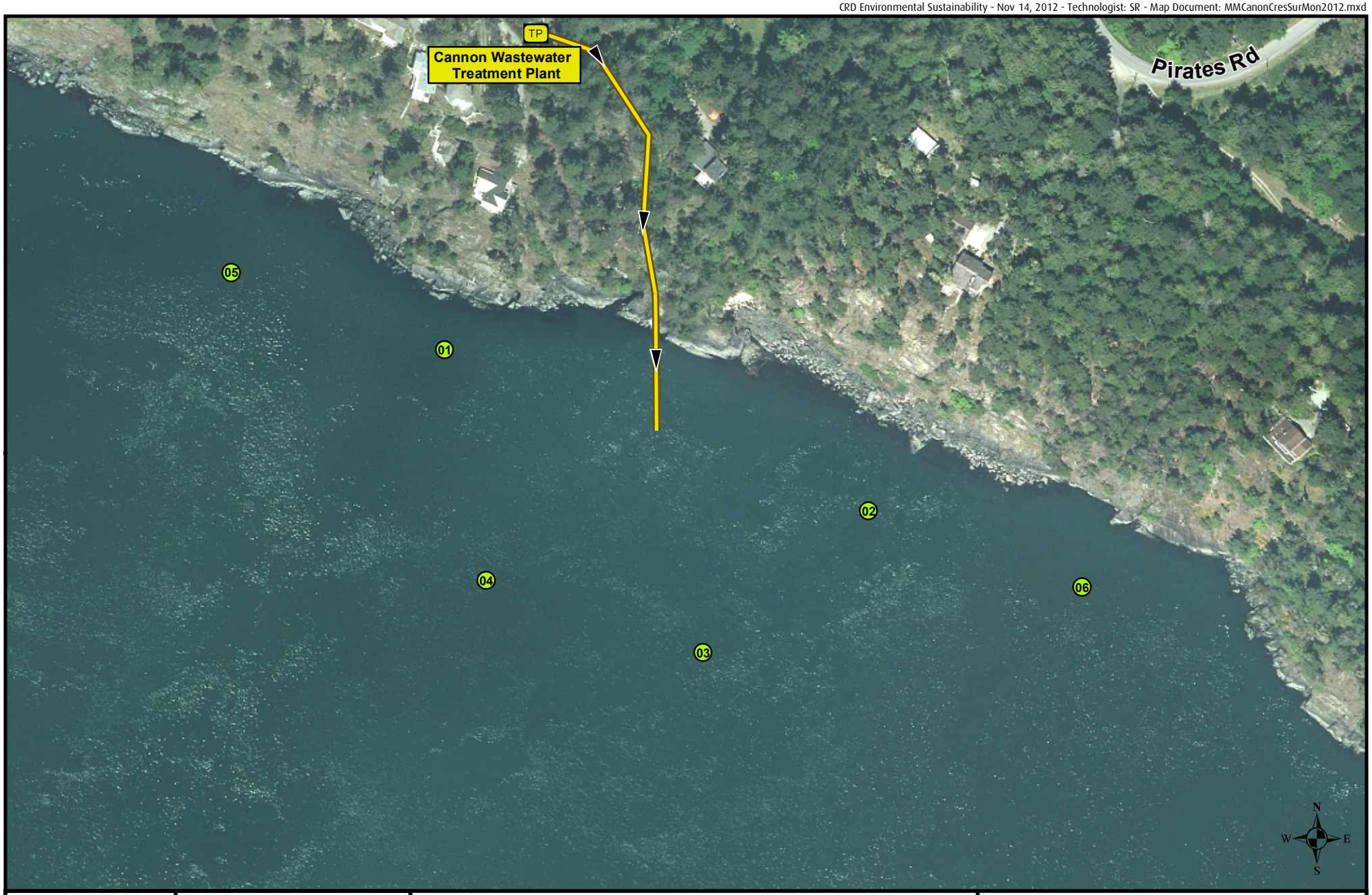
Making a difference...together

Metres

0 10 20 40 60 80 100

Projection: UTM ZONE 10N NAD 83





Making a difference...together

Metres

0 12.5 25 37.5 50

Projection: UTM ZONE 10N NAD 83

Sampling Stations

Outfall Pipe

Figure 2.3 CANNON CRESCENT SURFACE SAMPLING

Figure 2.4 Port Renfrew Shoreline and Receiving Water Station Locations

Sampling Station — Outfall Pipe

Making a difference...together

Metres
0 25 50 100 150 200 250
Projection: UTM ZONE 10N NAD 83

PRS-06
PRS-05
PRS-04
PRRW-03
PRRW-06
PRRW-02
PRRW-04
PRS-03
PRRW-05
PRRW-01
PRS-01
PRS-02
Clo-Oose Dr
Harris Cove Rd
Deering Rd
Queesto Dr
Tsonoqua Dr
Tsonoqua Dr
Klanamith St
Parkinson Rd
Deering Rd
Capital Regional District

CRD - Facilities Management & Engineering Services - Jun 30, 2021 - Technologist: sruljancich - Map Document: SurfaceSamplesPortRenfrew2021.mxd

3.0 GANGES WWTP

3.1 Introduction

The Ganges WWTP is located on the east side of Salt Spring Island (Figure 1.1). It discharges ultraviolet (UV) disinfected secondary treated effluent into Ganges Harbour through a 4,800 m outfall at a depth of 16 m. Because the average daily flow of this facility exceeds 100 m^3/day, both provincial and federal regulatory requirements must be met by this facility. Total residual chlorine must also be measured, but only when chlorine is used when washing the membranes.

The facility is regulated under BC MWR Registration RE-05521, dated April 28, 2005. Provincial and Federal regulatory requirements are described in Table 3.1.

Table 3.1 Ganges WWTP Regulatory Requirements

Parameter	Regulatory Requirement	
	Provincial	Federal
Maximum daily flow	<1,198 m^3/d	---
CBOD	max 25 mg/L	average 25 mg/L
TSS	max 25 mg/L	average 25 mg/L
Fecal coliform	max 1,000 CFU/100 mL	---
Unionized ammonia @15°C	---	max 1.25 mg/L
Total residual chlorine	---	average 0.02 mg/L
Toxicity test	96-hr Rainbow trout (pass)	---

This registration also has a requirement for receiving water monitoring. Routine monitoring was last required for this facility in 2020 and is next required in 2024.

It is anticipated that sampling will not be required again until 2024, unless there are planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter and one day duration in the summer.

The following section reports the results from the Ganges treatment plant WMEP (Table 3.2).

Table 3.2 Ganges Treatment Plant WMEP

Component	Parameter	Frequency
Wastewater	Flow	Daily
	Provincial compliance and treatment plant performance monitoring: • Influent: TSS, BOD, fecal coliform • Secondary effluent: TSS, fecal coliform • Disinfected secondary effluent: TSS, BOD, CBOD, fecal coliform, ammonia, pH	Once per month
	Effluent toxicity: • Rainbow trout 96-hour • *Daphnia magna* 48-hour	Once per year
	Federal compliance monitoring: • Final effluent: TSS, CBOD, unionized ammonia, total residual chlorine	Once per month
	Influent and effluent priority substances[1]	Once per year
	Sludge (mixed liquor)	Once per month
Receiving Water	Indicator bacteria (fecal coliform and enterococci)	2024, 2028, 2032

Notes:
[1]All priority substances are listed in Appendix A3

3.2 Results

3.2.1 Wastewater Monitoring

COMPLIANCE AND TREATMENT PLANT PERFORMANCE MONITORING

In 2021, all daily flows met regulatory limits for the Ganges WWTP (Table 3.3 and Appendix A1).

Compliance and treatment plant monitoring data (Table 3.4, Appendix A2) show that effluent quality was consistent with previous years for all parameters (CRD, 2011 to 2020). There were no exceedances of TSS, following replacement of the old membranes of the treatment plant in 2018. All other compliance parameters also met regulatory limits. Overall, the treatment plant removed approximately >99% of the TSS and >99% of the fecal coliform bacteria from the influent.

Total residual chlorine was measured 10 times in 2021, as part of federal regulations, to monitor levels resulting from chlorine used to clean the treatment plant membranes. Concentrations of total residual chlorine exceeded the permitted level 70% of the time in disinfected secondary effluent. However, this was most likely an artefact, due to measurements taken using a relatively insensitive field-based test kit that has a detection limit exactly the same as the federal guideline of 0.02 mg/L. The reliability of test kit results near the detection limit is low. CRD staff are investigating alternative chlorine test methods for use in the future.

Compliance data was reported to ENV on a monthly basis, with individual environmental impact reports (EIR) issued if there was an incident at the plant. There were two EIRs issued at Ganges WWTP in 2021, as a result of:

- High influent flow resulting in bypass of the MBBR (moving bed biofilm reactor) treatment process (November 9);
- High influent flow resulting in treatment bypass from November 14-16. Additionally, facility permeate was discharged overland into Ganges Creek.

Table 3.3 Ganges WWTP 2021 Annual Flow Summary

Month	Mean Flow (m^3/d)	Minimum Flow (m^3/d)	Maximum Flow (m^3/d)	Total Flow (m^3)	Number of Samples	Permit Violations (%)
January	524	367	753	16,259	31	0
February	478	409	602	13,385	28	0
March	437	385	540	13,541	31	0
April	420	352	473	12,596	30	0
May	390	335	461	12,086	31	0
June	425	351	462	12,763	30	0
July	439	392	504	13,613	31	0
August	452	377	496	14,011	31	0
September	460	356	565	13,813	30	0
October	476	400	650	14,749	31	0
November	630	425	1,081	18,909	30	0
December	469	347	619	14,546	31	0
Annual	466	335	1,081	170,271	365	**0**

Notes:
Provincially regulated maximum daily flow = 1,198 m^3/d

Table 3.4 Ganges WWTP 2021 Compliance and Treatment Plant Performance Monitoring Annual Summary

Source	Compliance Monitoring				Treatment Plant Performance Monitoring				
	Flow (m^3/d)	TSS (mg/L)	CBOD (mg/L)	Fecal Coliform (CFU/100 mL)	BOD (mg/L)	Ammonia (mg N/L)	Unionized Ammonia @15°C (mg/L N)	Total Residual Chlorine (mg/L)	pH
Influent									
Regulatory limit	---	---	---	---	---	---	---	---	---
Mean	466	331	---	17,104,001	366	---	---	---	---
Minimum	335	247	---	5,700,000	230	---	---	---	---
Maximum	1081	460	---	37,000,000	510	---	---	---	---
Regulatory violations (%)	---	---	---	---	---	---	---	---	---
Number of samples	365	12	---	12	12	---	---	---	---
Secondary effluent									
Regulatory limit	---	---	---	---	---	---	1.25	0.02	---
Mean	466	1	---	575	---	---	---	---	---
Minimum	335	1	---	29	---	---	---	---	---
Maximum	1,081	3	---	1,794	---	---	---	---	---
Percent reduction (from influent)	---	100	---	100	---	---	---	---	---
Regulatory violations	---	---	---	---	---	---			---
Number of samples	365	12	---	12	---	---			---
Disinfected secondary effluent									
Regulatory limit	1,198	25	25	1,000	---	---	1.25	0.02	---
Mean	466	1.0	1.1	0.9	2	5.52	0.0200	0.04	7.3
Minimum	335	<1	<2	<1	<2	0.02	<0.0005	0.02	7.0
Maximum	1,081	<1	2.1	1	<2	22	0.11	0.08	7.6
Percent reduction (from influent)	---	100	---	100	99	---	---	---	---
Regulatory violations (%)	0	0	0	0	---	---	0	70	---
Number of samples	365	12	12	12	12	12	12	10	12

TOXICITY TESTING

In 2021, disinfected effluent from July passed the 96-hour Rainbow trout acute toxicity test. This is consistent with previous years, with the exception of 2019, when toxicity tests failed as operations staff were adjusting the performance of the upgraded aeration system and were experiencing challenges with ammonia levels. These issues have now been fully resolved.

As in previous years (2012-2020), disinfected effluent from July passed the 48-hour *Daphnia magna* acute toxicity test, corresponding to an LC50 of >100%. The *Daphnia* test is not required, but was conducted to maintain consistency with other CRD discharge monitoring programs where toxicity testing is required.

PRIORITY SUBSTANCES

Of the 195 priority substances analyzed in Ganges WWTP effluent (Appendix A3), 72 parameters were detected at standard detection limits, (conventionals, nutrients, metals, acenaphthylene, phenanthrene, diethyl phthalate, alpha-terpineol). Influent results can also be found in Appendix A3.

In 2021, most priority substance concentrations in the Ganges WWTP effluent were below BC WQG (BCMoE&CCS, 2017a and 2019a) in undiluted effluent, before discharge to the environment (Appendix A3). Only copper and zinc exceeded BC WQG in undiluted effluent. All substances were below BC WQG after the near surface dilution factor of 419:1 was applied. This 419:1 dilution factor was determined by oceanographic modelling and is the predicted dilution factor to occur near the surface at the edge of the outfall IDZ (Seaconsult Marine Research Ltd, 1994).

SLUDGE (MIXED LIQUOR)

Results of sludge (mixed liquor) analysis were compared to BC OMRR Biosolids Class A criteria to assess the quality of the sludge produced at the Ganges WWTP (Appendix A4). This class rating identifies biosolids as the highest quality that can be produced according to ENV requirements. Class A Biosolids can be used in land applications (limits are set to protect human and environmental health) with an approved land application plan. Ganges WWTP mixed liquor is not applied to land but is transferred to a Vancouver Island septage treatment facility for disposal. However, the mixed liquor monitoring results are still valuable information for the RSCP to help assess the success of their codes of practice (e.g., those in place for dental offices).

The 2021 Ganges treatment plant sludge (mixed liquor) results for regulated parameters had concentrations well below the criteria for Class A Biosolids, except for copper which exceeded regulatory criteria in March and April. Historically, mercury levels have been elevated at times in Ganges sludge, but these have declined steadily over time (Figure 3.1).

3.2.2 Receiving Water Monitoring

RECEIVING WATER BACTERIA INDICATORS

There was no routine receiving water monitoring required at the Ganges WWTP in 2021.

Non-routine emergency monitoring was required following an extreme rain event in November 2021 that resulted in bypass of treatment works and discharge of facility permeate directly into Ganges Creek. Samples were collected from the creek before and after passage by the treatment plant, as well as along the shoreline where the creek discharges (Figure 2.1) on November 18th, with results in Table 3.5.

Most results (Table 3.5) were above the single sample Enterococci limit of 70 CF/100mL. Because the upstream control location results from before the treatment plant were above the threshold, the impact of the overland spill could not be differentiated from already elevated levels, and no further sampling was undertaken.

Table 3.5 Ganges WWTP 2021 Receiving Water Summary

Station	Enterococci (CFU/100 mL) Nov 18, 2021
A: Ganges Creek under bridge	440
B: Ganges Creek behind treatment plant, as reference sample	250
C: Beach near creek outlet	330
D: Shoreline marine sample, around the beach from Ganges Creek outlet	43

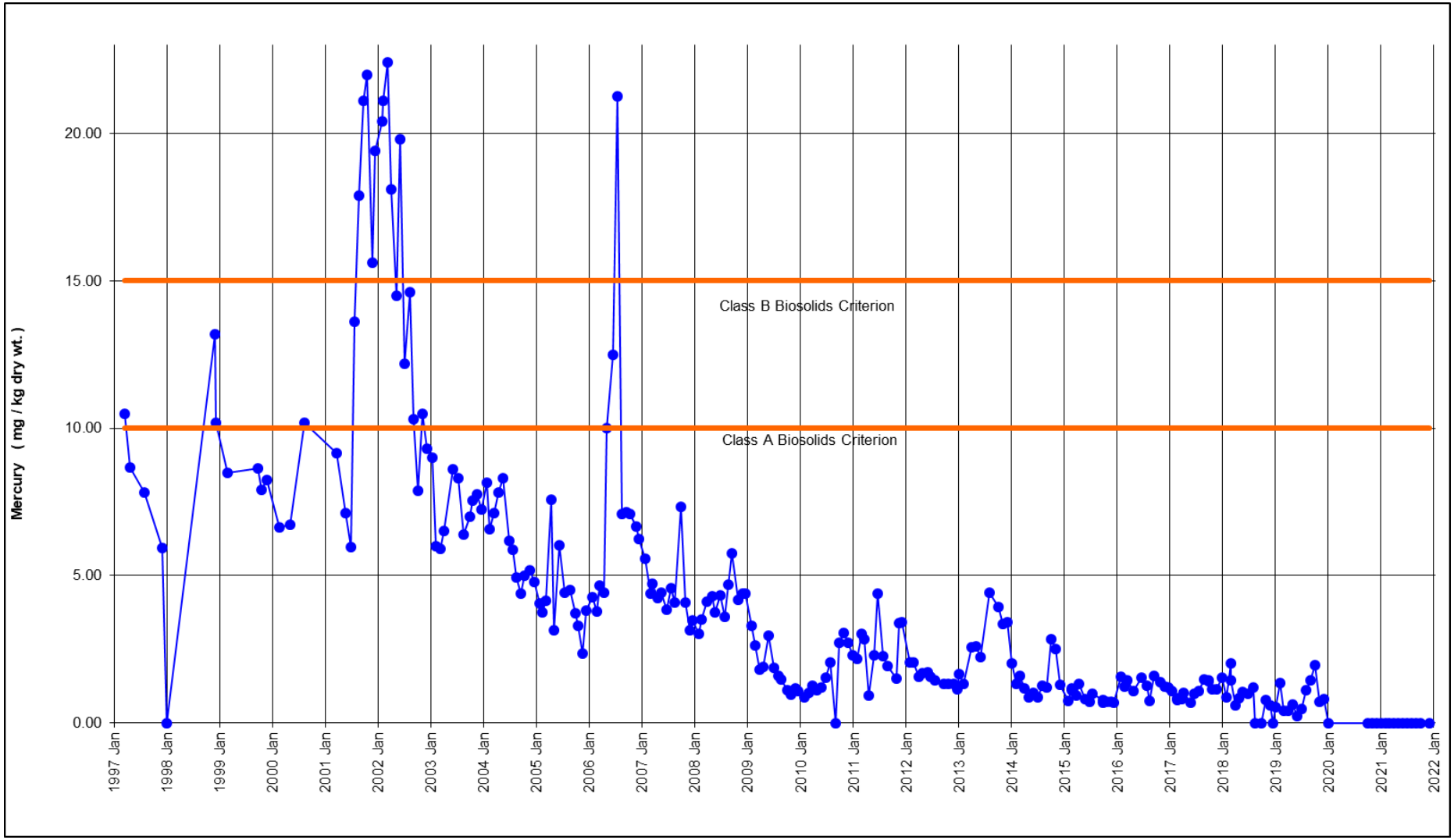


Figure 3.1 Ganges WWTP Mixed Liquor Mercury Levels (1997 to 2021)

3.3 Recommendations

CONTINUE TO SHARE RESULTS WITH THE CRD REGIONAL SOURCE CONTROL PROGRAM

Effluent priority pollutant and sludge (mixed liquor) results are valuable to the RSCP. Effluent priority pollutant monitoring is a requirement of the provincial registration for this facility and must continue, but sludge (mixed liquor) monitoring is not. It is recommended that sludge (mixed liquor) sampling continue to allow the RSCP to assess the effectiveness of their initiatives.

4.0 MALIVIEW WWTP

4.1 Introduction

The Maliview WWTP is located on the east side of Salt Spring Island (Figure 1.1). It discharges treated effluent into Trincomali Channel through a 213 m outfall at a depth of 14 m below sea level. The original primary treatment plant was upgraded to a secondary treatment facility in July 2006.

The facility is registered under BC MWR Registration RE-00242, as amended in June 2007.

Flows up to 60 m^3/d receive secondary treatment using the rotating biological contactor (RBC) and flows greater than 60 m^3/d (greater than twice the mean daily dry weather flow) receive preliminary treatment using fine screens. Both effluent streams are combined before discharge. Blending effluent streams is an option available under the MWR to deal with high effluent flows. Historically (prior to 2013), monitoring was done separately on the RBC and fine-screened portions of the effluent, and final effluent quality was predicted using a combination of the two effluent quality results and the relative flow volumes. In December 2012, a sampling point was installed that allowed for direct sampling of the combined final effluent quality. As such, the fine-screened effluent sampling point was abandoned in 2013 and replaced with the new combined final effluent sampling point. Compliance requirements are as follows:

Table 4.1 Maliview WWTP Regulatory Requirements

Parameter	Regulatory Requirements	
Maximum daily secondary flow	60 m^3/d	
Maximum daily fine-screened flow	190 m^3/d	
Maximum daily total flow	250 m^3/d	
	Flows up to 60 m^3/d	**Flows over 60 m^3/d**
Maximum CBOD	45 mg/L	130 mg/L
Maximum TSS	45 mg/L	130 mg/L

This registration also has a requirement for receiving water monitoring. Routine monitoring was last required for this facility in 2020 and is next required in 2024.

It is anticipated that sampling will not be required again until 2024, unless there are planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter and one day duration in the summer.

The following section reports the results from the Maliview treatment plant WMEP (Table 4.2).

Table 4.2 Maliview Treatment Plant WMEP

Component	Parameter	Frequency
Wastewater	Flow	Daily
	Compliance and treatment plant performance monitoring: • Influent: TSS, BOD, fecal coliform • Secondary fine-screened effluent: TSS, BOD, CBOD, fecal coliform, NH_3, pH • Combined final effluent: TSS, BOD, CBOD, fecal coliform, NH_3, pH	Once per month
	Effluent toxicity (voluntary): • Rainbow trout 96-hour	Once per year
Receiving Water	Indicator bacteria (fecal coliform and enterococci)	2024, 2028, 2032

4.2 Results

4.2.1 Wastewater Monitoring

COMPLIANCE AND TREATMENT PLANT PERFORMANCE MONITORING

Flow data, including exceedances, are summarized for effluent discharged from the fine screens (bypassing the secondary treatment unit) in Table 4.3, for the secondary treatment unit in Table 4.4, and for the entire facility in Table 4.5. The complete flow data set is presented in Appendix B1.

The RBC component of the Maliview WWTP was not designed to treat the volume of effluent that it presently receives, particularly when it is rainy and significant inflow and infiltration (I&I) enters the conveyance system. In addition, the process that splits flow between the RBC and the fine screens responds to instantaneous peak flows, rather than total daily flows. This results in frequent fine-screening events on days that the RBC unit is not operating at full capacity, as measured by the total daily flow.

Total effluent flows discharged from the Maliview treatment plant exceeded the permitted allowable maximum of 250 m^3/d on four days (1.1% of the time) in 2021. Flow bypassed the secondary treatment process and received fine screening only, despite a secondary flow of less than 60 m^3/d, on 130 days (36% of the time).

CRD staff and a contracting engineer are developing a detailed design for an upgrade to the facility to increase capacity and treatment reliability. The chosen solution has been fed into short-, medium- and longer-term upgrade plans. It should also be noted that repairs were made in summer 2019 to the upstream conveyance system to reduce I&I. Since these repairs, the frequency and volume of flow limit exceedances have been substantially reduced; wet weather peak flows have been reduced to almost half of previous years, but extreme wet weather will still lead to overflows.

Compliance data was reported to ENV on a monthly basis, with EIRs issued if there was an incident at the plant. There were 9 EIRs issued at Maliview WWTP in 2021, as a result of:

- power outage leading to short bypass of treatment works (January 13);
- CBOD exceedance (April 20, May 18, June 22, July 20);
- electrical fault resulting in shut down of the treatment process (August 31);
- RBC offline, CBOD and TSS exceedances (September 21);
- extreme rain event resulting in unscreened overflow, effluent exceedance, combined with power outage (November 14-16);
- extreme rain event resulting in overflow (November 28).

Compliance and treatment plant monitoring data is summarized in Table 4.6 and the complete data set is presented in Appendix B2. The secondary treatment unit removed approximately 83% of the TSS, 94% of fecal coliform and 85% of total BOD. The combined final effluent did not exceed low flow (<60 m^3/d) limits for TSS. CBOD exceeded low flow limits on two sampling days, representing 25% of the low flow sampling

events. The combined final effluent did not exceed high flow (>60 m^3/d) limits for TSS and CBOD on any of the sampling days.

TOXICITY TESTING

Beginning in 2021, toxicity testing was conducted at each of the Gulf Islands/Port Renfrew facilities in order to maintain consistency across the region. The effluent sample from July 20, 2021, failed the 96-hour Rainbow trout acute toxicity test. As this is the first year of toxicity testing at this facility, further data is required to draw conclusions. The toxicity test was not ammonia stabilized, which may be considered for future years, until the plant upgrades are completed.

Table 4.3 Maliview WWTP 2021 Fine-screened Effluent Flow Summary

Month	Mean Daily Flow (m^3/d)	Min Daily Flow (m^3/d)	Max Daily Flow (m^3/d)*	Total Flow (m^3)
January	53	5	134	1,641
February	39	11	101	1,099
March	16	6	40	483
April	2	0	11	73
May	0	0	0	0
June	0	0	0	0
July	0	0	0	0
August	0	0	0	0
September	0	0	0	0
October	3	0	60	101
November	99	4	348	2,970
December	75	33	201	2,317
Annual	**24**	**0**	**348**	**8,682**

Notes:
*Permitted maximum daily flow = 190 m^3/d

Table 4.4 Maliview WWTP 2021 Secondary Effluent Flow Summary

Month	Mean Daily Flow (m^3/d)	Min Daily Flow (m^3/d)	Max Daily Flow (m^3/d)*	Total Flow (m^3)
January	84	65	95	2,615
February	60	45	77	1,675
March	60	27	67	1,866
April	52	34	61	1,564
May	40	31	50	1,234
June	32	3	40	966
July	31	19	44	964
August	32	19	42	988
September	34	19	56	1,013
October	50	19	92	1,550
November	65	35	78	1,941
December	66	53	79	2,031
Annual	**50**	**3**	**95**	**18,404**

Notes:
*Provincially regulated maximum daily flow = 60 m^3/d

Table 4.5 Maliview WWTP 2021 Total Effluent Flow Summary

Month	Total Daily Flow				Days TF <60 (2° flow only expected)	Days 2° flow <60, but FS discharged	Days TF >60 (blended flow expected)	Days Exceeded Regulatory Maximum (250m3/d)
	Mean	Min.	Max.	Total				
January	137	84	226	4,255	0	31	31	0
February	100	66	162	2,792	0	12	28	0
March	76	34	104	2,348	1	21	30	0
April	55	34	67	1,637	19	9	10	0
May	40	31	50	1,234	31	0	0	0
June	32	3	40	966	30	0	0	0
July	31	19	44	964	31	0	0	0
August	32	19	42	988	31	0	0	0
September	34	19	56	1,013	30	0	0	0
October	53	19	138	1,651	22	4	9	0
November	164	74	412	4,911	0	23	30	10
December	140	96	267	4,348	0	30	31	3
Annual Total	74	3	412	27,104	195	130	169	1

Notes:
Permitted maximum daily total flow = 250 m^3/d
Permitted maximum daily fine-screened flow = 190 m^3/d
Flow splitting threshold (max. flow that can be handled by the RBC secondary treatment process) = 60 m^3/d
FS = fine-screened
2° = secondary treated flow
TF = total daily flow (combined FS and 2°)
The flow splitting mechanism responds to instantaneous peak flow, so can get FS flow even when TF <60 m3/day

Table 4.6 Maliview WWTP 2021 Compliance and Treatment Plant Performance Monitoring Annual Summary

Source	Compliance Monitoring				Treatment Plant Performance Monitoring		
	Flow (m^3/d)	TSS (mg/L)	CBOD (mg/L)	FC (CFU/100 mL)	BOD (mg/L)	NH_3 (mg/L N)	pH
Influent							
Regulatory Limit	250	---	---	---	---	---	---
Mean	74	251	265	6,501,417	265	---	---
Minimum	3	81		740,000	100	---	---
Maximum	412	520		41,000,000	670	---	---
Regulatory Violations (%)	1	---		---	---	---	---
Number of Samples	365	12.		12.	12.	---	---
Secondary Effluent							
Regulatory Limit	60	45	45	---	---	---	---
Mean	50	30	37	314,034	37	35.86	7.4
Minimum	3	18	11	32,000	15	3.30	7.1
Maximum	95	39	64	2,000,000	63	69.0	7.6
Percent Reduction	---	88	86	95	86	---	---
Regulatory Violations (%)	35	0	0	---	---	---	---
Number of Samples	365	12	12	12	12	12	12
Fine-Screened Effluent[1]							
Regulatory Limit	190	---	---	---	---	---	---
Mean	24	---	---	---	---	---	---
Minimum	0	---	---	---	---	---	---
Maximum	348	---	---	---	---	---	---
Percent Reduction	---	---	---	---	---	---	---
Regulatory Violations (%)	1.26	---	---	---	---	---	---
Number of Samples	365	---	---	---	---	---	---
Combined Final Effluent[2]							
Regulatory Limit[3]	250	45 130	45 130	---	---	---	---
Mean	74	42	40	383,858	41	38	19.4
Minimum	3	22	14	49,000	18	11	7.2
Maximum	412	90	87	1,200,000	79	64	150
Percent Reduction	---	83	85	94	85	---	---
Regulatory Violations (%)	1.10	0 0	25 ---	---	---	---	---
Number of Samples	365	8 4	12 12	12	12	12	12
Discharged Effluent							
Mean	74	37	29	383,858	41	37.0	13.4
Percent Reduction	---	85	---	94	85	---	---

Notes: [1] No fine-screened effluent samples were collected in 2021. See footnote 2.

[2] Historically, the values for final effluent were calculated using individual secondary and fine-screened effluent quality values along with their relative flow volume proportions. In 2013, the fine-screened effluent sampling point was abandoned and replaced by direct sampling of final combined (secondary + screened) effluent quality via a new combined sampling point that was installed in December 2012.

[3] Regulatory limits for TSS and CBOD are dependent upon whether average daily flow is above or below 60 m3/day. Limits are 45 mg/L if flows are below 60 m^3/day and 130 mg/L if above 60 m^3/day.

4.2.2 Receiving Water Monitoring

RECEIVING WATER BACTERIA INDICATORS

There was no routine or non-routine receiving water sampling required in 2021 at the Maliview WWTP.

4.3 Recommendations

INVESTIGATE WAYS TO ELIMINATE REGULATORY COMPLIANCE VIOLATIONS

Substantial upgrades to the Maliview WWTP are required to eliminate all regulatory compliance violations for this facility. Repairs were made in summer 2019 to the upstream conveyance system to reduce I&I. Since these repairs, the frequency and volume of flow limit exceedances have been substantially reduced; wet weather peak flows have been reduced to almost half of previous years, but extreme wet weather will still lead to overflows. Staff and consultants are developing a detailed design for a new treatment plant that will resolve flow and effluent quality issues.

5.0 SCHOONER WWTP

5.1 Introduction

The Schooner WWTP is located on the southwest side of North Pender Island (Figure 1.1). It discharges ultraviolet disinfected secondary treated effluent into Swanson Channel through a 198 m outfall at a depth of 8 m below sea level. Because the average daily flow of this facility exceeds 100 m^3/day, both provincial and federal regulatory requirements must be met.

The facility is regulated under BC MWR Registration RE-01693 dated November 15, 2000. Provincial and federal regulatory requirements are described in Table 5.1.

Table 5.1 Schooner WWTP Regulatory Requirements

Parameter	Regulatory Requirement	
	Provincial	Federal
Maximum daily flow	640 m^3/d	---
CBOD	max 45 mg/L	average 25 mg/L
TSS	max 45 mg/L	average 25 mg/L
Fecal coliform	200 CFU/100 mL	---
Unionized ammonia	---	max 1.25 mg/L
Total residual chlorine	---	average 0.02 mg/L
Toxicity test	96-hr Rainbow trout	---

This registration also has a requirement for receiving water monitoring. Routine monitoring was last required for this facility in 2020, and is next required in 2024.

It is anticipated that sampling will not be required again until 2024, unless there are planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter and one day duration in the summer.

The following section reports the results from the Schooner treatment plant WMEP (Table 5.2).

Table 5.2 Schooner Treatment Plant WMEP

Component	Parameter	Frequency
Wastewater	Flow	Daily
	Compliance and treatment plant performance monitoring: • Influent: TSS, BOD, fecal coliform • Secondary Effluent: TSS, fecal coliform, unionized NH_3, total residual chlorine • Disinfected secondary effluent: TSS, BOD, CBOD, fecal coliform, NH_3, pH, unionized NH_3	Once per month
	Federal compliance monitoring: • Final Effluent: TSS, CBOD, unionized ammonia, total residual chlorine, pH	Once per month (reported quarterly)
	Effluent toxicity	Once per year
Surface Water	Indicator bacteria (fecal coliform and enterococci)	2024, 2028, 2032

5.2 Results

5.2.1 Wastewater Monitoring

COMPLIANCE AND TREATMENT PLANT PERFORMANCE MONITORING

Flow data are summarized in Table 5.3 and the complete data set is presented in Appendix C1. In 2021, 19 total daily flows, representing 5% of the year, from the Schooner WWTP exceeded the allowable maximum, consistent with recent years.

Monthly compliance and treatment plant performance monitoring data are summarized in Table 5.4 and the complete data set is presented in Appendix C2. In 2021, all routine monthly compliance parameters at Schooner WWTP were within compliance limits. However, samples collected to confirm impact to treatment processes during overflow events (January 5th and 11th) and field-analyzed, were non-compliant for TSS. In addition, while samples were not collected during the power outages described below, it is assumed that the provincial fecal coliform limit was exceeded during these events, as the UV system cannot operate during power outages. The treatment plant removed approximately 93% of the TSS, >99% of the fecal coliform and 96% of the total BOD it received. Chlorine is not used at this facility, so is not monitored with respect to federal WSER requirements.

Compliance data was reported to ENV on a monthly basis, with EIRs issued if there was an incident at the plant. There were 23 EIRs issued at Schooner WWTP in 2021, as a result of:

- system-wide BC Hydro failure resulting in no UV disinfection for the duration (January 6, 13, October 10, 24);
- heavy rainfall event resulting in flow exceedance (January 1-6, Nov 4, 14-18, 25-29, December 11).

TOXICITY TESTING

As in previous years (2012-2020), the disinfected effluent sample from July 20, 2021 passed the 96-hour Rainbow trout acute toxicity test.

Table 5.3 Schooner WWTP 2021 Effluent Flow Annual Summary

Month	Mean Flow (m^3/d)	Min Flow (m^3/d)	Max Flow (m^3/d)*	Total Flow (m^3)	Permit Violations (%)
January	508	339	844	15,758	23
February	399	311	490	11,158	0
March	293	232	361	9,088	0
April	201	162	244	6,022	0
May	164	142	195	5,072	0
June	152	135	172	4,559	0
July	162	147	178	5,032	0
August	173	148	212	5,367	0
September	169	124	323	5,082	0
October	269	173	609	8,349	0
November	595	269	1,257	17,835	33
December	437	302	775	13,538	6
Annual	**293**	**124**	**1,257**	**106,860**	**5**

Notes:
*Provincially regulated maximum daily flow = 640 m^3/d

Table 5.4 Schooner WWTP 2021 Compliance Annual Summary

Source	Compliance Monitoring				Treatment Plant Performance Monitoring				
	Flow (m^3/d)	TSS (mg/L)	CBOD (mg/L)	FC (CFU/100 mL)	BOD (mg/L)	Ammonia (mg/L N)	Unionized Ammonia@15°C (mg N/L)	Total Residual Chlorine (mg/L)	pH
Influent									
Regulatory Limit	640	---	---	---	---	---	---	---	---
Mean	293	182	---	3,950,869	133	---	---	---	---
Minimum	124	36	---	640,000	16	---	---	---	---
Maximum	1257	650	---	13,000,000	270	---	---	---	---
Regulatory violations (%)	5.2	---	---	---	---	---	---	---	---
Number of samples	365	12	---	12	12	----	---	---	---
Secondary Effluent									
Regulatory Limit	---	---	---	---	---	---	---	---	---
Mean	293	12	---	33,371	---	---	---	---	---
Minimum	124	3	---	5,400	---	---	---	---	---
Maximum	1257	27	---	210,000	---	---	---	---	---
Percent Reduction	---	93	---	99	---	---	---	---	---
Regulatory violations	---	---	---	---	---	---	---	---	---
Number of samples	365	12	---	12	---	---	---	---	---
Disinfected Secondary Effluent									
Regulatory Limit	640	Max: 45 Avg.: 25	Max: 45 Avg.: 25	200	---	---	1.25	0.02	---
Mean	293	13	5	558	6	3.13	0.004	---	7.0
Minimum	124	2	2	2	<2	0.04	<0.0005	---	6.8
Maximum	1257	43	12	6,400	13	16.00	0.021	---	7.3
Percent Reduction	---	93	---	100	96	---	---	---	---
Regulatory violations (%)	5	0	0	8.3	---	---	0	---	---
Number of samples	365	12	11	12	11	12	4		12

Notes:
Data is comprised of routine, monthly sampling results.

5.2.2 Receiving Water Monitoring

RECEIVING WATER BACTERIA INDICATORS

Non-routine emergency marine monitoring was conducted around the Schooner WWTP outfall (Figure 2.2) on January 6th and December 14th as a result of treatment plant overflows following heavy rain events that lasted longer than 3 days. Surface water enterococci data are summarized in Table 5.5. Individual results were compared to the BC primary contact recreational guideline (Warrington, 2001) and Health Canada guideline for enterococci (Health Canada, 2012) of a maximum of 70 CFU/100 mL. The maximum enterococci concentration from all stations over both sampling days was 29 CFU/100mL, which is below the provincial and federal regulatory criteria.

5.3 Recommendations

INVESTIGATE WAYS TO ELIMINATE REGULATORY COMPLIANCE VIOLATIONS

Substantial upgrades to the Schooner WWTP and collection system would be required for this facility to eliminate all regulatory compliance violations. Staff are undertaking upgrades in a phased manner over a five- to seven-year period. Phase 1 upgrades are about 50% complete, including installation of a new Chart Drive pump station and forcemain, replacement of about 44 m of sewer pipe, implementing an I&I reduction program, and assessing the remaining life of the aeration tank at Schooner WWTP.

Staff and the consultant are also working on a design to upgrade both the Schooner and Cannon WWTPs, including back up power.

Table 5.5 Schooner Way WWTP 2021 Overflow Sampling

			6-Jan	14-Dec
Station	Location	Depth (m)	Enterococci CFU/100 mL	Enterococci CFU/100 mL
Sch-03	100 m SE	1	5	<1
		7	2	<1
Sch-04	100 m WSW	1	3	*
		7	29	*
Sch-05	100 m NW	1	1	1
		10	3	<1
Sch-06	100 m S	1	5	<1
		6	14	<1
Sch-10	200 m SSE	1	2	<1
Sch-14	200 m W	1	11	<1
Boat Nook A	Boat Nook	1	---	1
Boat Nook B	Boat Nook	1	---	<1

Notes:
--- not part of sampling program
*not collected due to wind/weather conditions

6.0 CANNON WWTP

6.1 Introduction

The Cannon WWTP is located on the southwest side of North Pender Island (Figure 1.1). It discharges undisinfected secondary effluent into Swanson Channel through a 60 m outfall at a depth of 31 m below sea level.

The facility is regulated under BC MWR Permit PE-00220 dated April 28, 1981. Regulatory requirements are described in Table 6.1.

Table 6.1 Cannon WWTP Regulatory Requirements

Parameter	Regulatory Requirement
Maximum daily flow	68 m^3/d
Maximum CBOD	45 mg/L
Maximum TSS	60 mg/L

This registration also has a requirement for receiving water monitoring. Routine monitoring was last required for this facility in 2020, and is next required in 2024.

It is anticipated that sampling will not be required again until 2024, unless there are planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter and one day duration in the summer.

The following section reports the results from the Cannon treatment plant WMEP (Table 6.2).

Table 6.2 Cannon Treatment Plant WMEP

Component	Parameter	Frequency
Wastewater	Flow	Daily
	Compliance and treatment plant performance monitoring[1] • Influent: TSS, CBOD, fecal coliform • Secondary Effluent: TSS, BOD, CBOD, fecal coliform, NH_3, pH	Once per month
	Effluent toxicity (voluntary): • Rainbow trout 96-hour	Once per year
Receiving Water	Indicator bacteria (fecal coliform and enterococci)	2024, 2028, 2032

6.2 Results

6.2.1 Wastewater Monitoring

COMPLIANCE AND TREATMENT PLANT PERFORMANCE MONITORING

In 2021, 52 total daily flows, representing 14% of the year, from the Cannon WWTP exceeded the allowable maximum (Table 6.3, Appendix D1). Flow exceedances occurred in January, February, October, November and December. Effluent quality was similar to previous years. Monthly compliance and treatment plant performance monitoring data are summarized in Table 6.4 and the complete data set is presented in Appendix D2. In 2021, all compliance parameters at Cannon WWTP were within compliance limits.

Overall, the treatment plant removed approximately 92% of the TSS, >99% of the fecal coliform, and 93% of the TBOD from the influent.

Compliance data was reported to ENV on a monthly basis, with EIRs issued if there was an incident at the plant. There were 52 EIRs issued at Cannon WWTP in 2021, all a result of overflows, due to heavy rain/snow (multiple dates in January, February, October, November and December).

TOXICITY TESTING

Beginning in 2021, toxicity testing was conducted at each of the Gulf Islands/Port Renfrew facilities in order to maintain consistency across the region. The undisinfected secondary effluent sample from July 20, 2021 passed the 96-hour Rainbow trout acute toxicity test.

Table 6.3 Cannon WWTP 2021 Annual Flow Summary

Month	Mean Flow (m^3/d)	Min Flow (m^3/d)	Max Flow (m^3/d)	Total Flow (m^3)	Permit Violations (%)
January	70	47	111	2,162	45
February	61	48	89	1,698	21
March	41	22	60	1,276	0
April	26	13	35	771	0
May	25	16	30	780	0
June	25	11	33	759	0
July	31	15	40	974	0
August	34	21	49	1,061	0
September	31	10	48	933	0
October	26	9	78	803	3
November	107	19	501	3,220	74
December	64	64	107	1,984	26
Annual	**45**	**9**	**501**	**16,421**	**14**

Notes:
Provincially regulated maximum daily flow = 68 m^3/d

Table 6.4 Cannon WWTP 2021 Compliance and Treatment Plant Performance Monitoring Annual Summary

Source	Compliance Monitoring				Treatment Plant Performance Monitoring		
	Flow (m^3/d)	TSS (mg/L)	CBOD (mg/L)	FC (CFU/100 mL)	TBOD (mg/L)	NH_3 (mg/L N)	pH
Influent							
Regulatory Limit	---	---	---	---	---	---	---
Mean	45	159	---	7,686,700	233	---	---
Minimum	9	12	---	100,000	15	---	---
Maximum	501	364	---	520,000,000	450	---	---
Permit Violations (%)	14	---	---	---	---	---	---
Number of Samples	365	12	---	12	12	---	---
Secondary Effluent							
Regulatory Limit	68	60	45	---	---	---	---
Mean	45	13	17	52,007	17	4.59	6.8
Minimum	9	5	3	6,300	5	0.20	5.9
Maximum	501	46	29	2,800,000	55	16.0	7.8
Percent Reduction	---	92	---	99	93	---	---
Permit Violations (%)	14	0	0	---	---	---	---
Number of Samples	365	12	12	12	12	12	12

6.2.2 Receiving Water Monitoring

RECEIVING WATER BACTERIA INDICATORS

Non-routine emergency monitoring was conducted on January 6th, 2021, and December 14th, 2021, around the Cannon WWTP (Figure 2.3) as a result of treatment plant overflows following heavy rain events that

lasted longer than 3 days. Surface water enterococci data are summarized in Table 5.5. Individual results were compared to the BC primary contact recreational guideline (Warrington, 2001) and Health Canada guideline for enterococci (Health Canada, 2012) of a maximum of 70 CFU/100 mL. The maximum enterococci concentration from all stations over both sampling days was 15 CFU/100mL, which is below the provincial and federal regulatory criteria.

Table 6.5 Cannon Crescent 2021 Overflow Sampling

			6-Jan	14-Dec
Station	Location	Depth (m)	Enterococci (CFU/100 mL)	Enterococci (CFU/100 mL)
Can – 01	100m NW	1	1	<1
Can – 01		9	1	*
Can – 02	100m NE	1	1	<1
Can – 02		14	4	*
Can – 03	100m SE	1	2	<1
Can – 03		29	<1	*
Can – 04	100m SW	1	1	1
Can – 04		29	<1	*
Can – 05	200m NW	1	15	1
Can – 06	200m NE	1	2	1

Notes:
*not collected due to wind/weather

6.3 Recommendations

INVESTIGATE WAYS TO ELIMINATE REGULATORY COMPLIANCE VIOLATIONS

Substantial upgrades to the Cannon WWTP and collection system would be required for this facility to eliminate all regulatory compliance violations. Staff are undertaking the proposed upgrades in a phased manner over a five- to seven-year period, with phase 1 upgrades approximately 50% complete.

CRD staff and a consultant are also working on a design to upgrade both the Schooner and Cannon WWTPs, including back up power.

7.0 PORT RENFREW WWTP

7.1 Introduction

The Port Renfrew WWTP is located on the southeast corner of Port San Juan on Vancouver Island (Figure 1.1). It discharges undisinfected secondary treated effluent into Port San Juan through an 81 m outfall at a depth of 3 m.

The facility is regulated under BC MWR Permit PE-00312 dated April 15, 1992. Regulatory requirements are described in Table 7.1.

Table 7.1 Port Renfrew Regulatory Requirements

Parameter	Regulatory Requirement
Maximum daily flow	220 m^3/d
Maximum CBOD	45 mg/L
Maximum TSS	60 mg/L

Routine receiving water monitoring was scheduled at the Port Renfrew WWTP in 2020. However, due to extenuating circumstances (staffing and boat availability), sampling was delayed. The receiving environment water sampling was conducted from the shoreline in spring/summer 2021.

It is anticipated that sampling will not be required again until 2024, unless there are planned bypasses, plant failures/overflows or wet weather overflows that exceed three days' duration in the winter and one day duration in the summer.

The following section reports the results from the Port Renfrew treatment plant WMEP (Table 7.2).

Table 7.2 Port Renfrew Treatment Plant WMEP

Component	Parameter	Frequency
Wastewater	Flow	Daily
	Compliance and treatment plant performance monitoring: • Influent: TSS, BOD, fecal coliform • Secondary Effluent: TSS, BOD, CBOD, fecal coliform, NH_3, pH	Once per month
	Effluent toxicity (voluntary): • Rainbow trout 96-hour	Once per year
Receiving Water	Indicator bacteria (fecal coliform and enterococci)	2024, 2028, 2032

7.2 Results

7.2.1 Wastewater Monitoring

COMPLIANCE AND TREATMENT PLANT PERFORMANCE MONITORING

Flow data are summarized in Table 7.3 and the complete data set is presented in Appendix E1. In 2021, there were four exceedances for daily flows at the Port Renfrew WWTP, representing 1.1% of the year's flow. Average monthly flow was similar to recent years.

Monthly compliance and treatment plant performance monitoring data are summarized in Table 7.4 and the complete data set is presented in Appendix E2. TSS exceeded the permitted value twice in 2021, with all other compliance parameters below regulatory limits. The treatment plant removed approximately 94% of the TSS, 95% of the BOD and >99% of the fecal coliforms.

Compliance data was reported to ENV on a monthly basis, with EIRs issued if there was an incident at the plant. There were six EIRs issued at Port Renfrew WWTP in 2021, as a result of:

- TSS exceedances (May 18, June 24); and
- overflow due to heavy rain (October 16, 26, 28, November 30).

TOXICITY TESTING

Beginning in 2021, toxicity testing was conducted at each of the Gulf Islands/Port Renfrew facilities in order to maintain consistency across the region. The undisinfected secondary effluent sample from July 20, 2021 passed the 96-hour Rainbow trout acute toxicity test.

Table 7.3 Port Renfrew WWTP 2021 Flow Summary

Month	Mean Flow (m^3/d)	Min Flow (m^3/d)	Max Flow (m^3/d)*	Total Flow (m^3)	Permit Violations (%)
January	68	32	199	2,109	0
February	57	33	144	1,585	0
March	54	33	137	1,681	0
April	33	25	46	999	0
May	37	29	54	1,151	0
June	37	29	48	1,107	0
July	42	36	52	1,308	0
August	42	28	55	1,317	0
September	59	35	144	1,761	0
October	96	44	332	2,967	3
November	126	37	315	3,782	10
December	70	40	179	2,164	0
Annual	**60**	**25**	**332**	**21,930**	**1.1**

Notes:
Provincially regulated maximum daily flow = 220 m^3/d

Table 7.4 Port Renfrew WWTP 2021 Compliance and Treatment Plant Performance Monitoring Annual Summary

Source	Compliance Monitoring				Treatment Plant Performance Monitoring		
	Flow (m^3/d)	TSS (mg/L)	CBOD (mg/L)	FC (CFU/100 mL)	BOD (mg/L)	NH^3 (mg/L N)	pH
Influent							
Regulatory Limit	---	---	---	---	---	---	---
Mean	60	490	---	8,834,717	422	---	---
Minimum	25	90	---	1,400,000	110	---	---
Maximum	332	2510	---	69,000,000	1,300	---	---
Permit Violations (%)	1.1	---	---	---	---	---	---
Number of Samples	365	12	---	12	12	---	---
Secondary Effluent							
Regulatory Limit	220	60	45	---	---	---	---
Mean	60	28	6	16,139	22	0.69	6.2
Minimum	25	9	3	3,500	4	0.04	5.0
Maximum	332	96	14	610,000	48	5.40	6.9
Percent Reduction	---	94	---	100	95	---	---
Permit Violations (%)	1	2	0	---	---	---	---
Number of Samples	365	12	12	12	12	12	12

7.2.2 Receiving Water Monitoring

RECEIVING WATER BACTERIA INDICATORS

The 2020 sampling year was the scheduled year for receiving water monitoring around the Port Renfrew outfall (Figure 2.4). However, due to extenuating circumstances (staffing and boat availability, and Covid-19), sampling was delayed. Surface water fecal coliform and enterococci data are summarized in Table 7.5 and Appendix E3. The geometric mean of each parameter at each station was calculated, and the geometric means and individual results were compared to the BC primary contact recreational guidelines (Warrington, 2001) and Health Canada guidelines for Enterococci (Health Canada, 2012).

The maximum enterococci concentration was 54 CFU/100mL and maximum fecal coliform concentration was 26 CFU/100 mL, well under guidelines (Table 5.5, Appendix E3). All six stations in 2021 had geometric means that were less than provincial and federal guidelines.

Table 7.5 Port Renfrew WWTP 2021 Shoreline Receiving Water Summary

Station	Depth (m)	Geomean		Minimum		Maximum	
		Enterococci CFU/100 mL	Fecal Coliform CFU/100 mL	Enterococci CFU/100 mL	Fecal Coliform CFU/100 mL	Enterococci CFU/100 mL	Fecal Coliform CFU/100 mL
PRS-01	1	5	3	<4	<4	20	8
PRS-02	1	10	8	<4	<4	28	16
PRS-03	1	7	7	<4	<4	54	26
PRS-04	1	7	3	<4	<4	26	6
PRS-05	1	14	3	6	<2	44	20
PRS-06	1	10	5	2	<2	44	14

7.3 Recommendations

MAINTAIN EFFECTIVENESS AND RELIABILITY OF THE TREATMENT PROCESS

Staff and consultants completed a feasibility study in 2015 to improve/increase the treatment plant capacity and ensure ongoing effective operation of the treatment plant and conveyance system into the future. Grant funding will be required in order to complete any upgrades to this system. Updates to the facility asset management plans are underway, and a phased implementation plan is anticipated pending funding.

8.0 REFERENCES

APHA (1998). Standard Methods for the Examination of Water and Wastewater, 20th Edition. American Public Health Association, Washington, DC.

BCMoE&CCS (2017a) British Columbia Working Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture. Water Protection & Sustainability Branch, British Columbia Ministry of Environment & Climate Change Strategy, Victoria, BC, Canada.

BCMoE&CCS (2017b). Environmental Management Act and Health Act, Organic Matter Recycling Regulation. Originally deposited and effective February 5, 2002. Last amended November 1, 2017. British Columbia Ministry of Environment & Climate Change Strategy, Victoria, BC Canada.

BCMoE&CCS (2019a) British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture. Water Protection & Sustainability Branch, British Columbia Ministry of Environment & Climate Change Strategy, Victoria, BC, Canada.

BCMoE&CCS (2019b) B.C. Recreational Water Quality Guidelines: Guideline Summary. Water Quality Guidelines Series, WQG-02. Prov. B.C., Victoria, BC, Canada.

CRD (2011). Gulf Islands and Port Renfrew Wastewater and Marine Environment Program 2010 Annual Report. Capital Regional District Environmental Protection, Victoria, BC, Canada.

CRD (2012). Gulf Islands and Port Renfrew Wastewater and Marine Environment Program 2011 Annual Report. Capital Regional District Environmental Protection, Victoria, BC, Canada.

CRD (2013). Gulf Islands and Port Renfrew Wastewater and Marine Environment Program 2012 Annual Report. Capital Regional District Environmental Protection, Victoria, BC, Canada.

CRD (2014). Gulf Islands and Port Renfrew Wastewater and Marine Environment Program 2013 Annual Report. Capital Regional District Environmental Protection, Victoria, BC, Canada.

CRD (2015). Gulf Islands and Port Renfrew Wastewater and Marine Environment Program 2014 Annual Report. Capital Regional District Environmental Protection, Victoria, BC, Canada.

CRD (2016). Gulf Islands and Port Renfrew Wastewater and Marine Environment Program 2015 Annual Report.

CRD (2017). Gulf Islands and Port Renfrew Wastewater and Marine Environment Program 2016 Annual Report.

CRD (2018). Gulf Islands and Port Renfrew Wastewater and Marine Environment Program 2017 Annual Report.

CRD (2020a). Gulf Islands and Port Renfrew Wastewater and Marine Environment Program 2018 Annual Report.

CRD (2020b). Gulf Islands and Port Renfrew Wastewater and Marine Environment Program 2019 Annual Report.

CRD (2021). Gulf Islands and Port Renfrew Wastewater and Marine Environment Program 2020 Annual Report.

Health Canada (2012). Guidelines for Canadian Recreational Water Quality. Third Edition. Published by authority of the Minister of Health, Ottawa, Ontario. 161 pp.

Seaconsult Marine Research Ltd. (1994). Wastewater Dilution and Dispersion for the Ganges Treatment Plant Outfall. Prepared for the Capital Regional District, Victoria, BC, Canada.

APPENDIX A

GANGES WWTP

Appendix A1 Ganges WWTP Effluent Flow 2021 (m^3/day)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	610	526	459	422	393	398	436	496	356	488	435	495
2	672	550	441	392	361	351	397	426	526	440	527	466
3	753	602	411	434	335	420	449	447	452	400	705	453
4	709	506	448	409	461	403	428	377	440	432	764	442
5	634	472	400	400	349	390	448	457	426	466	657	391
6	739	430	439	416	411	405	450	461	421	495	543	490
7	528	420	407	447	434	436	399	465	457	456	608	512
8	521	453	450	403	375	414	445	418	385	440	657	462
9	453	446	454	449	368	408	453	426	411	465	705	450
10	442	461	423	451	388	437	448	469	403	442	748	476
11	592	422	459	435	399	417	414	409	531	430	622	602
12	704	473	431	408	377	408	409	447	439	457	693	619
13	586	410	402	460	397	438	449	456	451	470	708	591
14	518	452	385	473	377	422	457	467	454	498	1,028	459
15	467	455	390	447	383	452	421	467	406	512	1,081	597
16	423	534	440	456	391	411	493	463	472	546	810	520
17	428	538	429	409	412	457	504	475	546	522	752	469
18	450	428	400	420	394	456	427	436	565	474	644	554
19	457	558	488	409	381	447	443	463	455	493	617	569
20	484	512	414	433	371	424	440	476	427	457	454	424
21	464	478	403	352	364	442	403	478	478	465	425	425
22	367	461	410	401	399	450	435	459	517	480	446	501
23	494	537	452	423	429	400	443	458	450	420	443	488
24	461	481	403	410	417	453	463	453	418	417	446	446
25	483	480	411	380	386	442	416	484	498	478	514	369
26	488	452	463	403	420	422	442	461	466	469	564	406
27	489	409	477	407	366	413	458	441	540	521	601	347
28	517	439	446	445	396	443	457	448	469	650	684	394
29	454	---	540	427	387	442	446	423	463	605	564	387
30	431	---	532	375	376	462	392	446	491	456	464	394
31	441	---	434	---	389	---	448	459	---	405	---	348
Min	367	409	385	352	335	351	392	377	356	400	425	347
Max	753	602	540	473	461	462	504	496	565	650	1,081	619
Mean	524	478	437	420	390	425	439	452	460	476	630	469
Total Flow	16,259	13,385	13,541	12,596	12,086	12,763	13,613	14,011	13,813	14,749	18,909	14,546

Annual Min	**335**
Annual Max	**1,081**
Annual Mean	**466**

Note: shading indicates exceedance of regulatory limit (1,198 m^3)

Appendix A2 Ganges WWTP Compliance and Treatment Plant Performance 2021

Date	Influent			Secondary Effluent (Undisinfected)		Secondary Effluent (Disinfected)							
	TSS (mg/L)	BOD (mg/L)	FC (CFU/100 mL)	TSS (mg/L)	FC (CFU/100 mL)	TSS (mg/L)	BOD (mg/L)	CBOD (mg/L)	FC (CFU/100 mL)	NH_3 (mg/L N)	Unionized NH_3 (mg/L N)	TRC (mg/L)	pH
Regulatory Limit						25		25	1000		1.25	0.02	
January	336	510	12,000,000	3.25	58	<1	<2	<2	<1	<0.015	<0.0005	0.05	7.5
February	268	350	14,000,000	0.75	275	<1	<2	<2	<1	15	0.022	0.02	7.2
March	247	310	12,000,000	01	153	<1	<2	<2	<1	11	0.021	0.06	7.2
April	343	380	37,000,000	2	1,318	<1	<2	<2	1	22	0.11	0.08	7.4
May	370	420	21,000,000	1	307	<1	<2	<2	<1	5.5	0.035	0.05	7.0
June	247	290	36,000,000	1	29	<1	<2	<2	<1	0.39	0.0012	0.02	7.2
July	408	430	24,000,000	01	315	<1	<2	<2	<1	5.6	0.046	0.05	7.6
August	380	470	33,000,000	01	391	<1	<2	<2	<1	0.063	<0.0005	0.03	7.1
September	460	460	27,000,000	1.65	222	<1	<2	2.1	<1	0.028	<0.0005	0.04	7.2
October	330	240	7,600,000	1.25	1,308	<1	<2	<2	<1	4.9	0.018	0.02	7.1
November	320	300	12,000,000	1	730	<1	<2	<2	<10	0.18	<0.0005	---	7.2
December	268	230	5,700,000	1.025	1,794	<1	<2	<2	<1	1.6	0.0014	---	7.3
Mean	331	366	17,104,001	1.33	575	<1	<2	1.1	0.9	5.5	0.02	0.04	7.3
Min	247	230	5,700,000	1	29	<1	<2	<2	<1	0.015	<0.0005	0.02	7.0
Max	460	510	37,000,000	3.25	1,794	<1	<2	2.1	1	22	0.11	0.08	7.6
n	12	12	12	12	12	12	12	12	12	12	12	10	12
Mean Daily Loading	kg/day	kg/day		kg/day		kg/day				kg/day	kg/day	kg/day	
	155	171	---	0.62	---	0.5	---	---	---	2.57	0.0093	0.02	---

Notes:
TSS = total suspended solids, BOD = biochemical oxygen demand, CBOD = carbonaceous biochemical oxygen demand, FC = fecal coliforms, TRC = total residual chlorine, NH_3 = ammonia
Shading indicates exceedance of regulatory limit.

Appendix A3 Ganges WWTP Priority Substances Analyzed in Influent and Effluent 2021

Parameter	Units	MDL	Ganges Influent	Ganges Effluent	Effluent Diluted	Loading (kg/year)	BC WQG	CCME / HC WQG
CONVENTIONALS								
alkalinity (as CaCO3)	mg/L	1.0	<1	<1	ND	ND		
alkalinity - Bicarbonate	mg/L	1.0	210	92	0.22	14.4		
biochemical oxygen demand (BOD)	mg/L	30	300	2.1	0.005	0.329		
carbonaceous biochemical oxygen demand (CBOD)	mg/L	30	360	<2	n/d	n/d		
chemical oxygen demand (COD)	mg/L	10	885	36	0.0859	5.64		
chloride	mg/L	1	72	76	0.1814	11.9		
cyanide-SAD	mg/L	0.0005	0.0034	0.0032	0.00001	0.0005		
cyanide-WAD	mg/L	0.0005	0.0029	0.0007	0.000002	0.0001	0.001	
hardness (as CaCO3) dissolved	mg/L	0.5	39.8	46.3	0.11	7.25		
hardness (as CaCO3)	mg/L	0.5	56	48.8	0.12	7.64		
oil & grease, mineral	mg/L	2	<2	<2	ND	ND		
oil & grease, total	mg/L	1	6.9	<1	ND	ND		
total organic carbon	mg/L	10	77	10	0.024	1.57		
pH	pH	---	6.81	7.04	0.017	n/a		
conductivity	µS/cm	2	670	460	1.098	n/a		
sulfide	mg/L	0.0018	0.052	0.007	0.00002	0.001		
sulphate	mg/L	1	17	26	0.062	4.07		
total suspended solids	mg/L	2.5	320	<1	ND	ND		
BACTERIOLOGY								
Enterococci	CFU/100 mL	1000	590,000	<1	ND	ND	35 geomean / 70 single sample	35 geomean / 70 single sample
Fecal Coliforms	CFU/100 mL	100	2,500,000	<1	ND	ND		
NUTRIENTS								
N - NH3 (as N)	mg/L	0.75	42	0.87	0.0021	0.136	19.7	
N - NH3 (as N)- unionized @ 15°C	mg/L	0.001	0.058	0.0054	0.00001	0.001		
N - NO2 (as N)	mg/L	0.005	<0.005	0.0764	0.0002	0.012		
N - NO3 (as N)	mg/L	0.02	<0.02	1.01	0.0024	0.158		
N - NO3 + NO2 (as N)	mg/L	0.02	<0.02	1.09	0.0026	0.171		
N - TKN (as N)	mg/L	1	48.3	3.04	0.0073	0.476		
N - TN	mg/L	1	48.3	4.13	0.0099	0.647		
P - PO4 - ortho (as P) dissolved	mg/L	0.03	3.6	2	0.0048	0.313		
P - PO4 - total (as P) total	µg/L	5	6,450	2,330	5.56	0.365		

Parameter	Units	MDL	Ganges Influent	Ganges Effluent	Effluent Diluted	Loading (kg/year)	BC WQG	CCME / HC WQG
METALS DISSOLVED								
aluminum	µg/L	0.5	33.3	27	0.064	0.0042		
antimony	µg/L	0.02	0.238	0.336	0.0008	0.00005		
arsenic	µg/L	0.02	0.519	0.294	0.0007	0.00005		
barium	µg/L	0.02	6.92	5.95	0.0142	0.0009		
beryllium	µg/L	0.01	<0.01	<0.01	ND	ND		
cadmium	µg/L	0.005	0.0209	0.0359	0.0001	0.000006		
calcium	µg/L	0.05	9.48	12.1	0.0289	1.90		
chromium	µg/L	0.1	0.44	0.38	0.0009	0.00006		
cobalt	µg/L	0.005	0.199	0.231	0.0006	0.00004		
copper	µg/L	0.05	45.5	9.43	0.0225	0.0015		
iron	µg/L	1	328	73.8	0.176	0.012		
lead	µg/L	0.005	0.479	0.238	0.0006	0.00004		
magnesium	µg/L	0.05	3.92	3.91	0.009	0.612		
manganese	µg/L	0.05	43.2	44.7	0.107	0.007		
mercury	µg/L	0.038	<0.038	<0.038	ND	ND		
molybdenum	µg/L	0.05	0.313	0.319	0.0008	0.00005		
nickel	µg/L	0.02	2.29	1.19	0.0028	0.0002		
phosphorus	µg/L	2	4190	2270	5.42	0.356		
potassium	µg/L	0.05	17.9	18	0.043	2.82		
selenium	µg/L	0.04	0.213	0.144	0.0003	0.00002		
silver	µg/L	0.005	0.122	0.0073	0.00002	0.000001		
thallium	µg/L	0.002	<0.002	<0.002	ND	ND		
tin	µg/L	0.2	1.2	0.51	0.0012	0.00008		
zinc	µg/L	0.1	42.9	57.3	0.137	0.009		
METALS - TOTAL								
aluminum	µg/L	3	375	43.2	0.1031	0.007		
antimony	µg/L	0.02	0.272	0.324	0.0008	0.00005		
arsenic	µg/L	0.02	0.63	0.323	0.0008	0.00005	12.5	12.5
barium	µg/L	0.05	17.7	7.82	0.019	0.001		
beryllium	µg/L	0.01	<0.01	<0.01	n/d	n/d	100	
cadmium	µg/L	0.005	0.166	0.043	0.0001	0.000007	0.12	0.12
calcium	µg/L	0.25	14.7	12.9	0.031	2.02		
chromium	µg/L	0.1	0.93	0.51	0.0012	0.00008		
cobalt	µg/L	0.01	0.379	0.326	0.0008	0.00005		
copper	µg/L	0.1	87.2	11.2	0.027	0.002	<2 (lt), 3 (st)	

Parameter	Units	MDL	Ganges Influent	Ganges Effluent	Effluent Diluted	Loading (kg/year)	BC WQG	CCME / HC WQG
iron	µg/L	5	765	477	1.14	0.075		
lead	µg/L	0.02	2.5	0.572	0.0014	0.00009	≤2 (lt), 140 (st)	
magnesium	µg/L	0.25	4.69	4.05	0.0097	0.634		
manganese	µg/L	0.1	71.8	69	0.165	0.011		
mercury	µg/L	0.038	<0.038	<0.038	ND	ND		0.16
molybdenum	µg/L	0.05	0.473	0.346	0.0008	0.00005		
nickel	µg/L	0.1	3.39	1.31	0.0031	0.0002	8.3	
potassium	µg/L	0.25	19.6	19.1	0.046	2.99		
selenium	µg/L	0.04	0.27	0.151	0.0004	0.00002	2	
silver	µg/L	0.01	0.107	<0.01	ND	ND	1.5 (lt), 3 (st)	7.5
thallium	µg/L	0.002	0.0056	<0.002	ND	ND		
tin	µg/L	0.2	1.28	0.54	0.0013	0.00008		
zinc	µg/L	1	160	68.7	0.164	0.011	10 (lt), 55 (st)	
METALS - OTHER								
chromium III	mg/L	0.0099	<0.0099	<0.00099	ND	ND	56	
Chromium VI	mg/L	0.0099	<0.0099	<0.00099	ND	ND		
dibutyltin	µg/L	0.001	<0.01	<0.01	ND	ND		
dibutyltin dichloride	µg/L	0.001	<0.01	<0.01	ND	ND		
methyl mercury	ng/L	0.023	1.03	0.048	0.0001	0.0000008		
monobutyltin	µg/L	0.001	0.002	0.008	0.0000	0.000001		
monobutyltin trichloride	µg/L	0.001	0.004	0.013	0.0000	0.000002		
tributyltin	µg/L	0.001	<0.01	<0.01	ND	ND	0.001	
tributyltin chloride	µg/L	0.001	<0.01	<0.01	ND	ND		
ALDEHYDES								
acrolein	µg/L	2.8	<2.8	<2.8	ND	ND		
CHLORINATED PHENOLICS								
2,4 + 2,5 dichlorophenol	µg/L	0.5	<0.5	<0.5	ND	ND		
2-chlorophenol	µg/L	0.5	<0.5	<0.5	ND	ND		
2,4,6-trichlorophenol	µg/L	0.5	<0.5	<0.5	ND	ND		
4-chloro-3-methylphenol	µg/L	1	<1	<1	ND	ND		
pentachlorophenol	µg/L	0.5	<0.5	<0.5	ND	ND		
PHENOLIC COMPOUNDS								
total phenols	mg/L	0.008	0.045	<0.0075	ND	ND		

Parameter	Units	MDL	Ganges Influent	Ganges Effluent	Effluent Diluted	Loading (kg/year)	BC WQG	CCME / HC WQG
NON-CHLORINATED PHENOLICS								
2,4-dimethylphenol	µg/L	2.5	<2.5	<2.5	ND	ND		
2,4-dinitrophenol	µg/L	6.5	<6.5	<6.5	ND	ND		
2-methyl-4,6-dinitrophenol	µg/L	2.5	<2.5	<2.5	ND	ND		
2-nitrophenol	µg/L	2.5	<2.5	<2.5	ND	ND		
4-nitrophenol	µg/L	2.5	<2.5	<2.5	ND	ND		
phenol	µg/L	2.5	10.3	<2.5	ND	ND		
POLYCYCLIC AROMATIC HYDROCARBONS (PAH)								
2-chloronaphthalene	µg/L	0.25	<0.25	<0.25	ND	ND		
2-methylnaphthalene	µg/L	0.01	0.05	<0.01	ND	ND	0.0202	
acenaphthene	µg/L	0.01	0.021	<0.01	ND	ND	6	
acenaphthylene	µg/L	0.01	0.19	0.013	0.00003	ND		
anthracene	µg/L	0.01	<0.01	<0.01	ND	ND		
benzo(a)anthracene	µg/L	0.01	0.012	<0.01	ND	ND		
benzo(a)pyrene	µg/L	0.005	0.06	<0.005	ND	ND	0.01	
benzo(b)fluoranthene	µg/L	0.01	<0.01	<0.01	ND	ND		
benzo(b)fluoranthene + benzo(j)fluoranthene	µg/L	0.01	<0.01	<0.01	ND	ND		
benzo(g,h,i)perylene	µg/L	0.02	<0.02	<0.02	ND	ND		
benzo(k)fluoranthene	µg/L	0.01	<0.01	<0.01	ND	ND		
chrysene	µg/L	0.01	0.042	<0.01	ND	ND	0.1	
dibenzo(a,h)anthracene	µg/L	0.02	<0.02	<0.02	ND	ND		
fluoranthene	µg/L	0.01	0.047	<0.01	ND	ND		
fluorene	µg/L	0.01	0.08	<0.01	ND	ND	12	
indeno(1,2,3-c,d)pyrene	µg/L	0.02	<0.02	<0.02	ND	ND		
naphthalene	µg/L	0.01	0.033	<0.01	ND	ND	1	1.4
phenanthrene	µg/L	0.01	0.099	0.034	0.0001	0.000005		
pyrene	µg/L	0.01	0.044	<0.01	ND	ND		
PAH-high molecular weight	µg/L	0.02	0.2	<0.02	ND	ND		
PAH-low molecular weight	µg/L	0.05	0.49	<0.05	ND	ND		
total PAHs	µg/L	0.05	0.69	<0.05	ND	ND		
SEMIVOLATILE ORGANICS								
bis(2-ethylhexyl)phthalate	µg/L	5	14.1	<5	ND	ND		
butylbenzyl phthalate	µg/L	2.5	<2.5	<2.5	ND	ND		
diethyl phthalate	µg/L	0.25	<0.25	0.41	0.001	0.00006		
dimethyl phthalate	µg/L	0.25	<0.25	<0.25	ND	ND		

Parameter	Units	MDL	Ganges Influent	Ganges Effluent	Effluent Diluted	Loading (kg/year)	BC WQG	CCME / HC WQG
di-n-butyl phthalate	µg/L	2.5	<2.5	<2.5	ND	ND		
di-n-octyl phthalate	µg/L	0.25	<0.25	<0.25	ND	ND		
MISC SEMIVOLATILE ORGANICS								
bis(2-chloroethoxy)methane	µg/L	0.25	<0.25	<0.25	ND	ND		
bis(2-chloroethyl)ether	µg/L	0.25	<0.25	<0.25	ND	ND		
bis(2-chloroisopropyl)ether	µg/L	0.25	<0.25	<0.25	ND	ND		
hexachlorobutadiene	µg/L	0.25	<0.25	<0.25	ND	ND		
hexachlorocyclopentadiene	µg/L	0.25	<0.25	<0.25	ND	ND		
hexachloroethane	µg/L	0.25	<0.25	<0.25	ND	ND		
isophorone	µg/L	0.25	<0.25	<0.25	ND	ND		
nitrobenzene	µg/L	0.25	<0.25	<0.25	ND	ND		
N-nitrosodimethylamine	µg/L	1	<1	<1	ND	ND		
N-nitrosodi-n-propylamine	µg/L	1	<1	<1	ND	ND		
N-nitrosodiphenylamine	µg/L	1	<1	<1	ND	ND		
VOLATILE ORGANIC COMPOUNDS								
MONOCYCLIC AROMATIC HYDROCARBONS								
1,2,4-trichlorobenzene	µg/L	0.2	<0.2	<0.2	ND	ND		5.4
1,2-dichlorobenzene	µg/L	0.5	<0.5	<0.5	ND	ND		42
1,2-diphenylhydrazine	µg/L	0.05	<0.05	<0.05	ND	ND		
1,3-dichlorobenzene	µg/L	0.5	<0.5	<0.5	ND	ND		
1,4-dichlorobenzene	µg/L	0.5	<0.5	<0.5	ND	ND		
2,6-dinitrotoluene	µg/L	0.25	<0.25	<0.25	ND	ND		
3,3-dichlorobenzidine	µg/L	0.5	<0.5	<0.5	ND	ND		
4-bromophenyl phenyl ether	µg/L	0.05	<0.05	<0.05	ND	ND		
4-chlorophenyl phenyl ether	µg/L	0.25	<0.25	<0.25	ND	ND		
benzene	µg/L	0.4	<0.4	<0.4	ND	ND	110	110
ethylbenzene	µg/L	0.4	<0.4	<0.4	ND	ND	250	25
m & p xylenes	µg/L	0.4	<0.4	<0.4	ND	ND		
o-xylene	µg/L	0.4	<0.4	<0.4	ND	ND		
styrene	µg/L	0.5	<0.5	<0.5	ND	ND		
toluene	µg/L	0.4	7.3	<0.4	ND	ND		215
xylenes	µg/L	0.4	<0.4	<0.4	ND	ND		
CHLORINATED ALIPHATIC								
1,1,1,2-tetrachloroethane	µg/L	0.5	<0.5	<0.5	ND	ND		
1,1,1-trichloroethane	µg/L	0.5	<0.5	<0.5	ND	ND		

Parameter	Units	MDL	Ganges Influent	Ganges Effluent	Effluent Diluted	Loading (kg/year)	BC WQG	CCME / HC WQG
1,1,2,2-tetrachloroethane	µg/L	0.5	<0.5	<0.5	ND	ND		
1,1,2-trichloroethane	µg/L	0.5	<0.5	<0.5	ND	ND		
1,1-dichloroethane	µg/L	0.5	<0.5	<0.5	ND	ND		
1,1-dichloroethene	µg/L	0.5	<0.5	<0.5	ND	ND		
1,2-dichloroethane	µg/L	0.5	<0.5	<0.5	ND	ND		
1,4-dioxane	µg/L	0.5	<0.5	<0.5	ND	ND		
2,4-dinitrotoluene	µg/L	0.5	<0.5	<0.5	ND	ND		
alpha-terpineol	µg/L	0.1	0.22	0.23	0.0005	0.00004		
bromomethane	µg/L	0.25	<0.25	<0.25	ND	ND		
chlorobenzene	µg/L	5	5.2	<5	ND	ND		
chlorodibromomethane	µg/L	1	<1	<1	ND	ND		
chloroethane	µg/L	0.5	<0.5	<0.5	ND	ND		
chloroethene	µg/L	1	<1	<1	ND	ND		
chloromethane	µg/L	1	<1	<1	ND	ND		
ALIPHATIC								
1,2-dibromoethane	µg/L	0.2	<0.2	<0.2	ND	ND		
1,2-dichloropropane	µg/L	0.5	<0.5	<0.5	ND	ND		
acrylonitrile	µg/L	1	<1	<1	ND	ND		
cis-1,2-dichloroethene	µg/L	1	<1	<1	ND	ND		
cis-1,3-dichloropropene	µg/L	1	<1	<1	ND	ND		
dibromomethane	µg/L	2	<2	<2	ND	ND		
methyl tertiary butyl ether	µg/L	4	<4	<4	ND	ND	440	5,000
tetrabromomethane	µg/L	50	<50	<50	ND	ND		
tetrachloroethene	µg/L	0.5	<0.5	<0.5	ND	ND		
tetrachloromethane	µg/L	0.5	<0.5	<0.5	ND	ND		
trans-1,2-dichloroethene	µg/L	1	<1	<1	ND	ND		
trans-1,3-dichloropropene	µg/L	1	<1	<1	ND	ND		
trichloroethene	µg/L	0.5	<0.5	<0.5	ND	ND		
trichlorofluoromethane	µg/L	4	<4	<4	ND	ND		
trichloromethane	µg/L	1	9.2	<1	ND	ND		
TRIHALOMETHANES								
bromodichloromethane	µg/L	1	<1	<1	ND	ND		
dichlorodifluoromethane	µg/L	2	<2	<2	ND	ND		
tribromomethane	µg/L	1	<1	<1	ND	ND		

Parameter	Units	MDL	Ganges Influent	Ganges Effluent	Effluent Diluted	Loading (kg/year)	BC WQG	CCME / HC WQG
KETONES								
dimethyl ketone	µg/L	15	49	<15	ND	ND		
methyl ethyl ketone	µg/L	50	<50	<50	ND	ND		

Notes:

Shading indicates WQG exceedance; *dilution calculated from maximum concentration
BC WQG = British Columbia Water Quality Guidelines, CCME WQG = Canadian Council of Ministers of the Environment Water Quality Guidelines, HC = Health Canada WQG
(lt) = long term, (st) = short term
NM indicates not measured; ND indicates non detect; --- value not available

Appendix A4 Ganges WWTP Sludge (Mixed Liquor) Concentrations 2021

Regulated Parameters (mg/kg dry)	Class A Biosolids Limit (mg/kg dry)*	Jan	Feb+	Mar	Apr	May	Jun^	Jul	Aug	Sep	Oct	Nov^	Dec	Mean
Metals														
arsenic	75	1.53	1.47	1.62	1.78	1.48	2.17	1.96	1.89	1.60	1.86	---	1.76	1.72
cadmium	20	1.16	1.12	1.00	1.06	1.00	1.08	0.98	0.98	0.77	0.84	---	0.99	1.01
chromium	1,060	6.33	5.39	5.82	5.63	4.59	6.16	6.92	5.44	4.31	5.29	---	5.83	5.59
cobalt	151	1.50	1.35	1.36	1.46	1.22	1.38	1.23	1.23	1.26	1.34	---	1.38	1.34
copper	757	748	678	800	836	669	663	571	521	528	606	---	608	659
lead	505	12.1	10.4	11.1	12.1	10.6	12.7	12.9	9.4	10.8	9.8	---	11.0	11.1
mercury	5	0.048	0.004	0.013	0.016	0.010	0.012	0.014	0.014	0.021	<DL	---	0.042	0.018
molybdenum	20	2.11	2.15	2.74	2.90	2.44	3.54	3.19	3.10	2.93	3.19	---	2.81	2.77
nickel	181	11.41	10.40	11.20	11.49	10.18	10.79	11.40	10.67	9.71	10.93	---	10.19	10.73
selenium	14	1.08	1.38	1.86	2.19	1.73	1.97	2.15	2.01	1.79	1.94	---	1.62	1.76
thallium	5	0.028	0.026	0.026	0.029	0.022	0.022	0.024	0.021	0.023	0.023	---	0.026	0.025
vanadium	656	4.16	3.49	3.36	2.97	1.99	2.62	1.22	1.37	1.41	1.99	---	3.38	2.62
zinc	1,868	304	317	368	391	374	401	428	400	390	416	---	321	369
Unregulated Parameters (mg/kg dry)	**Class A Biosolids Limit (mg/kg dry)***	**Jan**	**Feb+**	**Mar**	**Apr**	**May**	**Jun^**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov^**	**Dec**	**Mean**
Conventionals														
moisture	n/a	98.7	98.6	---	---	---	99.1	99.0	99.1	99	98.6	---	98.4	98.8
pH	n/a	6.13	6.03	5.99	5.94	5.81	6.23	6.05	6.37	6.09	6.01	---	5.88	6.05
Metals														
aluminum	n/a	1,822	1,764	1,811	1,760	1,396	1,822	1,660	1,567	1,490	1,564	---	1,819	1,687
antimony	n/a	0.785	0.530	0.595	0.815	0.513	0.853	0.991	0.983	0.751	0.786	---	0.606	0.728
barium	n/a	66.1	59.2	57.9	59.7	49.8	53.3	73.1	58.4	49.8	55.2	---	56.9	58.2
beryllium	n/a	<DL	0.0375	0.0378	0.0349	0.0255	<DL	0.0280	<DL	<DL	0.0214	---	0.0294	0.031
bismuth	n/a	18.2	15.2	18.7	21.2	18.0	18.6	18.4	16.4	17.2	17.3	---	15.6	17.5
boron	n/a	38.6	54.7	60.4	65.5	62.8	69.3	54.8	52.6	36.4	29.3	---	21.3	50.0
calcium	n/a	9,185	8,657	10,840	9,891	9,527	9,722	9,420	9,444	8,960	8,857	---	7,688	9,237
iron	n/a	2,089	2,059	2,356	2,073	2,247	2,756	2,650	3,178	2,370	2,093	---	2,475	2,367
lithium	n/a	1.36	1.58	1.49	1.55	1.27	1.67	1.34	1.38	1.20	1.23	---	1.39	1.42
magnesium	n/a	4,096	4,285	5,193	6,196	6,102	6,067	5,340	5,644	6,120	5,914	---	5,081	5,360
manganese	n/a	177	156	143	154	140	121	111	99	103	111	---	125	133
phosphorus	n/a	14,670	17,565	21,890	23,050	22,690	23,670	20,400	23,330	22,600	24,070	---	18,440	20,828

Unregulated Parameters (mg/kg dry)	Class A Biosolids Limit (mg/kg dry)*	Jan	Feb+	Mar	Apr	May	Jun^	Jul	Aug	Sep	Oct	Nov^	Dec	Mean
potassium	n/a	6,970	10,113	12,950	14,980	14,330	12,220	10,100	11,330	11,900	12,140	---	11,190	11,528
silver	n/a	4.82	4.50	4.19	4.55	3.96	4.56	4.85	3.47	3.04	2.66	---	2.38	3.96
sodium	n/a	5,756	4,303	12,360	4,618	4,880	9,222	27,000	6,900	5,900	5,943	---	3,300	7,874
strontium	n/a	57.7	46.8	44.1	54.6	45.2	50.1	51.8	44.1	42.6	46.1	---	43.9	47.8
sulphur	n/a	7,556	7,711	8,800	10,040	8,145	11,440	29,900	7,444	6,100	7,000	---	5,275	9,760
tellurium	n/a	<DL	0.073	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	---	0.063	0.069
thorium	n/a	<DL	0.015	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	---	0.013	0.014
tin	n/a	1.17	0.80	1.29	2.18	4.28	2.77	4.11	12.11	3.83	1.31	---	1.53	3.02
titanium	n/a	32.3	3.3	20.4	51.4	20.3	42.0	38.9	18.7	8.5	7.9	---	21.3	22.4
tungsten	n/a	<DL	0.447	0.640	0.618	0.451	0.867	0.840	0.589	0.610	0.600	---	0.488	0.600
uranium	n/a	0.116	0.101	0.120	0.113	0.079	0.114	0.099	0.088	0.090	0.085	---	0.119	0.102
zirconium	n/a	0.539	0.071	0.404	0.975	0.822	0.930	1.230	1.800	0.247	0.262	---	0.560	0.659

Notes:
Shading indicates exceedance of regulatory limit

+ represents the mean of two field replicate samples.

^ ---November sample was not collected

* *From Organic Matter Recycling Regulation (B.C. Reg. 18/2002, Schedule 4 Section 3, February 28, 2019) which references Trade Memorandum T-4-93 'Safety Guidelines for Fertilizers and Supplements' (Sept 1997) and contains maximum acceptable metal concentrations based on annual application rates (mg metal/kg product) 4400 kg/ha –yr.*

APPENDIX B

MALIVIEW WWTP

Appendix B1 Maliview WWTP Effluent Flow 2021 (m^3/day)

Day	Jan			Feb			Mar			Apr			May			Jun			Jul			Aug			Sep			Oct			Nov			Dec		
	F-S	Sec	T-C	F-S	Sec	T-C	F-S	Sec	T-C	F-S	Sec	T-C	F-S	Sec	T-C	F-S	Sec	T-C	F-S	Sec	T-C	F-S	Sec	T-C	F-S	Sec	T-C	F-S	Sec	T-C	F-S	Sec	T-C	F-S	Sec	T-C
1	91	84	175	51	65	116	40	64	104	5	61	65	0	48	48	0	21	21	0	33	33	0	31	31	0	29	29	0	59	59	9	74	82	78	65	143
2	109	84	192	92	57	149	26	61	87	4	59	62	0	46	46	0	32	32	0	38	38	0	31	31	0	29	29	0	41	41	4	70	74	58	67	124
3	114	83	197	101	56	156	29	59	87	11	56	67	0	44	44	0	32	32	0	35	35	0	35	35	0	32	32	0	46	46	28	72	100	45	68	113
4	110	80	189	69	61	130	23	59	82	6	60	66	0	47	47	0	28	28	0	44	44	0	33	33	0	31	31	0	36	36	98	76	174	44	65	109
5	114	84	198	50	73	123	24	59	83	9	58	67	0	39	39	0	32	32	0	36	36	0	33	33	0	33	33	0	39	39	124	66	189	41	63	104
6	100	86	186	42	72	113	25	61	86	9	58	66	0	42	42	0	30	30	0	32	32	0	40	40	0	32	32	0	34	34	71	69	140	40	63	103
7	97	83	180	37	67	104	20	66	86	2	59	60	0	41	41	0	36	36	0	31	31	0	31	31	0	32	32	0	31	31	59	67	125	66	63	128
8	59	85	144	37	61	98	25	67	92	0	58	58	0	47	47	0	33	33	0	33	33	0	34	34	0	21	21	0	31	31	101	68	168	71	63	133
9	50	87	137	25	50	75	16	55	70	2	57	59	0	46	46	0	32	32	0	30	30	0	42	42	0	32	32	0	19	19	83	59	141	55	63	118
10	42	87	129	23	61	84	17	65	82	6	58	64	0	50	50	0	34	34	0	31	31	0	24	24	0	*	*	0	40	40	119	67	185	41	64	105
11	44	92	136	18	56	74	15	63	78	4	61	65	0	32	32	0	34	34	0	32	32	0	33	33	0	29	29	0	39	39	76	67	143	62	67	129
12	59	82	141	13	54	67	13	67	79	6	61	67	0	40	40	0	36	36	0	31	31	0	34	34	0	31	31	0	35	35	81	68	148	201	66	267
13	134	92	226	15	54	69	19	63	82	1	45	46	0	41	41	0	34	34	0	19	19	0	35	35	0	34	34	0	36	36	84	64	148	133	65	198
14	99	86	184	15	54	69	16	62	78	0	53	53	0	38	38	0	40	40	0	27	27	0	27	27	0	35	35	0	55	55	134	60	194	101	53	154
15	52	94	146	15	55	69	21	58	79	0	55	55	0	39	39	0	31	31	0	29	29	0	30	30	0	31	31	0	23	23	348	60	408	110	69	179
16	38	92	130	60	58	118	13	61	74	1	52	53	0	38	38	0	35	35	0	31	31	0	35	35	0	38	38	0	26	26	335	77	412	81	69	150
17	30	90	120	63	57	119	13	62	74	0	55	55	0	40	40	0	36	36	0	32	32	0	33	33	0	47	47	0	73	73	159	60	219	53	69	122
18	27	86	113	48	58	106	10	62	72	2	53	55	0	35	35	0	35	35	0	29	29	0	32	32	0	56	56	1	92	92	107	43	150	47	74	121
19	18	85	103	49	59	108	9	63	72	7	56	63	0	38	38	0	39	39	0	34	34	0	31	31	0	43	43	0	63	63	107	35	141	170	79	248
20	15	83	98	58	59	116	11	62	73	1	54	55	0	37	37	0	36	36	0	30	30	0	31	31	0	39	39	0	44	44	76	59	135	99	76	175
21	10	85	95	41	55	95	13	60	73	0	47	47	0	35	35	0	38	38	0	31	31	0	35	35	0	19	19	0	38	38	37	78	115	58	77	135
22	8	80	87	39	53	92	12	65	77	0	45	45	0	36	36	0	35	35	0	34	34	0	31	31	0	33	33	0	46	46	31	77	108	53	70	123
23	5	82	87	25	45	70	7	27	34	0	45	45	0	39	39	0	35	35	0	31	31	0	29	29	0	29	29	0	58	58	24	71	95	96	63	159
24	7	78	84	11	68	79	10	61	71	0	46	46	0	37	37	0	33	33	0	35	35	0	19	19	0	27	27	0	56	56	24	65	88	101	62	163
25	27	77	103	17	77	94	9	63	72	0	45	45	0	42	42	0	30	30	0	35	35	0	27	27	0	29	29	0	64	64	21	64	84	93	61	154
26	28	83	111	31	69	100	9	62	71	0	53	53	0	35	35	0	32	32	0	32	32	0	32	32	0	29	29	0	55	55	100	65	165	86	61	146
27	12	92	103	27	63	89	6	62	68	0	34	34	0	38	38	0	28	28	0	20	20	0	32	32	0	40	40	0	71	71	89	65	153	67	61	128
28	20	95	114	33	64	97	7	58	65	0	44	44	0	43	43	0	36	36	0	27	27	0	31	31	0	47	47	0	66	66	127	65	191	53	63	116
29	41	82	123	--	--	--	15	59	73	0	45	45	0	39	39	0	3*	3	0	30	30	0	35	35	0	38	38	60	78	138	206	64	270	43	64	106
30	44	78	122	--	--	--	9	59	68	0	39	39	0	31	31	0	34	34	0	30	30	0	35	35	0	33	33	30	83	113	114	57	171	45	63	108
31	46	65	111	--	--	--	6	60	65	--	--	--	0	38	38	--	--	--	0	30	30	0	34	34	--	--	--	11	79	89	--	--	--	33	63	96
Min	5	65	84	11	45	67	6	27	34	0	34	34	0	31	31	0	3	3	0	19	19	0	19	19	0	19	19	0	19	19	4	35	74	33	53	96
Max	134	95	226	101	77	156	40	67	104	11	61	67	0	50	50	0	40	40	0	44	44	0	42	42	0	56	56	60	92	138	348	78	412	201	79	267
Mean	53	84	137	39	60	99	16	60	76	2	52	55	0	40	40	0	32	32	0	31	31	0	32	32	0	34	34	3	50	53	99	65	164	75	66	140
Total Flows	1,641	2,615	4,255	1,099	1,675	2,774	483	1,866	2,348	73	1,564	1,637	0	1,234	1,234	0	966	966	0	964	964	0	988	988	0	972	972	101	1,550	1,651	2,970	1,941	4,911	2,317	2,031	4,348

Annual Min	**0**	**3**	**3**
Annual Max	**348**	**95**	**412**
Annual Mean	**24**	**50**	**74**

Notes:
F-S: Fine-screened; Sec: Secondary; T-C: Total combined.
Shading indicates exceedance of regulatory limit (250m^3/day T-C)
*****Low flow on June 29th was a result of maintenance on June 28th, when the WWTP was cleaned, and sludge removed. There was no effluent flow during cleaning.

Appendix B2 Maliview WWTP Compliance and Treatment Plant Performance 2021

Date	Influent			Secondary Effluent (Undisinfected)						Secondary Effluent Final Combined (secondary + screened)							
	TSS (mg/L)	BOD (mg/L)	FC (CFU/100 mL)	TSS (mg/L)	BOD (mg/L)	CBOD (mg/L)	FC (CFU/100 mL)	NH_3 (mg/L N)	pH	TSS (mg/L)	TSS Applicable Limit (mg/L)	BOD (mg/L)	CBOD (mg/L)	CBOD Applicable Limit (mg/L)	FC (CFU/100 mL)	Ammonia (mg/L N)	pH
January	286	210	3,800,000	23	25	15	88,000	12	7.5	28	130	24	15	130	120,000	13	7.5
February	113	100	12,000,000	38	42	30	290,000	19	7.1	73	130	79	87	130	300,000	19	7.2
March	122	250	1,300,000	31	37	25	240,000	25	7.3	38	45	40	39	45	210,000	23	7.3
April	340	260	32,000,000	39	51	43	2,000,000	39	7.5	44	130	51	50	130	850,000	41	7.4
May	190	240	3,200,000	36	53	36	880,000	58	7.6	40	130	49	53	130	840,000	58	7.6
June	340	670	24,000,000	35	58	53	750,000	50	7.3	41	45	59	64	45	580,000	52	7.3
July	338	350	5,900,000	33	63	64	650,000	69	7.5	31	45	68	68	45	710,000	64	7.6
August	305	340	7,100,000	23	29	23	480,000	38	7.6	33	45	29	22	45	450,000	62	7.6
September	207	210	41,000,000	29	45	19	550,000	63	7.6	34	45	22	22	45	580,000	63	7.6
October	520	210	11,000,000	39	27	25	370,000	38	7.5	29	45	21	24	45	300,000	36	7.5
November	172	210	2,800,000	20	15	20	56,000	16	.4	22	45	18	14	45	49,000	16	7.7
December	81	130	740,000	18	19	11	32,000	3	7.1	90	130	31	20	130	1,200,000	11	8.1
Mean	251	265	6,501,417	30	37	28	314,034	36	7.4	42	---	41	40	---	383,858	38	7.5
Min	81	100	740,000	18	15	11	32,000	3	7.1	22	---	18	14	---	49,000	11	7.2
Max	520	670	41,000,000	39	63	64	2,000,000	69	7.6	90	---	79	87	---	1,200,000	64	8.1
n	12	12	12	12	12	12	12	12	12	12	---	12	12	---	12	12	12
Mean Daily Loading	kg/day			kg/day				kg/day	---	kg/day	---			---		kg/day	---
	19	---	---	1.5	---	---	---	1.8	---	3.1	---	---	---	---	---	2.8	---

Notes:
TSS and CBOD shading indicates exceeding of the applicable regulatory limit
FC = Fecal Coliforms, TSS = total suspended solids, BOD = biochemical oxygen demand, CBOD = carbonaceous biochemical oxygen demand, FC = fecal coliforms, TRC = total residual chlorine, NH_3 = ammonia
TSS/CBOD secondary effluent (disinfected limit) = 45 mg/L when flow ≤60, and = 130 mg/L when flow >60

APPENDIX C

SCHOONER WWTP

Appendix C1 Schooner WWTP Effluent Flow 2021 (m^3/day)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	692	358	361	241	176	145	147	171	166	335	282	612
2	699	430	350	229	195	149	157	163	143	242	269	543
3	844	476	354	244	194	154	154	164	164	212	354	460
4	779	470	333	234	181	147	167	148	156	195	551	410
5	690	434	325	236	174	140	173	158	182	190	808	444
6	675	401	331	241	161	154	160	185	185	179	502	401
7	695	370	330	218	183	151	149	175	181	215	400	437
8	573	366	319	216	162	160	156	212	153	237	387	418
9	564	334	312	215	165	146	155	193	141	198	319	396
10	518	339	273	197	168	147	158	180	150	213	482	377
11	509	340	323	221	165	141	176	173	124	240	479	376
12	508	311	282	225	150	135	168	176	150	218	489	694
13	636	311	283	210	173	154	150	171	139	198	520	557
14	573	311	294	213	147	158	157	175	127	173	568	494
15	568	330	300	203	157	155	155	200	132	185	1,194	405
16	488	450	281	196	152	169	172	210	127	288	1,257	368
17	471	453	282	190	171	141	176	184	135	438	710	330
18	463	453	274	190	162	137	175	175	194	409	573	314
19	406	468	283	173	149	155	176	163	219	320	653	775
20	379	490	268	193	142	155	161	168	176	276	615	553
21	362	461	294	177	164	158	166	167	174	248	542	457
22	355	458	301	164	150	145	171	178	151	230	520	404
23	352	413	290	169	155	149	165	177	143	276	455	467
24	350	401	274	165	161	151	148	165	157	254	427	423
25	393	378	258	198	167	151	178	151	160	265	367	401
26	412	409	266	176	153	172	171	157	183	199	743	380
27	363	390	249	185	152	163	158	162	237	270	727	366
28	371	353	255	165	151	164	157	166	323	231	760	302
29	376	---	258	162	163	157	159	161	214	609	1,094	310
30	355	---	232	176	167	156	159	174	196	476	788	341
31	339	---	253	---	162	---	158	165	---	330	---	323
Min	339	311	232	162	142	135	147	148	124	173	269	302
Max	844	490	361	244	195	172	178	212	323	609	1,257	775
Mean	508	399	293	201	164	152	162	173	169	269	595	437
Total Flows	15,758	11,158	9,088	6,022	5,072	4,559	5,032	5,367	5,082	8,349	17,835	13,538

Notes: shading indicates exceedance of regulatory limit (640 m^3/day)

Annual Min	**131**
Annual Max	**1,257**
Annual Mean	**293**

Appendix C2 Schooner WWTP Compliance and Treatment Plant Performance 2021

Date	Influent			Secondary Effluent		Secondary Effluent Disinfected						
	TSS (mg/L)	BOD (mg/L)	FC (CFU/100 mL)	TSS (mg/L)	FC (CFU/100 mL)	TSS (mg/L)	BOD (mg/L)	CBOD (mg/L)	FC (CFU/100 mL)	NH_3 (mg/L N)	pH	Unionized NH_3 (mg/L)
Regulatory Limit						45 max / 25 mean		45 max / 25 mean	200			1.25
January	72	120	2,600,000	6	11,500	5	3	2	4	0.1	7.0	<0.0005
February	150	88	4,300,000	7	54,000	9	4	4	49	0	6.8	<0.0005
March	107	100	2,400,000	16	32,000	20	8	8	45	12	6.9	0.021
April	160	220	5,600,000	22	90,000	43	12	12	110	8	6.9	0.011
May	161	210	5,600,000	27	87,000	21	8	8	12	0.4	6.8	<0.0005
June	360	270	4,800,000	3	29,000	3	---	3	9	0.1	6.9	<0.0005
July	80	86	5,300,000	8	210,000	8	4	3	23	0	7.1	<0.0005
August	273	130	5,400,000	6	5,400	6	2	2	26	0.2	6.9	<0.0005
September	650	230	9,400,000	7	29,000	2	3	3	9	0.1	6.9	<0.0005
October	67	91	1,600,000	8	12,000	5	3	3	5	0.0	7.2	<0.0005
November	36	16	640,000	26	170,000	24	13	4	6400	0.8	7.3	0.0015
December	65	38	13,000,000	10	6,300	7	4	---	2	16.0	7.1	0.012
Mean	182	133	3,950,869	12	33,371	13	6	5	558	3.1	7.0	0.004
Min	36	16	640,000	3	5,400	2	<2	2	2	0.0	6.8	<0.0005
Max	650	270	13,000,000	27	210,000	43	13	12	6400	16.0	7.3	0.02
n	12	12	12	12	12	12	11	11	12	12.0	12	12
Mean Daily Loading	kg/day			kg/day		kg/day				kg/day		kg/day
	53	---	---	3.6	---	3.7	---	---	---	0.9	---	0.001

Notes:
TSS = total suspended solids, BOD = biochemical oxygen demand, CBOD = carbonaceous biochemical oxygen demand, FC = fecal coliforms, TRC = total residual chlorine, NH_3 = ammonia
--- data not collected
Shading indicates exceedance of regulatory limit

APPENDIX D

CANNON WWTP

Appendix D1 Cannon WWTP Effluent Flow 2021 (m^3/day)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	90	57	50	14	23	23	32	48	34	49	21	93
2	89	66	33	30	25	25	34	41	34	31	19	77
3	111	89	43	30	26	22	27	48	34	32	22	70
4	98	80	43	32	25	25	30	34	25	31	34	67
5	87	72	43	32	26	19	38	32	37	17	90	67
6	87	65	45	32	25	28	29	32	38	16	59	62
7	100	62	50	26	16	27	32	29	34	21	76	64
8	82	59	51	26	26	26	29	34	25	27	81	58
9	82	55	47	13	28	26	32	33	25	12	82	56
10	76	51	40	28	27	11	34	32	27	25	93	50
11	75	51	40	31	25	24	27	28	30	25	91	54
12	79	51	39	35	26	29	28	28	42	29	93	107
13	90	50	56	31	16	28	26	21	38	21	98	85
14	56	48	45	31	24	33	26	29	30	17	103	72
15	74	51	43	25	23	29	15	40	31	9	266	64
16	56	77	45	16	27	25	30	34	29	21	501	54
17	65	74	38	26	29	24	32	35	28	32	214	51
18	63	55	31	28	27	28	37	35	20	35	121	46
19	57	72	60	27	24	13	37	28	34	23	108	94
20	53	66	40	26	24	28	32	34	35	24	97	75
21	51	63	44	23	21	29	34	49	31	23	95	63
22	51	60	45	24	24	26	28	45	24	21	89	57
23	47	61	44	23	29	24	17	34	26	25	70	68
24	49	53	38	13	28	27	30	32	24	25	61	57
25	61	52	41	29	28	26	36	33	29	21	50	59
26	62	59	35	30	26	24	37	30	27	9	114	57
27	55	50	22	26	26	29	40	31	48	20	91	55
28	54	49	31	25	20	29	35	22	48	17	110	55
29	56	---	33	17	26	27	35	38	36	78	161	49
30	53	---	30	22	30	25	36	37	10	44	110	45
31	53	---	31	---	30	---	39	35	---	23	---	53
Min	47	48	22	13	16	11	15	21	10	9	19	45
Max	111	89	60	35	30	33	40	49	48	78	501	107
Mean	70	61	41	26	25	25	31	34	31	26	107	64
Total Flows	2,162	1,698	1,276	771	780	759	974	1,061	933	803	3,220	1,984

Annual Min	**9**
Annual Max	**501**
Annual Mean	**45**

Notes: shading indicates exceedance of regulatory limit (68 m^3/day)

Appendix D2 Cannon WWTP Compliance and Treatment Plan Performance 2021

Date	Influent			Secondary Effluent (Undisinfected)					
	TSS (mg/L)	BOD (mg/L)	FC (CFU/100 mL)	TSS (mg/L)	BOD (mg/L)	CBOD (mg/L)	FC (CFU/100 mL)	NH_3 (mg/L N)	pH
Regulatory Limit				60		45			
January	120	220	2,600,000	8	21	12	2,800,000	16.0	7.7
February	30	47	8,000,000	5	16	4.3	39,000	2.1	6.5
March	116	200	27,000,000	8	21	9.1	16,000	0.3	6.0
April	178	450	45,000,000	12	20	15	88,000	0.3	6.3
May	340	230	520,000,000	13	5	5.6	43,000	0.2	6.1
June	177	250	100,000	8	14	6.4	11,000	1.9	6.2
July	55	250	5,000,000	9	5	3.1	6,300	8.7	7.4
August	143	310	8,400,000	5	9	5.6	11,000	1.0	6.6
September	270	345	8,000,000	46	55	29	1,300,000	0.4	5.9
October	364	370	11,000,000	10	22	8.1	83,000	7.1	7.4
November	12	15	730,000	20	7	4.8	75,000	1.0	7.5
December	103	110	12,000,000	10	9	7.6	9,600	16.0	7.8
Mean	159	233	7,686,700	13	17	17.05	52,007	4.6	6.8
Min	12	15	100,000	5	5	3.1	6,300	0.2	5.9
Max	364	450	520,000,000	46	55	29	2,800,000	16.0	7.8
N	12	12	12	12	12	12	12	12.0	12
Mean Daily Loading	kg/day			kg/day				kg/day	
	7.2	---	---	0.6	---	---	---	0.2	---

Notes:
TSS = total suspended solids, BOD = biochemical oxygen demand, CBOD = carbonaceous biochemical oxygen demand, FC = fecal coliforms, NH_3 = ammonia
Shading indicates exceedance of regulatory limit.

APPENDIX E

PORT RENFREW WWTP

Appendix E1 Port Renfrew WWTP Effluent Flow 2021 (m^3/day)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	154	58	47	38	33	30	38	41	36	88	40	179
2	199	67	38	38	33	29	43	39	38	77	103	94
3	107	52	36	46	38	31	51	42	45	86	131	67
4	124	56	38	45	49	38	51	38	64	55	154	53
5	109	65	65	36	48	41	40	42	57	77	139	49
6	73	66	68	31	41	43	43	35	43	100	138	40
7	56	49	87	36	35	33	39	47	38	79	130	41
8	59	38	55	33	33	33	38	40	35	53	107	45
9	47	36	42	40	37	31	38	40	35	115	108	44
10	61	40	38	40	37	29	45	45	35	97	91	51
11	92	33	33	37	33	36	40	41	52	60	108	79
12	176	36	33	35	29	42	38	43	51	59	135	88
13	88	38	36	31	29	47	40	42	44	53	116	77
14	60	38	43	31	36	40	48	47	39	59	280	67
15	54	54	38	29	36	35	42	49	39	212	275	67
16	47	41	33	29	33	35	39	54	37	332	104	55
17	51	36	35	36	33	31	52	45	79	179	74	46
18	47	48	34	34	34	29	49	40	110	100	119	145
19	40	56	54	27	32	37	38	42	91	68	50	77
20	35	58	72	29	33	37	37	42	73	60	44	58
21	35	144	137	27	31	33	37	44	46	59	37	51
22	32	93	74	29	38	42	42	53	42	66	46	104
23	38	56	52	25	41	48	36	40	42	82	41	77
24	47	47	119	31	48	46	40	40	38	72	42	83
25	44	112	65	33	34	29	47	42	45	145	218	72
26	40	63	47	30	31	35	38	46	57	113	113	65
27	36	52	50	29	54	46	46	28	118	100	186	63
28	34	54	81	29	52	42	43	55	74	137	315	58
29	36	---	52	27	39	38	42	40	117	90	119	58
30	36	---	40	39	37	40	42	38	144	53	217	53
31	56	---	40	---	33	---	48	38	---	44	---	59
Min	32	33	33	25	29	29	36	28	35	44	37	40
Max	199	144	137	46	54	48	52	55	144	332	315	179
Mean	68	57	54	33	37	37	42	42	59	96	126	70
Total Flows	2,109	1,585	1,681	999	1,151	1,107	1,308	1,317	1,761	2,967	3,782	2,164

Annual Min	**25**
Annual Max	**332**
Annual Mean	**60**

Notes:
Shading indicates exceedance of regulatory limit (220 m^3/day)

Appendix E2 Port Renfrew WWTP Compliance and Treatment Plant Performance 2021

Date	Influent			Secondary Effluent					
	TSS (mg/L)	BOD (mg/L)	FC (CFU/100 mL)	TSS (mg/L)	BOD (mg/L)	CBOD (mg/L)	FC (CFU/100 mL)	NH_3 (mg/L N)	pH
Regulatory Limit				60		45			
January	159	240	2,600,000	14	17	4	9,900	0.2	5.9
February	594	470	2,200,000	9	20	7	610,000	1.1	6.4
March	106	260	2,000,000	13	15	4	3,500	0.1	6.9
April	193	1300	7,000,000	14	32	14	39,000	0.1	6.2
May	353	480	4,400,000	77	47	14	60,000	5.4	5.0
June	90	180	7,500,000	96	48	4	3,800	0.2	6.4
July	216	290	61,000,000	17	18	4	3,700	0.2	6.1
August	2,510	760	69,000,000	27	21	7	6,600	0.6	5.7
September	200	180	11,000,000	14	4	3	37,000	0.3	5.9
October	96	110	1,400,000	12	10	3	24,000	0.05	6.6
November	1230	610	22,000,000	29	21	3	9,700	0.04	6.6
December	136	180	60,000,000	9	6	4	7,900	0.1	6.7
Mean	490	422	8,834,717	28	22	6	16,139	0.7	6.2
Min	90	110	1,400,000	9	4	3	3,500	0.04	5.0
Max	2,510	1,300	69,000,000	96	48	14	610,000	5.4	6.9
N	12	12	12	12	12	12	12	12	12
Mean Daily Loading	kg/day			kg/day				kg/day	
	29	---	---	0.7	---	---	---	0.04	---

Notes:
TSS = total suspended solids, BOD = biochemical oxygen demand, CBOD = carbonaceous biochemical oxygen demand, FC = fecal coliforms, NH_3 = ammonia
--- data not calculated
Shading indicates regulatory exceedance.

Appendix E3 Port Renfrew WWTP Receiving Water Monitoring 2021 (all data presented as CFU/100mL)

Station	Depth (m)	08-Jul		16-Jul		23-Jul		29-Jul		05-Aug	
		Entero-cocci	Fecal Coliform	Entero-cocci	Fecal Coliform	Entero-cocci	Fecal Coliform	Entero-cocci	Fecal Coliform	Entero-cocci	Fecal Coliform
PRS-01	1	<4	<4	4	2	6	6	2	2	20	8
PRS-02	1	<4	<4	16	4	28	12	8	16	16	16
PRS-03	1	<4	<4	54	4	2	12	2	26	52	6
PRS-04	1	<4	<4	8	2	26	6	2	2	16	4
PRS-05	1	6	<4	44	2	12	20	20	<2	8	2
PRS-06	1	6	6	14	4	2	12	14	<2	44	14