Gulf Islands and Port Renfrew
Wastewater and Marine Environment Program 2020 Report

Capital Regional District | Parks & Environmental Services, Environmental Protection

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GULF ISLANDS AND PORT RENFREW
WASTEWATER AND MARINE ENVIRONMENT PROGRAM
2020 REPORT

EXECUTIVE SUMMARY

This report summarizes the 2020 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 undisinfected, secondary treated effluent; and one (Maliview) discharges undisinfected, 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. Influent and sludge monitoring provides 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, with 2020 a required year. Surface water sampling is also required in the event of emergency or planned bypass/overflow.

GANGES WWTP

Wastewater

The CRD analyzed wastewater influent and effluent for conventional and priority substances, plus effluent for acute toxicity. In 2020, 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. Staff are investigating alternative chlorine test methods for use in the future.

Of the 190 priority substances analyzed, 69 parameters were detected at standard detection limits (conventionals, metals, naphthalene, phenanthrene, low molecular weight polycyclic aromatic hydrocarbons (PAHs), total PAHs, and 1,4-dioxane). 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. Substances that exceeded BC WQG in undiluted effluent were: weak acid dissociable cyanide, cadmium, copper and zinc. All substances were below BC WQG after the minimum dilution calculation was applied. Minimum dilution represents 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 2020 passed the 96-hour trout acute toxicity test with 100% survival of test organisms. 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 with 100% survival, consistent with previous testing conducted from 2011-2019.

Sludge (Mixed Liquor)

Ganges WWTP sludge (mixed liquor) met the criteria for BC Organic Matter Recycling Regulations (OMRR) Class A Biosolids in 2020. None of the metals measured, including mercury, which has exceeded limits in the past, exceeded applicable OMRR Class A Biosolids limits.

Receiving Water

Routine receiving water monitoring was conducted at the Ganges WWTP in 2020. All results were below regulatory limits. 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 2020.

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 less than 60 m^3/d. For instantaneous flows equivalent to 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 14% of the days in 2020. 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 10% of the days. Exceedance of the allowable maximum of 250 m^3/d for total combined daily flows occurred on 1% of the days in 2020. Flow to the secondary treatment plant exceeded 60 m^3/d on 53% of days in 2020, resulting in a portion of the effluent bypassing the secondary treatment process of the plant to be treated solely by fine screening. Flow exceedances of the allowable maximum of 190 m^3/day to the fine-screened portion of the facility occurred on 1% of days in 2020.

The combined final effluent exceeded low flow (<60 m^3/d) registration limits for TSS in three samples, representing 38% of the low flow sampling events. CBOD exceeded limits in one monthly sample, representing 13% 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.

Receiving Water

Routine receiving water monitoring was conducted at the Maliview WWTP in 2020. All results were below regulatory limits. 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 once in 2020. During an operational inspection conducted in August 2020, CRD staff discovered that treated effluent from the Maliview WWTP was discharging from a break/leak in the outfall pipe into the intertidal zone of the marine environment. After repairs were completed, shoreline samples were collected. All samples were well below regulatory requirements.

Next Steps

Investigate ways to eliminate regulatory compliance violations. Staff and consultants have prepared a Strategic Asset Management Plan for the Maliview WWTP, and a subsequent 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 seven times in 2020, representing 2% of the year. All other regular, monthly effluent compliance parameters met regulatory criteria in 2020. Samples collected to confirm impact to treatment processes during three overflow events and field-analyzed were non-compliant for TSS.

Toxicity Testing

Effluent from July 2020 passed the 96-hour trout acute toxicity test with 100% survival. The sample also passed the 48-hour *Daphnia* acute toxicity test with 100% survival. These results are consistent with previous testing conducted from 2011-2019.

Receiving Water

Routine receiving water monitoring was conducted at the Schooner WWTP in 2020. All results were below regulatory limits. 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 2020.

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 for Phase 1 and this work is being undertaken. Grant funding is being sought for the remaining phases, planned for the next 5-7 years.

CANNON CRESCENT

Wastewater

The Cannon WWTP exceeded regulatory limits for flow 33 times in 2020, representing 9% of the year. All other effluent compliance parameters met regulatory criteria in 2020.

Receiving Water

Routine receiving water monitoring was conducted at the Cannon WWTP in 2020. All results were below regulatory limits. 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 2020, following two series of plant overflows occurring over three or more days in January and February. 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 for Phase 1 and this work is being undertaken. Grant money is being sought for the remaining phases, planned for the next 5-7 years.

PORT RENFREW

Wastewater

The Port Renfrew WWTP exceeded regulatory limits for flow one time in 2020, representing 0.3% of the year. All other effluent compliance parameters met regulatory criteria in 2020.

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 is planned to be conducted from the shoreline in spring/summer 2021.

Non-routine emergency receiving environment sampling was required once in 2020.

Next Steps

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. Update to the facility asset management plans are underway, and a phased implementation plan is anticipated pending funding.

GULF ISLANDS AND PORT RENFREW
WASTEWATER AND MARINE ENVIRONMENT PROGRAM
2020 REPORT

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1.0 INTRODUCTION

This report summarizes the 2020 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, as described.

1.1.2 Toxicity Testing

Effluent from Ganges and Schooner WWTPs were analyzed for toxicity to Rainbow trout (96-h LC50 test) and *Daphnia magna* (48-h LC50 test). Toxicity testing was a requirement under the MWR registrations for both these facilities.

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. Influent and effluent 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 behaviour 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 2020 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.

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 that such monitoring be undertaken for all CRD wastewater facilities, but that the inter-year frequency of monitoring would depend 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, in addition to 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 the 5-in-30 sampling 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 2020 sampling year represents year four of the current round of this four-year routine monitoring cycle, and receiving environment was conducted for four of the five facilities. The Port Renfrew sampling was delayed to 2021 due to staff availability limitations. 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 Cannon Crescent WWTP in 2020, following multiple days of plant overflows as a result of heavy rain events. The samples were analyzed for enterococci and results were compared to Health Canada (Health Canada, 2012) and ENV (MoE&CCS, 2019b) guidelines for enterococci, which include the requirements that no single sample should exceed 70 CFU/100 mL (Table 1.2).

During an operational inspection conducted in August 2020, CRD staff discovered that treated effluent from the Maliview WWTP was discharging from a break/leak in the outfall pipe into the intertidal zone of the marine environment. Repairs were conducted and shoreline sampling conducted.

In February 2020, a partial blockage of the outfall pipe at the Port Renfrew WWTP. A relief point was opened up to allow discharge to the marine environment. Shoreline sampling was conducted.

Table 1.2 Receiving Water Monitoring Regulatory Requirements

Parameter	Regulatory Requirement (CFU/100 mL)	
	Provincial	Federal
Fecal Coliform – geomean	---	---
Enterococci – geomean	35	35
Enterococci – single sample	70	70

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 lab, 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 Schooner and Ganges WWTPs were collected by grab sampling. Testing was conducted using standardized and approved protocols by Nautilus Environmental (Burnaby, BC). Effluent toxicity was determined through two tests:

1. A 96-hour acute toxicity test (EPS 1/RM/13) using juvenile Rainbow trout (*Oncorhynchus mykiss*). Five effluent concentrations plus one control were tested, with 10 test organisms per concentration. The number of organisms surviving at 96 hours was recorded, with 50% or greater survival in 100% effluent considered a pass, while less than 50% survival is a fail.

2. A 48-hour acute toxicity test (EPS 1/RM/14) using *Daphnia magna*. Five effluent concentrations plus one control were tested, with 10 test organisms per concentration. The number of organisms surviving at 48 hours was recorded, with 50% or greater survival in 100% effluent considered a pass, while less than 50% survival is a fail.

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 sample was 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. Non-routine emergency sampling occurred after wet weather overflows that exceeded three days' duration in the winter at the Cannon Crescent facility. Non-routine shoreline sampling was also conducted at the Maliview and Port Renfrew facilities after repairs/maintenance.

Routine receiving water 5-in-30 sampling was conducted at the four Gulf Islands sites in the spring of 2020. Port Renfrew was scheduled for routine receiving water sampling, but was delayed, due to personnel shortages. The receiving environment water sampling is planned to be conducted from the shoreline in spring/summer 2021.

Non-routine emergency receiving water sampling was conducted on January 27, 2020 and February 10, 2020 at the Cannon Crescent WWTP, as a result of treatment plant overflows, following heavy rain events.

On each sampling, date, receiving water samples were collected at six offshore stations around each outfall (Figures 2.1, 2.2, 2.4 and 2.5):

- 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 and fecal coliform) was analyzed at Bureau Veritas using the same methods as those used for wastewater. Geometric mean values were calculated for each bacteriological indicator at each station/depth. 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, Table 1.2).

Non-routine emergency receiving water sampling was conducted for the Cannon Crescent WWTP, as noted in Section 1.2, utilizing the same methodology as above, with samples analyzed for enterococci only.

Non-routine shoreline sampling was conducted at the Maliview WWTP (Figure 2.3) and at the Port Renfrew WWTP (Figure 2.6), as noted in Section 1.2.

Ganges Surface Monitoring Locations

Outfall Pipe

01 = Sampling Station

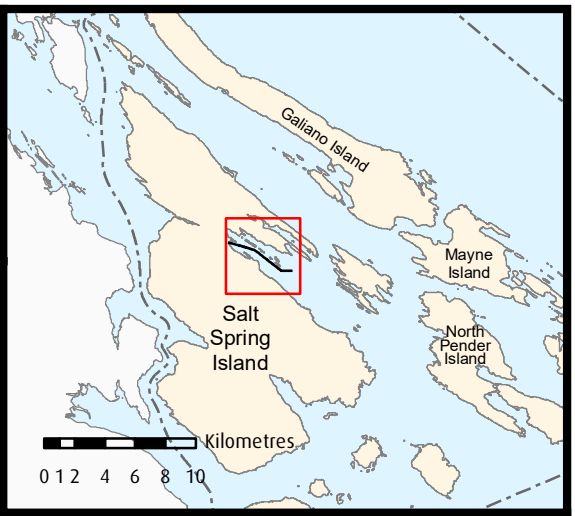
Making a difference...together

Metres

0 250 500 1,000 1,500

Projection: UTM ZONE 10N NAD 83

Important This map is for general information purposes only. The Capital Regional District (**CRD**) makes no representations or warranties regarding the accuracy or completeness of this map or the suitability of the map for any purpose. **This map is not for navigation.** The CRD **will not be liable** for any damage, loss or injury resulting from the use of the map or information on the map and the map may be changed by the CRD at any time.



Ganges Harbour

Welbury Point

05 04 01 03 02 06

Swanson Channel

N W E S

CRD - Facilities Management & Engineering Services - Apr 01, 2019 - Technologist: sruljancich - Map Document: SurfaceSamplesGanges0rtho2019.mxd

Maliview Surface Monitoring Locations

Outfall Pipe

01 = Sampling Station

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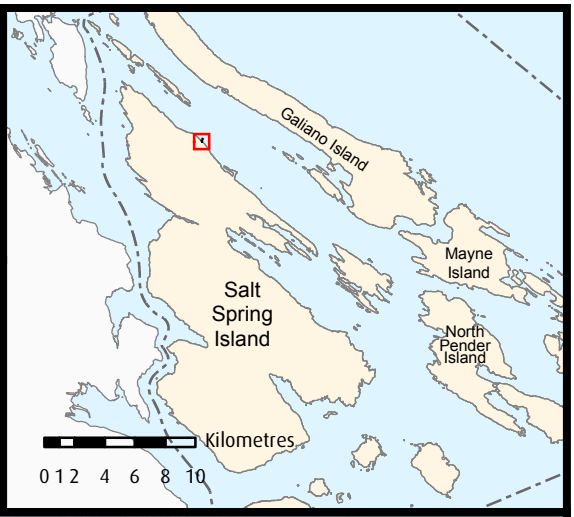
0 50 100 200 300 Metres

Projection: UTM ZONE 10N NAD 83



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Fernwood Point

08 03 04 02 05 12

Walker's Hook Rd

Westcott Rd

Fer de Lance Rd

Maliview Dr

Hedger Rd

CRD - Parks & Environmental Services - Environmental Engineering - Mar 15, 2017 - Technologist: SR - Map Document: SurfaceSamplesMailiviewOrtho.mxd

Parks & CRD Environmental Sustainability - Jun16, 2014 - Technologist: SR - Map Document: EmergencyOverflowSampSitesGulfIslands.mxd

MAL-SH-01

MAL-SH-02

MAL-SH-03

MAL-SH-04

MAL-SH-05

MAL-SH-06

MAL-SH-07

Maliview Wastewater Treatment Plant

TP

Fernwood Rd

Walkers Hook Rd

Westcott Rd

Fer de Lance Rd

Fer de Lance Rd

Maliview Dr

Hedger Rd

Trincomali Channel

SALT SPRING ISLAND

N

W

E

CRD
Making a difference... together

Metres
0 25 50 100 150

Projection: UTM ZONE 10N NAD 83

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- Emergency Overflow Sampling Site
- Stormwater Discharge Location
- TP CRD Wastewater Treatment Plant
- Sewer Outfalls
- Lot Lines

EMERGENCY OVERFLOW SAMPLING SITES
MALIVIEW

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

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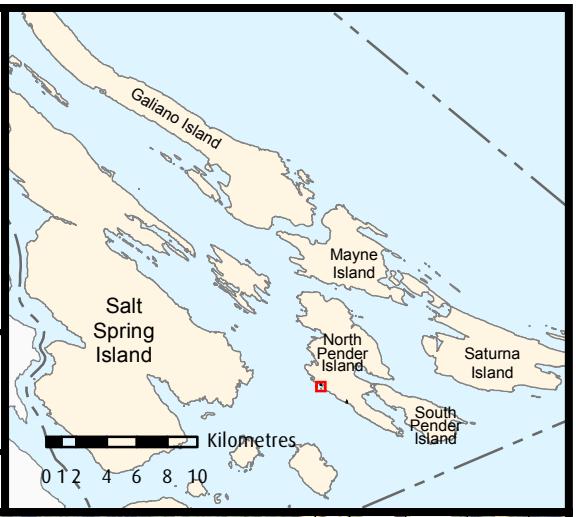
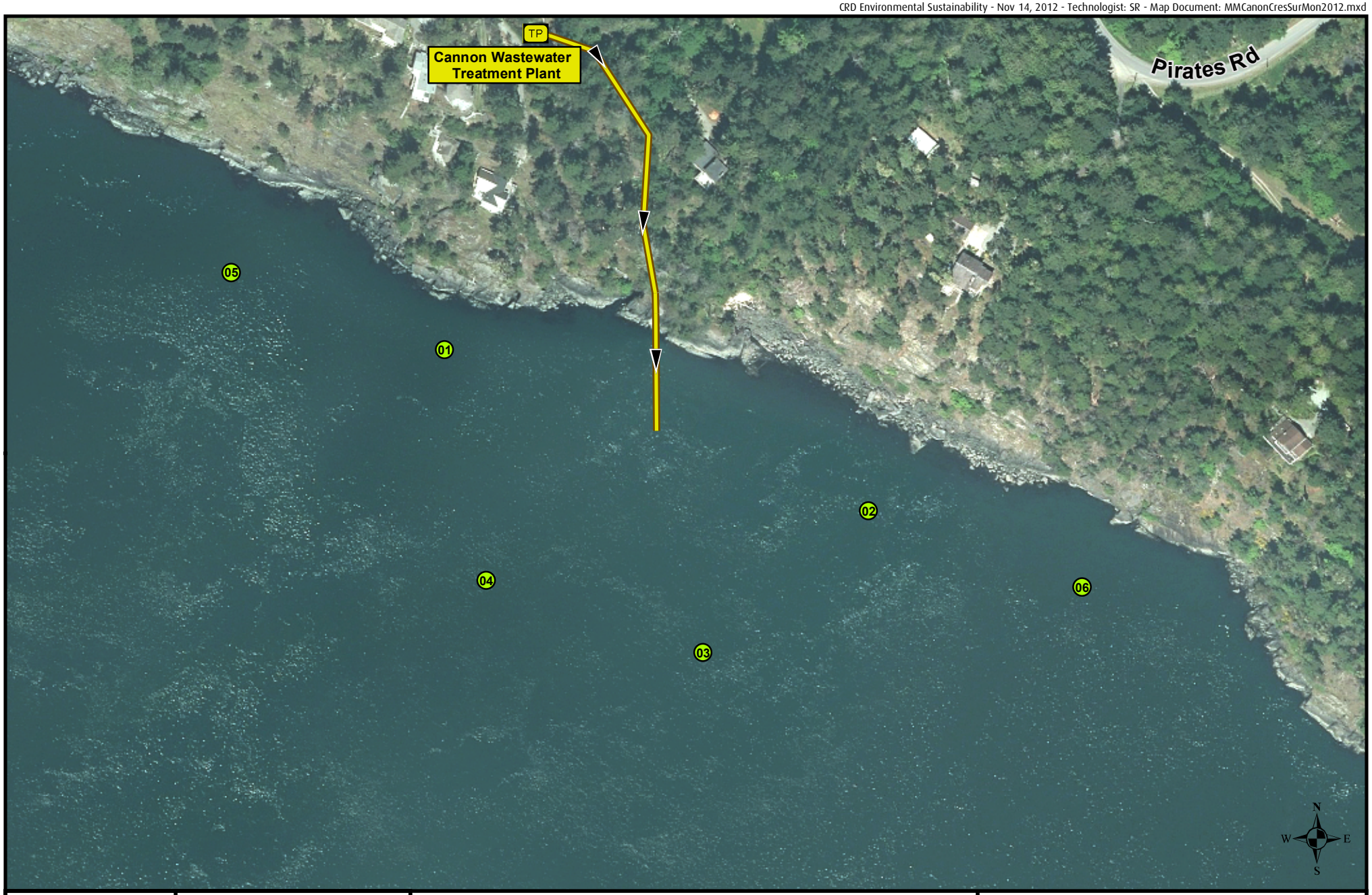


CRD - Parks & Environmental Services - Environmental Engineering - Apr 15, 2016 - Technologist: SR - Map Document: SurfaceSamplesSchoonerWayOrtho.mxd

CRD Environmental Sustainability - Nov 14, 2012 - Technologist: SR - Map Document: MMCanonCresSurMon2012.mxd



Making a difference...together

Metres

0 12.5 25 37.5 50

Projection: UTM ZONE 10N NAD 83

Important This map is for general information purposes only. The Capital Regional District (**CRD**) makes no representations or warranties regarding the accuracy or completeness of this map or the suitability of the map for any purpose. **This map is not for navigation.** The CRD **will not be liable** for any damage, loss or injury resulting from the use of the map or information on the map and the map may be changed by the CRD at any time.

Sampling Stations

Outfall Pipe

CANNON CRESCENT SURFACE SAMPLING

Figure 2.6 Port Renfrew Shoreline Sampling

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 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.

Ganges WWTP went through significant planned upgrades in 2019 to replace end-of-life equipment. In addition, the CRD requested a maximum daily flow limit increase of 10% in December 2019, as a result of increasing peak flow volumes. This was approved in early January 2020, effective from December 2019.

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 required for this facility in 2020 and was conducted in February and March.

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)	2020, 2024, 2028

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 2020, 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 2019). 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 five times in 2020, 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 67% 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. 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 2020, as a result of:

- Flow meter malfunction resulting in erroneous flow data (January 1);
- High flow resulting in bypass of the MBR (January 23).

Table 3.3 Ganges WWTP 2020 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	568	384	972	17,593	31	0
February	514	411	855	14,905	29	0
March	411	206	514	12,745	31	0
April	602	412	1,010	18,058	30	0
May	330	295	380	10,229	31	0
June	366	316	443	10,966	30	0
July	413	328	486	12,800	31	0
August	422	392	495	13,097	31	0
September	408	295	509	12,231	30	0
October	432	359	567	13,381	31	0
November	507	389	728	15,220	30	0
December	531	423	719	16,473	31	0
Annual	**458**	**206**	**1,010**	**167,287**	**365**	**0**

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

Table 3.4 Ganges WWTP 2020 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 N/L)	Total Residual Chlorine (mg/L)	pH
Influent									
Regulatory limit	---	---	---	---	---	---	---	---	---
Mean	458	337	---	15,239,359	298	---	---	---	---
Minimum	206	186	---	4,500,000	61	---	---	---	---
Maximum	1,010	572	---	70,000,000	450	---	---	---	---
Regulatory violations (%)	---	---	---	---	---	---	---	---	---
Number of samples	365	12	---	12	12	---	---	---	---
Secondary effluent									
Regulatory limit	---	---	---	---	---	---	1.25	0.02	---
Mean	458	2	---	84	---	---	---	---	---
Minimum	206	1	---	10	---	---	---	---	---
Maximum	1,010	3	---	328	---	---	---	---	---
Percent reduction (from influent)	---	99	---	>99	---	---	---	---	---
Regulatory violations	---	---	---	---	---	---			---
Number of samples	365	12	---	12	---	---			---
Disinfected secondary effluent									
Regulatory limit	1,198	25	25	1,000	---	---	1.25	0.02	---
Mean	458	1	2	48	2	0.13	0.0004	0.05	7.3
Minimum	206	<1	<2	<1	<2	0.04	<0.0005	<0.02	7.1
Maximum	1,010	2.8	<3	290	2	0	0.00	0.08	7.7
Percent reduction (from Influent)	---	>99	---	>99	>99	---	---	---	---
Regulatory violations (%)	0	0	0	0	---	---	0	67	---
Number of samples	365	12	12	12	12	12	12	9	12

TOXICITY TESTING

In 2020, disinfected effluent from July passed the 96-hour Rainbow trout acute toxicity test with 100% survival of test organisms. 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 (2012-2019), disinfected effluent from July passed the 48-hour *Daphnia magna* acute toxicity test with 100% survival of test organisms, corresponding to an LC50 of >100%. The *Daphnia* test is not required, but it was conducted to maintain consistency with other CRD discharge monitoring programs where toxicity testing is conducted.

PRIORITY SUBSTANCES

Of the 190 priority substances analyzed in Ganges WWTP effluent (Appendix A3), 69 parameters were detected at standard detection limits, (conventionals, metals, naphthalene, phenanthrene, low molecular weight PAHs, total PAHs, and 1,4-dioxane).

In 2020, 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). Substances that exceeded the established BC WQG in undiluted effluent were: weak acid dissociable cyanide, cadmium, copper and zinc. 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 treatment plant (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 2020 Ganges treatment plant sludge (mixed liquor) results had metal concentrations well below the criteria for Class A Biosolids. Historically, mercury levels have been elevated at times in Ganges sludge. Due to an error, mercury was only analyzed four times in 2020. All available 2020 mercury results were all below the Class A limit of 5.0 mg/kg, and have declined steadily over the past 10 years, except for peaks in 2002 and 2006 (Figure 3.1). The peaks in mercury concentrations in 2002 reached three times the historic mean. This was thought to be a result of implementation of the RSCP dental code of practice in July 2001, when plumbing lines within dental offices were flushed prior to installing the required amalgam separators. This purging of accumulated amalgam (likely containing high concentrations of mercury) may have then accumulated in the Ganges sludge that was removed in 2001 and 2002 (CRD, 2009). Mercury concentrations began to decline steadily after July 2002 and had met the Class A criterion by the last quarter of 2005. The causes of the few spikes in mercury concentrations since 2005 are unknown, but no spikes have been observed since late 2008. Monthly analyses will continue, in order to determine if there is a pattern to future spikes. If a pattern is identified, a source investigation will be initiated.

3.2.2 Receiving Water Monitoring

RECEIVING WATER BACTERIA INDICATORS

Routine surface water fecal coliform and enterococci data are summarized in Table 3.5 and Appendix A5. 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 1 CFU/100 mL and the maximum fecal coliform concentration was 2 CFU/100 mL, both well under guidelines (Table 3.5, Appendix A5). All six stations in 2020 had a geometric mean less than provincial and federal guidelines, with geometric means of <1 CFU/100 mL for both enterococci and fecal coliforms.

Table 3.5 Ganges Harbour WWTP 2020 Receiving Water Summary

Station	Location	Depth	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
Gan-01	100 m NE	top	<1	<1	<1	<1	<1	1.0
		middle	<1	<1	<1	<1	<1	2.0
Gan-02	100 m SE	top	<1	<1	<1	<1	<1	<1
		middle	<1	<1	<1	<1	1.0	<1
Gan-03	100 m SW	top	<1	<1	<1	<1	<1	<1
		middle	<1	<1	<1	<1	1.0	1.0
Gan-04	100 m NW	top	<1	<1	<1	<1	<1	<1
		middle	<1	<1	<1	<1	<1	1.0
Gan-05	200 m NW	top	<1	<1	<1	<1	<1	<1
Gan-06	200 m NE	top	<1	<1	<1	<1	<1	<1

There was no non-routine emergency monitoring required in 2020 at this facility.

The 2020 sampling year was a scheduled year for receiving water monitoring at Ganges WWTP. 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.

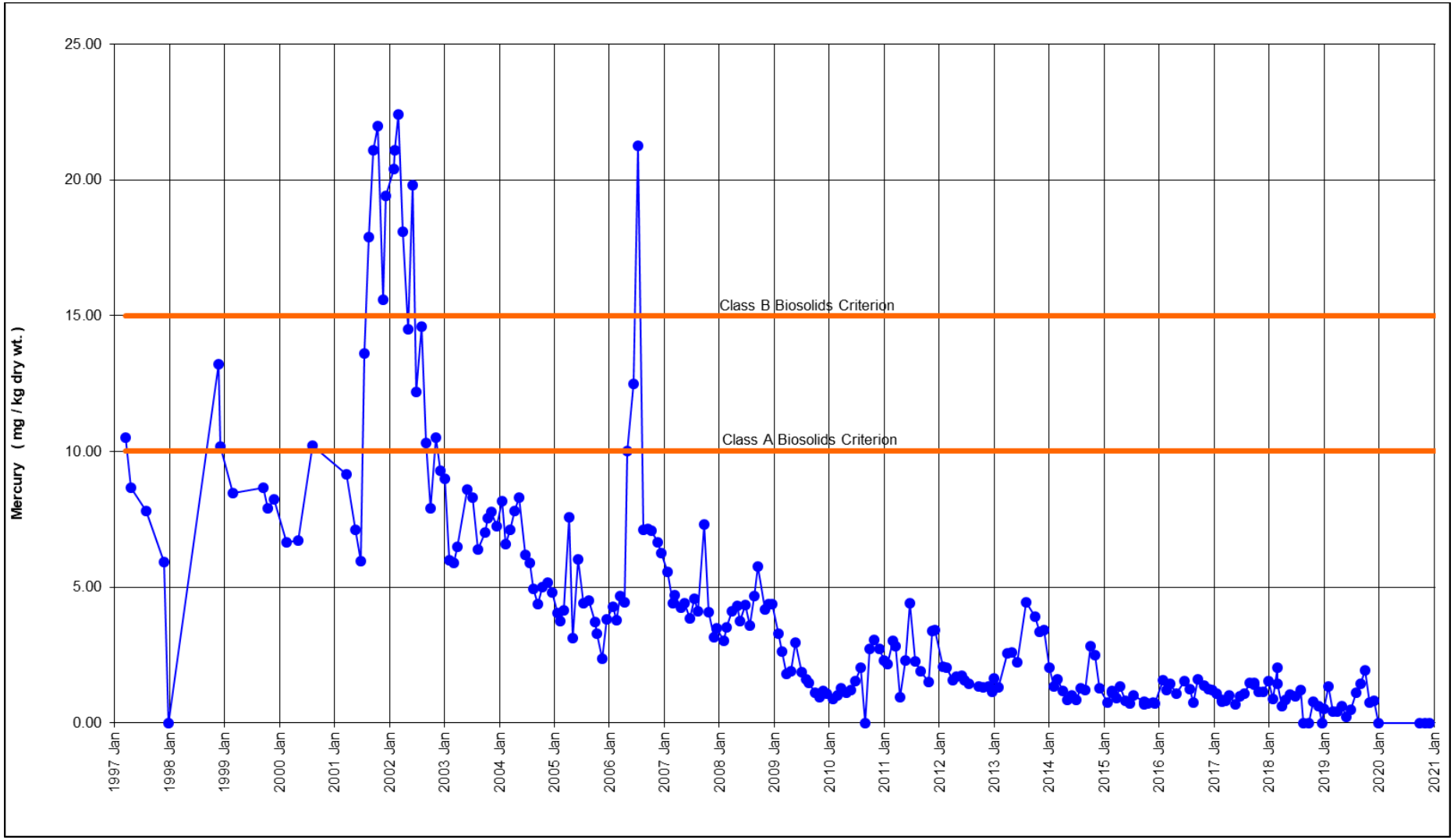


Figure 3.1 Ganges WWTP Mixed Liquor Mercury Levels (1997 to 2020)

*Note: due to error, mercury was only analyzed Jan., Oct., Nov. and Dec., 2020.

3.3 Recommendations

CONTINUE TO SHARE RESULTS WITH THE 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 required for this facility in 2020 and was conducted in February and March. Non-routine shoreline sampling was conducted in September, 2020 following the discovery, and subsequent repair, of a crack in the outfall pipe.

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
Receiving Water	Indicator bacteria (fecal coliform and enterococci)	2020, 2024, 2028

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 two days (1% of the time) in 2020. Flow bypassed the secondary treatment process and received fine screening only, despite a secondary flow of less than 60 m^3/d, on 85 days (23% of the time).

CRD staff have met on site with a contracting engineer who has reviewed the design and operation of the facility to identify solutions to increase capacity and treatment. 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 10 EIRs issued at Maliview WWTP in 2020, as a result of:

- heavy rain causing flow exceedance (January 23, February 1);
- crack in pipe resulting in discharge of sewage to beach (August 10);
- power outage resulting in a short bypass of untreated sewage (August 12);
- follow-up to the cracked pipe detailing completed repairs (September 11);
- mechanical failure to gear drive system (September 21);
- update to September 21 report regarding the mechanical failure (October 6);
- power outage leading to short bypass of untreated effluent (October 13);
- snow event leading to power outage and to short bypass of untreated effluent (December 21); and
- update to original report with final incident reports and final overflow volumes (December 21).

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, 88% of fecal coliform and 85% of total BOD. The combined final effluent exceeded low flow (<60 m^3/d) limits for TSS on three sampling days, representing 38% of the low flow sampling events. CBOD exceeded limits on one sampling day, representing 13% 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.

Table 4.3 Maliview WWTP 2020 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	93	39	223	2,898
February	51	11	236	1,481
March	10	1	33	310
April	5	0	15	142
May	3	0	17	104
June	1	0	12	45
July	4	0	26	128
August	0	0	2	5
September	0	0	0	0
October	0	0	5	5
November	27	0	96	815
December	46	6	115	1,430
Annual	**20**	**0**	**236**	**7,344**

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

Table 4.4 Maliview WWTP 2020 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	61	43	69	1,879
February	62	25	81	1,806
March	58	45	64	1,794
April	58	46	70	1,745
May	58	44	65	1,794
June	49	15	61	1,464
July	39	14	50	1,206
August	40	25	51	1,252
September	36	3	67	1,091
October	58	25	96	1,798
November	84	56	99	2,528
December	84	66	90	2,606
Annual	**57**	**3**	**99**	**20,961**

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

Table 4.5 Maliview WWTP 2020 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	154	96	289	4,777	0	10	31	1
February	119	48	303	3,449	1	11	28	1
March	68	46	96	2,103	9	15	21	0
April	63	48	78	1,886	12	11	18	0
May	61	48	82	1,898	13	11	17	0
June	50	15	67	1,508	27	9	3	0
July	43	30	52	1,334	31	13	0	0
August	41	25	53	1,257	31	5	0	0
September	36	3	67	1,091	29	0	1	0
October	58	25	96	1,803	14	0	17	0
November	111	56	191	3,343	1	0	29	0
December	130	78	202	4,036	0	0	31	0
Annual Total	**78**	**3**	**303**	**28,406**	**168**	**85**	**195**	**2**

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 mechanisms responds to instantaneous peak flow, so can get FS flow even when TF <60 m3/day

Table 4.6 Maliview WWTP 2020 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	78	250	---	5,940,950	228	---	---
Minimum	3	29	---	1,100,000	24	---	---
Maximum	303	870	---	150,000,000	690	---	---
Regulatory Violations (%)	1	---	---	---	---	---	---
Number of Samples	366	12	---	12	12	---	---
Secondary Effluent							
Regulatory Limit	60	45	45	---	---	---	---
Mean	57	32	28	460,017	31	35	7.4
Minimum	3	18	10	100,000	17	9	7.1
Maximum	99	71	73	3,100,000	75	77	7.7
Percent Reduction	---	87	---	92	87	---	---
Regulatory Violations (%)	42	0	0	---	---	---	---
Number of Samples	366	12	12	12	12	12	12
Fine-Screened Effluent[1]							
Regulatory Limit	190	---	---	---	---	---	---
Mean	20	---	---	---	---	---	---
Minimum	0	---	---	---	---	---	---
Maximum	236	---	---	---	---	---	---
Percent Reduction	---	---	---	---	---	---	---
Regulatory Violations (%)	1	---	---	---	---	---	---
Number of Samples	366	---	---	---	---	---	---
Combined Final Effluent[2]							
Regulatory Limit[3]	250	45 / 130	45 / 130	---	---	---	---
Mean	78	42	29	733,027	34	34	7.5
Minimum	3	19	15	89,000	13	9	7.2
Maximum	303	93	78	11,000,000	83	76	7.8
Percent Reduction	---	83	---	88	85	---	---
Regulatory Violations (%)	1	38 / 0	13 / 0	---	---	---	---
Number of Samples	366	8 / 4	8 / 4	12	12	12	12
Discharged Effluent							
Mean	78	37	29	733,027	34	34	12
Percent Reduction	---	85	---	88	85	---	---

Notes: [1] No fine-screened effluent samples were collected in 2020. 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

Surface water fecal coliform and enterococci data are summarized in Table 4.7 and Appendix B3. 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 10 CFU/100 mL and the maximum fecal coliform concentration was 140 CFU/100 mL, both under applicable guidelines (Table 4.7, Appendix B3). All maximum bacterial results were recorded on the February 25, 2020 sampling day. An inquiry into Plant activity on that day did not reveal anything unusual that may account for these results. All six stations in 2020 had a geometric mean less than provincial and federal guidelines, with a maximum geometric mean of <1 CFU/100 mL for enterococci and 2.8 CFU/100 mL for fecal coliforms.

During an operational inspection conducted on August 10, 2020, staff discovered that treated effluent from the Maliview WWTP was discharging from a break/leak in the outfall pipe into the intertidal zone of the marine environment. Beach signs were posted and repairs were completed on September 10. To ensure the impact from the beach had dissipated, shoreline sampling was conducted on September 11 (Figure 2.3). All results were well below recreational guidelines.

The 2020 sampling year was a scheduled year for receiving water monitoring at Maliview. 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 or one day duration in the summer.

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 have prepared a Strategic Asset Management Plan, and a subsequent detailed design for a new treatment plant that will resolve flow and effluent quality issues.

Table 4.7 Maliview WWTP 2020 Receiving Water Summary

Station	Location	Depth	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
Mal-02	100 m SW	top	<1	2	<1	<1	10	140
		middle	<1	3	<1	<1	1	43
Mal-03	100 m NW	top	<1	<1	<1	<1	<1	2
		middle	<1	1.0	<1	<1	1	2
Mal-04	100 m NE	top	<1	<1	<1	<1	<1	1
		middle	<1	<1	<1	<1	1	3
Mal-05	100 m SE	top	<1	1.3	<1	<1	1	27
		middle	<1	<1	<1	<1	1	2
Mal-08	200 m NW	top	<1	<1	<1	<1	1	1
Mal-12	200 m SE	top	<1	2	<1	<1	3	63

Table 4.8 Shoreline Sampling Maliview WWTP: September 11, 2020

Station	Enterococci (CFU/100 mL)
Shoreline 1	4
Shoreline 2	6
Shoreline 3	3
Shoreline 4	<1
Shoreline 5	8
Shoreline 6	5
Shoreline 7	2

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 required for this facility in 2020 and was conducted in February and March. In 2020, there was no non-routine emergency receiving environment sampling required.

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)	2020, 2024, 2028

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 2020, seven total daily flows, representing 2% 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 2020, all routine monthly compliance parameters at Schooner WWTP were within compliance limits in collected samples. Samples collected to confirm impact to treatment processes during three overflow events (as noted below on January 22nd, 31st, and February 5th) and field-analyzed, were non-compliant for TSS. However, 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 97% of the TSS, >99% of the fecal coliform and 98% 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 13 EIRs issued at Schooner WWTP in 2020, as a result of:

- system-wide BC Hydro failure resulting in no UV disinfection for the duration (January 10);
- heavy rainfall event resulting in TSS and likely FC exceedances, plus flow exceedance (January 22);
- heavy rainfall event resulting in flow exceedance (January 24);
- overflow due to heavy rain, TSS over permitted level (January 31);
- heavy rainfall event resulting in flow exceedance (February 1);
- heavy rainfall event resulting in flow and TSS exceedance (February 5);
- heavy rainfall event resulting in flow exceedance (February 6);
- system-wide BC Hydro failure resulting in no UV disinfection for the duration (March 13, November 16, December 15, 21);
- system-wide BC Hydro failure resulting in no UV disinfection for the duration, plus flow exceedance (December 30); and
- heavy rainfall event resulting in flow exceedance (December 31).

TOXICITY TESTING

As in previous years (2012-2019), the 2020 disinfected effluent sample from July 21, 2020 passed the 96-hour Rainbow trout acute toxicity test with 100% survival of test organisms.

The disinfected effluent sample from July 21, 2020 also passed the 48-hour *Daphnia magna* acute toxicity test with 100% survival of test organisms. The *Daphnia* test is not required, but it was conducted to maintain consistency with other CRD discharge monitoring programs where toxicity testing is required.

Table 5.3 Schooner WWTP 2020 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	418	295	819	12,973	6
February	434	261	891	12,574	14
March	267	228	369	8,276	0
April	228	175	291	6,825	0
May	172	152	217	5,344	0
June	158	140	184	4,725	0
July	159	133	194	4,932	0
August	176	153	213	5,446	0
September	165	131	283	4,959	0
October	215	143	379	6,676	0
November	309	174	529	9,270	0
December	373	224	665	11,572	3
Annual	**256**	**131**	**891**	**93,572**	**2**

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

Table 5.4 Schooner WWTP 2020 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	256	313	---	7,176,950	247	---	---	---	---
Minimum	131	117	---	1,100,000	34	---	---	---	---
Maximum	891	820	---	24,000,000	750	---	---	---	---
Regulatory violations (%)	2	---	---	---	---	---	---	---	---
Number of samples	366	12	---	12	12	----	---	---	---
Secondary Effluent									
Regulatory Limit	---	---	---	---	---	---	---	---	---
Mean	256	11	---	59,791	---	---	---	---	---
Minimum	131	4	---	6,300	---	---	---	---	---
Maximum	891	26	---	170,000	---	---	---	---	---
Percent Reduction	---	96	---	99	---	---	---	---	---
Regulatory violations	---	---	---	---	---	---	---	---	---
Number of samples	366	12	---	12	---	---	---	---	---
Disinfected Secondary Effluent									
Regulatory Limit	640	Max.: 45 Avg.: 25	Max.: 45 Avg.: 25	200	---	---	1.25	0.02	---
Mean	256	9	4	23	4	1.60	<0.0005	---	7.0
Minimum	131	4	2	5	3	0.09	<0.0005	---	6.8
Maximum	891	21	6	73	7	11	<0.0005	---	7.8
Percent Reduction	---	97	---	100	98	---	---	---	---
Regulatory violations (%)	2	0*	0	0	---	---	0	---	---
Number of samples	366	12	12	12	12	12	4		12

Notes:
Data is comprised of routine, monthly sampling results. Three field-analyzed samples were non-compliant.
These samples were taken on: January 22 with a TSS of 685 mg/L, January 31 with a TSS of 204 mg/L and February 5 with a TSS of 216 mg/L.

5.2.2 Receiving Water Monitoring

RECEIVING WATER BACTERIA INDICATORS

Surface water fecal coliform and enterococci data are summarized in Table 5.5 and Appendix C3. 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).

Maximum enterococci and fecal coliform concentrations were both 2 CFU/100 mL, well under guidelines (Table 5.5, Appendix B3). All six stations in 2020 had a geometric mean less than provincial and federal guidelines, with geometric means of <1 CFU/100 mL for both enterococci and fecal coliforms.

There was no non-routine emergency monitoring required in 2020 at this facility. The 2020 sampling year was a scheduled year for receiving water monitoring at Schooner Way. 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 or one day duration in the summer.

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 and consultants completed a condition assessment of the sewer service assets in 2011. Several assets were noted to be nearing the end of their life and upgrades were approved. Staff are undertaking the proposed 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.

The service area residents recently approved the borrowing of $6M for capital improvement infrastructure upgrades, including back-up power. Installation of the new standby generator will be complete in 2022. Next steps are being determined, but it is likely that additional funding will be required to complete phases 2 and 3 of the work, which will involve major upgrades to five pump stations and to Cannon and Schooner WWTPs.

Table 5.5 Schooner Way WWTP 2020 Receiving Water Summary

Station	Location	Depth	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
Sch-03	100 m SE	top	<1	<1	<1	<1	<1	1
		middle	<1	<1	<1	<1	1.0	2
Sch-04	100 m WSW	top	<1	<1	<1	<1	<1	1
		middle	<1	<1	<1	<1	<1	<1
Sch-05	100 m NW	top	<1	<1	<1	<1	<1	1
		middle	<1	<1	<1	<1	2	<1
Sch-06	100 m S	top	<1	<1	<1	<1	1	1
		middle	<1	<1	<1	<1	2	<1
Sch-10	200 m SSE	top	<1	<1	<1	<1	2	<1
Sch-14	200 m W	top	<1	<1	<1	<1	1	1

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 (note that the length has previously been erroneously reported as 204 m long) 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 required for this facility in 2020 and was conducted in February and March. In 2020, there were also two non-routine emergency receiving environment sampling events required, in January and February.

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
Receiving Water	Indicator bacteria (fecal coliform and enterococci)	2020, 2024, 2028

6.2 Results

6.2.1 Wastewater Monitoring

COMPLIANCE AND TREATMENT PLANT PERFORMANCE MONITORING

In 2020, 34 total daily flows, representing 9% of the year, from the Cannon WWTP exceeded the allowable maximum (Table 6.3, Appendix D1). Flow exceedances occurred in January, February, 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 2020, all compliance parameters at Cannon WWTP were within compliance limits in collected samples.

Overall, the treatment plant removed approximately 88% 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 34 EIRs issued at Cannon WWTP in 2020, all a result of overflows, due to heavy rain/snow (multiple dates in January, February, November and December).

Table 6.3 Cannon WWTP 2020 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	65	43	103	2,004	32
February	61	28	119	1,765	31
March	42	27	60	1,358	0
April	37	19	43	1,095	0
May	42	26	52	1,296	0
June	39	32	55	1,163	0
July	36	26	53	1,116	0
August	33	22	44	1,017	0
September	31	17	52	926	0
October	42	17	65	1,294	0
November	51	28	84	1,520	13
December	58	58	87	1,797	32
Annual	**45**	**17**	**119**	**16,308**	**9**

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

Table 6.4 Cannon WWTP 2020 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	96	---	11,452,491	227	---	---
Minimum	7	16	---	1,100,000	30	---	---
Maximum	119	382	---	78,000,000	590	---	---
Permit Violations (%)	9	---	---	---	---	---	---
Number of Samples	366	12	---	12	12	---	---
Secondary Effluent							
Regulatory Limit	68	60	45	---	---	---	---
Mean	45	12	16	25,158	16	2.53	6.5
Minimum	17	3	<2	2,500	3	0.05	2.0
Maximum	119	44	11	220,000	48	8.40	7.4
Percent Reduction	---	88	---	100	93	---	---
Permit Violations (%)	9	0	0	---	---	---	---
Number of Samples	366	12	12	12	12	12	12

6.2.2 Receiving Water Monitoring

RECEIVING WATER BACTERIA INDICATORS

Surface water fecal coliform and enterococci data are summarized in Table 6.5 and Appendix D3. 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 3 CFU/100 mL and the maximum fecal coliform concentration was 1 CFU/100 mL, both well under guidelines (Table 6.5, Appendix D3). All six stations in 2020 had a geometric mean less than provincial and federal guidelines, with geometric means of <1 CFU/100 mL for both enterococci and fecal coliforms.

Table 6.5 Cannon Crescent WWTP 2020 Receiving Water Summary

Station	Location	Depth	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
Can-01	100m NW	top	<1	<1	<1	<1	1	1
		middle	<1	<1	<1	<1	2	1
Can-02	100m NE	top	<1	<1	<1	<1	1	1
		middle	<1	<1	<1	<1	1	1
Can-03	100m SE	top	<1	<1	<1	<1	<1	<1
		middle	<1	<1	<1	<1	3	<1
Can-04	100m SW	top	<1	<1	<1	<1	2	<1
		middle	<1	<1	<1	<1	1	1
Can-05	200m NW	top	<1	<1	<1	<1	<1	<1
Can-06	200m NE	top	<1	<1	<1	<1	<1	<1

Table 6.6 Cannon Crescent Overflow Sampling Conducted in 2020

27-Jan-20			10-Feb-20	
Station	Depth (m)	Enterococci (CFU/100 mL)	Depth (m)	Enterococci (CFU/100 mL)
Can – 01	1	<1	1	<1
Can – 01	11	2	13	1
Can – 02	1	1	1	1
Can – 02	9	1	10	2
Can – 03	1	<1	1	<1
Can – 03	5	1	20	1
Can – 04	1	<1	1	<1
Can – 04	3	<1	20	<1
Can – 05	1	<1	1	1

Non-routine overflow sampling was required at Cannon Crescent on January 27, 2020 as a result of plant overflows occurring January 23-26, and on February 10, 2020 as a result of plant overflows occurring January 29-February 9, as a result of heavy rain events. Results are detailed in Table 6.6. All of the enterococci results were well below the provincial and federal monitoring guidelines (Section 1.2).

The 2020 sampling year was the scheduled year for receiving water monitoring at Cannon Crescent. 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 or one day duration in the summer.

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 and consultants completed a condition assessment of the sewer service assets in 2011. Several assets were noted to be nearing the end of their life and upgrades were approved. Staff are undertaking the proposed upgrades in a phased manner over a five- to seven-year period, with phase 1 upgrades are about 50% complete.

The service area residents recently approved the borrowing of $6M for capital improvement infrastructure upgrades, including back-up power. Next steps are being determined, but it is likely that additional funding will be required to complete phases 2 and 3 of the work, which will involve major upgrades to five pump stations and to Cannon and Schooner WWTPs.

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 availability), sampling was delayed. The receiving environment water sampling is planned to be conducted from the shoreline in spring/summer 2021.

Non-routine receiving environment sampling was required once in February of 2020.

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
Receiving Water	Indicator bacteria (fecal coliform and enterococci)	2020, 2024, 2028

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 2020, there was one exceedance for daily flows at the Port Renfrew WWTP, representing 0.3% 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. All compliance parameters were below regulatory limits. The treatment plant removed approximately 88% of the TSS, 91% 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 two EIRs issued at Port Renfrew WWTP in 2020, as a result of:

- overflow due to heavy rain (January 1); and
- partially-blocked outfall pipe causing surcharge through a low point manhole (February 10).

Table 7.3 Port Renfrew WWTP 2020 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	106	46	258	3,294	3
February	61	30	199	1,757	0
March	42	28	77	1,312	0
April	34	23	63	1,024	0
May	45	32	59	1,382	0
June	42	26	62	1,263	0
July	40	26	62	1,255	0
August	48	34	81	1,477	0
September	46	26	131	1,393	0
October	56	27	116	1,749	0
November	70	39	163	2,105	0
December	78	34	170	2,409	0
Annual	**56**	**23**	**258**	**20,418**	**0.3**

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

Table 7.4 Port Renfrew WWTP 2020 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	56	176	---	4,596,113	194	---	---
Minimum	23	33	---	910,000	41	---	---
Maximum	258	414	---	23,000,000	380	---	---
Permit Violations (%)	0.3	---	---	---	---	---	---
Number of Samples	366	12	---	12	12	---	---
Secondary Effluent							
Regulatory Limit	220	60	45	---	---	---	---
Mean	56	21	7	59,205	18	1.14	6.1
Minimum	23	7	3	6,800	2	0.07	4.7
Maximum	258	56	28	1,600,000	47	5.0	6.8
Percent Reduction	---	88	---	99	91	---	---
Permit Violations (%)	0	0	0	---	---	---	---
Number of Samples	366	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 at Port Renfrew. However, due to extenuating circumstances (staffing availability), sampling was delayed. The receiving environment water sampling is planned to be conducted from the shoreline in spring/summer 2021.

Non-routine shoreline sampling was conducted at Port Renfrew on February 21st, 2020 following the discovery of a partial blockage of the outfall pipe. Effluent was observed to be entering a ditch on the WWTP land, flowing under the road through a culvert, and into the marine environment. Results are detailed in Table 7.5. All of the enterococci results were well below the provincial and federal monitoring guidelines (Section 1.2).

Table 7.5 Port Renfrew Shoreline Sampling Conducted in 2020

21-Feb-20		
Station	Enterococci (CFU/100 mL)	E. coli (CFU/100 mL)
Sample – 01	0	8
Sample – 02	2	7
Sample – 03	0	4
Sample – 04	1	4
Sample – 05	1	6

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.

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. Update to the facility asset management plans are underway, and a phased implementation plan is anticipated pending funding.

8.0 REFERENCES

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APPENDIX A

GANGES WWTP

Appendix A1 Ganges WWTP Effluent Flow Data 2020 (m^3/day)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	478	640	419	452	300	357	383	425	371	421	499	500
2	404	855	427	548	307	363	421	395	408	359	429	463
3	478	604	418	897	304	337	441	405	295	387	578	506
4	573	522	431	927	327	337	396	423	509	364	496	464
5	550	501	427	937	347	343	384	420	416	416	489	445
6	522	621	466	822	295	321	417	495	424	399	481	441
7	535	584	438	998	334	316	413	409	389	367	444	508
8	653	578	440	979	321	333	365	433	431	422	437	553
9	652	548	409	885	322	388	453	412	387	429	471	487
10	517	472	444	1010	317	383	427	394	419	414	458	511
11	625	505	504	759	343	379	387	440	439	436	419	482
12	603	500	467	486	347	410	375	433	393	408	515	423
13	602	427	470	446	308	343	434	473	369	567	620	461
14	574	501	431	492	313	348	411	439	413	439	523	501
15	464	474	434	465	312	363	328	413	399	438	533	563
16	384	468	396	487	305	355	464	413	393	434	626	578
17	446	445	415	473	337	373	419	412	405	395	728	577
18	423	425	404	481	332	375	465	405	395	452	637	558
19	573	484	206	484	351	389	417	427	368	460	554	601
20	523	497	414	483	331	343	439	440	360	471	497	521
21	458	477	360	495	347	341	442	440	401	437	478	694
22	553	463	366	422	333	374	330	436	426	453	435	719
23	701	451	349	412	323	323	486	407	455	520	536	562
24	972	583	417	501	312	443	446	409	460	463	533	534
25	737	478	408	473	380	410	412	424	473	422	514	456
26	570	468	385	481	357	356	381	411	388	464	488	505
27	609	477	395	451	364	406	389	421	376	449	453	539
28	604	446	364	444	361	369	409	392	425	429	456	490
29	559	411	353	424	329	391	452	423	433	472	389	521
30	639	---	374	444	333	397	410	408	411	394	504	675
31	612	---	514	---	337	---	404	420	---	400	---	635
Min	384	411	206	412	295	316	328	392	295	359	389	423
Max	972	855	514	1010	380	443	486	495	509	567	728	719
Average	568	514	411	602	330	366	413	422	408	432	507	531
Total Flow	17,593	14,905	12,745	18,058	10,229	10,966	12,800	13,097	12,231	13,381	15,220	16,473

Annual Min	**206**
Annual Max	**1,010**
Annual Average	**459**

Note: shading indicates exceedance of regulatory limit (1,090 m^3)

Appendix A2 Ganges WWTP Compliance and Treatment Plant Performance 2020

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	400	5,800,000	<1	10	1.2	<2	<2	<1	0.09	<0.0005	0.02	7.1
February	274	240	70,000,000	2	13	<1	<2	<2	4	0.15	<0.0005	0.06	7.2
March	572	420	14,000,000	2	26	1.2	<2	<2	<1	0.10	<0.0005	<0.02	7.2
April	540	450	13,000,000	2	66	<1	<2	<2	10	0.19	<0.0005	---	7.7
May	190	61	4,500,000	3	328	<1	<2	<2	60	0.04	<0.0005	0.08	7.3
June	294	250	21,000,000	2	246	<1	<2	<3	78	0.05	<0.0005	---	7.1
July	186	310	11,000,000	3	85	2.8	<2	<2	120	<0.16	<0.0019	0.06	7.2
August	472	310	37,000,000	2	52	<1	<2	<2	290	0.07	<0.0005	0.04	7.3
September	388	410	53,000,000	2	10	<1	<2	<2	13	0.41	0.0013	0.06	7.1
October	202	220	16,000,000	2	13	<1	<2	<2	2	0.07	<0.0005	---	7.7
November	270	260	9,300,000	2	103	2.0	<2	<2	<1	0.15	<0.0005	0.05	7.1
December	314	250	7,000,000	2	56	<1	<2	<2	1	0.06	<0.0005	0.02	7.3
Mean	337	298	15,239,359	2.0	84	1.3	<2	<2	48	0.129	0.0004	0.05	7.3
Min	186	61	4,500,000	<1	10	<1	<2	<2	<1	0.04	<0.0005	<0.02	7.1
Max	572	450	70,000,000	3	328	2.8	<2	<3	290	0.41	0.001	0.08	7.7
N	12	12	12	12	12	12	12	12	12	12	12	9	12
Mean Daily Loading	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day
	154.2	136.7	---	0.91	---	0.6	---	---	---	0.06	0.0002	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 Priority Substances Detected in Ganges WWTP Influent and Effluent 2020

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	270	82	0.20	10		
biochemical oxygen demand (BOD)	mg/L	15	210	<2	ND	ND		
carbonaceous biochemical oxygen demand (CBOD)	mg/L	30	230	<2	ND	ND		
chemical oxygen demand (COD)	mg/L	10	564	52	0.12	6.3		
chloride	mg/L	1.0	74	80	0.19	9.8		
cyanide-SAD	mg/L	0.001	0.007	0.003	0.00001	0.0004		
cyanide-WAD	mg/L	0.001	0.005	0.002	0.00001	0.0003	0.001	
hardness (as CaCO3) dissolved	mg/L	0.5	49	45	0.11	5.5		
hardness (as CaCO3)	mg/L	0.5	60	47	0.11	5.7		
oil & grease, mineral	mg/L	2.0	2.7	<2	ND	ND		
oil & grease, total	mg/L	1.0	11	<1	ND	ND		
total organic carbon	mg/L	10	61	<10	ND	ND		
pH	pH	---	7.3	7.1	0.02	n/a		
pH @ 15°C	pH	---	6.7	6.7	0.02	n/a		
specific conductivity - 25°C.	µS/cm	2.0	770	450	1.1	n/a		
sulfide	mg/L	0.01	0.21	0.01	0.00003	0.002		
sulphate	mg/L	1.0	24	22	0.05	2.7		
total suspended solids	mg/L	5.0	120	1.2	0.003	0.15		
BACTERIOLOGY								
Enterococci	CFU/100 mL	100	2,800,000	7.0	0	---	35 geomean / 70 single sample	35 geomean / 70 single sample
Fecal Coliforms	CFU/100 mL	100	12,000,000	41	0	---		
NUTRIENTS								
N - NH3 (as N)	mg/L	0.4	43	<0.015	ND	ND	19.7	
N - NH3 (as N)- unionized @ 15°C	mg/L	0.001	0.06	<0.0005	ND	ND		
N - NO2 (as N)	mg/L	0.01	<0.005	0.03	0.0001	0.003		
N - NO3 (as N)	mg/L	0.02	<0.02	1.4	0.003	0.17		
N - NO3 + NO2 (as N)	mg/L	0.02	<0.02	1.4	0.003	0.17		
N - TKN (as N)	mg/L	1	60	0.76	0.002	0.09		
N - TN	mg/L	1	60	2.2	0.005	0.26		
P - PO4 - ortho (as P) dissolved	mg/L	0.03	4.7	0.42	0.001	0.05		
P - PO4 - total (as P) total	mg/L	0.005	7.73	0.49	0.001	0.0001		

Parameter	Units	MDL	Ganges Influent	Ganges Effluent	Effluent Diluted	Loading (kg/year)	BC WQG	CCME / HC WQG
METALS DISSOLVED								
aluminum	µg/L	0.5	20	19	0.04	0.002		
antimony	µg/L	0.02	0.49	0.23	0.0006	0.00003		
arsenic	µg/L	0.02	0.54	0.21	0.0005	0.00003		
barium	µg/L	0.02	6.62	7.62	0.02	0.0009		
beryllium	µg/L	0.01	<0.01	<0.01	ND	ND		
cadmium	µg/L	0.01	0.03	0.04	0.0001	0.000005		
calcium	µg/L	0.0001	0.012	0.012	0.00003	0.0015		
chromium	µg/L	0.1	0.26	0.23	0.0005	0.00003		
chromium VI	µg/L	0.000001	<0.000001	<0.000001	ND	ND		
cobalt	µg/L	0.01	0.18	0.17	0.0004	0.00002		
copper	µg/L	0.1	59	11	0.03	0.001		
iron	µg/L	1.0	225	35	0.08	0.004		
lea	µg/L	0.01	0.43	0.23	0.0005	0.00003		
magnesium	µg/L	0.0001	0.0046	0.0036	0.00001	0.00044		
manganese	µg/L	0.1	51	43	0.10	0.005		
mercury	µg/L	0.002	<0.0019	<0.0019	ND	ND		
molybdenum	µg/L	0.1	0.46	0.08	0.0002	0.00001		
nickel	µg/L	0.02	1.65	0.73	0.002	0.0001		
phosphorus	µg/L	2.0	5,310	486	1.16	0.06		
potassium	µg/L	0.0001	0.018	0.015	0.00004	0.0018		
selenium	µg/L	0.04	0.30	0.14	0.0003	0.00002		
silver	µg/L	0.01	0.23	0.01	0.00003	0.000002		
thallium	µg/L	0.00	0.00	<0.002	ND	ND		
tin	µg/L	0.2	0.94	0.26	0.0006	0.00003		
zinc	µg/L	0.1	49	57	0.14	0.007		
METALS - TOTAL								
aluminum	µg/L	3.0	185	24	0.06	0.003		
antimony	µg/L	0.02	0.45	0.25	0.0006	0.00003		
arsenic	µg/L	0.02	0.61	0.20	0.0005	0.00002	12.5	12.5
barium	µg/L	0.1	15	7.93	0.02	0.001		
beryllium	µg/L	0.01	<0.01	<0.01	ND	ND	100	
cadmium	µg/L	0.01	0.11	0.36	0.0008	0.00004	0.12	0.12
calcium	µg/L	0.0003	0.016	0.013	0.00003	0.0015		
chromium	µg/L	0.1	0.50	0.22	0.0005	0.00003		
chromium III	µg/L	0.000001	<0.000001	<0.000001	ND	ND	56	

Parameter	Units	MDL	Ganges Influent	Ganges Effluent	Effluent Diluted	Loading (kg/year)	BC WQG	CCME / HC WQG
cobalt	µg/L	0.01	0.31	0.18	0.0004	0.00002		
copper	µg/L	0.1	118	11	0.03	0.001	<2 (lt), 3 (st)	
iron	µg/L	5.0	481	44	0.10	0.005		
lead	µg/L	0.02	2.51	0.25	0.0006	0.00003	≤2 (lt), 140 (st)	
magnesium	µg/L	0.0003	0.0052	0.0038	0.00001	0.0005		
manganese	µg/L	0.1	78	46	0.11	0.006		
mercury	µg/L	0.002	0.02	<0.0019	ND	ND		0.16
molybdenum	µg/L	0.1	0.55	0.08	0.0002	0.00001		
nickel	µg/L	0.1	2.20	0.86	0.002	0.0001	8.3	
potassium	µg/L	0.0003	0.019	0.016	0.00004	0.002		
selenium	µg/L	0.04	0.35	0.14	0.0003	0.00002	2	
silver	µg/L	0.01	0.26	0.02	0.00004	0.000002	1.5 (lt), 3 (st)	7.5
thallium	µg/L	0.002	0.01	<0.002	ND	ND		
tin	µg/L	0.2	1.32	0.27	0.0006	0.00003		
zinc	µg/L	1.0	114	59	0.14	0.0072	10 (lt), 55 (st)	
METALS - OTHER								
dibutyltin	µg/L	0.001	<0.001	<0.001	ND	ND		
dibutyltin dichloride	µg/L	0.001	<0.001	<0.001	ND	ND		
methyl mercury	ng/L	0.02	0.98	0.33	0.0008	0.00000004		
monobutyltin	µg/L	0.001	<0.001	<0.001	ND	ND		
monobutyltin trichloride	µg/L	0.001	<0.001	<0.001	ND	ND		
tributyltin	µg/L	0.001	<0.001	<0.001	ND	ND	0.001	
tributyltin chloride	µg/L	0.001	<0.001	<0.001	ND	ND		
ALDEHYDES								
acrolein	µg/L	3	<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	1.0	<1	<1	ND	ND		
pentachlorophenol	µg/L	0.5	<0.5	<0.5	ND	ND		
PHENOLIC COMPOUNDS								
total phenols	mg/L	0.008	0.07	<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		
4,6-dinitro-2-methylphenol	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	3.1	<3.1	<2.5	ND	ND		
phenol	µg/L	2.5	11	<2.5	ND	ND		
POLYCYCLIC AROMATIC HYDROCARBONS (PAH)								
2-chloronaphthalene	µg/L	0.3	<0.25	<0.25	ND	ND		
2-methylnaphthalene	µg/L	0.01	0.02	<0.01	ND	ND	0.0202	
acenaphthene	µg/L	0.01	0.02	<0.01	ND	ND	6	
acenaphthylene	µg/L	0.01	<0.01	<0.01	ND	ND		
anthracene	µg/L	0.01	0.06	<0.01	ND	ND		
benzo(a)anthracene	µg/L	0.01	0.14	<0.01	ND	ND		
benzo(a)pyrene	µg/L	0.01	0.11	<0.005	ND	ND	0.01	
benzo(b)fluoranthene	µg/L	0.01	0.15	<0.01	ND	ND		
benzo(b)fluoranthene + benzo(j)fluoranthene	µg/L	0.01	0.15	<0.01	ND	ND		
benzo(g,h,i)perylene	µg/L	0.02	0.14	<0.02	ND	ND		
benzo(k)fluoranthene	µg/L	0.01	0.13	<0.01	ND	ND		
chrysene	µg/L	0.01	0.12	<0.01	ND	ND	0.1	
fluoranthene	µg/L	0.01	0.13	<0.01	ND	ND		
fluorene	µg/L	0.01	0.13	<0.01	ND	ND	12	
indeno(1,2,3-c,d)pyrene	µg/L	0.1	<0.14	<0.02	ND	ND		
naphthalene	µg/L	0.01	0.04	0.03	0.0001	0.000003	1	1.4
phenanthrene	µg/L	0.01	0.08	0.01	0.00003	0.000001		
pyrene	µg/L	0.01	0.09	<0.01	ND	ND		
PAH-high molecular weight	µg/L	0.1	1.20	<0.02	ND	ND		
PAH-low molecular weight	µg/L	0.01	0.35	0.04	0.0001	0.000005		
total PAHs	µg/L	0.1	1.50	0.04	0.0001	0.000005		
SEMIVOLATILE ORGANICS								
bis(2-ethylhexyl)phthalate	µg/L	5.0	10	<5	ND	ND		
butylbenzyl phthalate	µg/L	2.5	2.80	<2.5	ND	ND		
diethyl phthalate	µg/L	0.3	0.76	<0.25	ND	ND		
di-n-butyl phthalate	µg/L	2.5	<2.5	<2.5	ND	ND		
di-n-octyl phthalate	µg/L	0.6	<0.64	<0.25	ND	ND		

Parameter	Units	MDL	Ganges Influent	Ganges Effluent	Effluent Diluted	Loading (kg/year)	BC WQG	CCME / HC WQG
MISC SEMIVOLATILE ORGANICS								
bis(2-chloroethoxy)methane	µg/L	0.3	<0.25	<0.25	ND	ND		
bis(2-chloroethyl)ether	µg/L	0.3	<0.25	<0.25	ND	ND		
bis(2-chloroisopropyl)ether	µg/L	0.3	<0.25	<0.25	ND	ND		
hexachlorobutadiene	µg/L	0.3	<0.25	<0.25	ND	ND		
hexachlorocyclopentadiene	µg/L	0.3	<0.25	<0.25	ND	ND		
hexachloroethane	µg/L	0.3	<0.25	<0.25	ND	ND		
isophorone	µg/L	0.3	<0.25	<0.25	ND	ND		
nitrobenzene	µg/L	0.3	<0.25	<0.25	ND	ND		
N-nitrosodimethylamine	µg/L	1.0	<1	<1	ND	ND		
N-nitrosodi-n-propylamine	µg/L	1.0	<1	<1	ND	ND		
N-nitrosodiphenylamine	µg/L	1.0	<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	0.1	<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	0.57	<0.5	ND	ND		
2,6-dinitrotoluene	µg/L	0.3	<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	0.1	<0.05	<0.05	ND	ND		
4-chlorophenyl phenyl ether	µg/L	0.3	<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	7.60	<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		
1,1,2,2-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		
1,1,2-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
1,2-dichloroethane	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		
1,4-dioxane	µg/L	0.1	<0.1	0.34	0.0008	0.00004		
2,4-dinitrotoluene	µg/L	0.3	<0.25	<0.25	ND	ND		
alpha-terpineol	µg/L	5.0	<5	<5	ND	ND		
bromomethane	µg/L	1.0	<1	<1	ND	ND		
chlorobenzene	µg/L	0.5	<0.5	<0.5	ND	ND		
chlorodibromomethane	µg/L	1.0	<1	<1	ND	ND		
chloroethane	µg/L	1.0	<1	<1	ND	ND		
chloroethene	µg/L	0.5	<0.5	<0.5	ND	ND		
chloromethane	µg/L	1.0	<1	<1	ND	ND		
ALIPHATIC								
acrylonitrile	µg/L	1.0	<1	<1	ND	ND		
methyl tertiary butyl ether	µg/L	4.0	<4	<4	ND	ND	440	5,000
cis-1,2-dichloroethene	µg/L	1.0	<1	<1	ND	ND		
cis-1,3-dichloropropene	µg/L	1.0	<1	<1	ND	ND		
dibenzo(a,h)anthracene	µg/L	0.02	0.14	<0.02	ND	ND		
1,2-dibromoethane	µg/L	0.2	<0.2	<0.2	ND	ND		
dibromomethane	µg/L	2.0	<2	<2	ND	ND		
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		
1,2-dichloropropane	µg/L	0.5	<0.5	<0.5	ND	ND		
trans-1,2-dichloroethene	µg/L	1.0	<1	<1	ND	ND		
trans-1,3-dichloropropene	µg/L	1.0	<1	<1	ND	ND		
trichloroethene	µg/L	0.5	<0.5	<0.5	ND	ND		
trichlorofluoromethane	µg/L	4.0	<4	<4	ND	ND		
trichloromethane	µg/L	1.0	8.80	<1	ND	ND		
TRIHALOMETHANES								
bromodichloromethane	µg/L	1.0	1.10	<1	ND	ND		
dichlorodifluoromethane	µg/L	2.0	<2	<2	ND	ND		
tribromomethane	µg/L	1.0	<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	53	<15	ND	ND		
methyl ethyl ketone	µg/L	50	<50	<50	ND	ND		
methyl isobutyl ketone	µg/L	10	<10	<10	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 2020

Regulated Parameters (mg/kg dry wt)	Class A Biosolids Limit (mg/kg)*	Jan	Feb+		Mar	Apr	May	Jun^	Jul	Aug	Sep+		Oct	Nov	Dec	Average
Metals				std dev								std dev				
arsenic	20	0.0178	0.0140	0.0008	0.0135	0.0097	0.0117	---	0.0422	0.0257	0.0039	0.0014	0.0113	0.0149	0.0180	0.017
cadmium	20	0.0103	0.0077	0.0003	0.0071	0.0064	0.0216	---	0.0612	0.0273	0.0039	0.0007	0.0098	0.0100	0.0120	0.016
chromium	100	0.0491	0.0475	0.0049	0.0475	0.0345	0.0420	---	0.1340	0.0758	0.0148	0.0031	0.0343	0.0442	0.0759	0.055
cobalt	25	0.0224	0.0191	0.0008	0.0166	0.0121	0.0135	---	0.0328	0.0186	0.0039	0.0009	0.0098	0.0127	0.0169	0.016
copper	3,500	8.74	7.25	0.22	6.42	5.39	6.54	---	18.9	10.2	1.895	0.415	12.5000	6.3600	7.8500	8.368
lead	120	0.130	0.103	0.004	0.096	0.084	0.102	---	0.306	0.195	0.035	0.007	0.0842	0.1080	0.1210	0.124
mercury	10	0.006	---	---	---	---	---	---	---	---	---	---	0.0032	0.0032	0.0034	0.004
molybdenum	200	0.021	0.022	0.001	0.023	0.018	0.022	---	0.063	0.046	0.009	0.002	0.0199	0.0284	0.0321	0.028
nickel	450	0.094	0.088	0.004	0.085	0.070	0.087	---	0.274	0.162	0.024	0.006	0.0901	0.1270	0.1300	0.112
selenium	200	0.017	0.014	0.001	0.014	0.012	0.015	---	0.047	0.025	0.005	0.002	0.0116	0.0172	0.0168	0.018
zinc	10,000	2.97	2.375	0.075	2.38	3.04	3.01	---	9.21	5.3	1.1305	0.2295	2.7800	3.2200	3.3400	3.523
Unregulated Parameters (mg/kg dry wt)	**Class A Biosolids Limit (mg/kg)***	**Jan**	**Feb+**		**Mar**	**Apr**	**May**	**Jun^**	**Jul**	**Aug**	**Sep+**		**Oct**	**Nov**	**Dec**	**Average**
Conventionals																
Metals																
aluminum	n/a	24.8	20.1	1.3	1.3	13.3	13.6	---	39.6	24.1	4.955	1.125	11.6	19.3	22.6	17.8
antimony	n/a	0.004	0.004	0.001	0.005	0.004	0.004	---	0.020	0.012	0.002	0.000	0.0059	0.0116	0.0073	0.007
barium	n/a	0.78	0.62	0.02	0.66	0.48	0.59	---	1.60	1.12	0.18	0.036	0.424	0.507	0.614	0.690
beryllium	n/a	0.0005	<0.001	0	<0.001	<0.001	<0.001	---	0.00075	<0.001	<0.001	0.000	<0.001	<0.001	<0.001	0.001
bismuth	n/a	0.163	0.136	0.006	0.135	0.125	0.132	---	0.390	0.275	0.056	0.012	0.143	0.175	0.185	0.174
boron	n/a	0.337	0.272	0.010	0.320	0.240	0.303	---	0.886	0.764	<0.5	0.000	0.510	0.720	0.648	0.500
calcium	n/a	99.6	73.0	2.5	85.6	63.8	73.3	---	213	132	41.2	5.70	77.2	95.1	105	96.3
iron	n/a	21	23.7	3.45	20.4	21.2	20.5	---	53.8	34.3	9.37	1.34	16.0	27.6	27.3	25.0
lithium	n/a	0.019	0.020	0.001	0.017	0.018	0.016	---	0.023	0.020	0.008	0.000	0.012	0.014	0.020	0.017
magnesium	n/a	42.3	35.6	1.45	35.9	32.1	34.8	---	101	74.6	25.2	3.50	35.9	43.0	52.5	46.6
manganese	n/a	4.18	3.35	0.115	2.63	2.27	2.62	---	5.17	2.49	0.521	0.086	1.23	1.98	2.34	2.62
phosphorus	n/a	174	146	7	147	129	132	---	447	308	94.8	14.3	135	168	202	189
potassium	n/a	94.8	81.3	3.4	95.6	85.1	82	---	230	163	64.8	6.65	78.6	92.6	116	108
silver	n/a	0.057	0.053	0.004	0.044	0.047	0.049	---	0.142	0.072	0.012	0.002	0.038	0.090	0.069	0.061
sodium	n/a	48.3	50.9	1.8	80.5	58.8	57.3	---	64.3	72.9	59.15	1.15	56.2	50.0	47.9	58.8
strontium	n/a	0.534	0.428	0.017	0.393	0.358	0.443	---	1.12	0.730	0.201	0.029	0.437	0.580	0.629	0.532

Appendix A4, cont'd

Unregulated Parameters (mg/kg dry wt)	Class A Biosolids Limit (mg/kg)*	Jan	Feb+		Mar	Apr	May	Jun^	Jul	Aug	Sep+		Oct	Nov	Dec	Average
Conventionals																
Metals (cont'd)																
sulphur	n/a	51.4	54.7	1.75	43.2	<30	42.9	---	165	116	<30	0.000	53.4	81.4	106	79.3
tellurium	n/a	<0.0005	<0.005	0	<0.005	<0.005	<0.005	---	<0.0005	<0.005	<0.005	0.000	<0.005	<0.005	<0.005	<0.005
thallium	n/a	0.0003	<0.0002	0	<0.0002	<0.0002	0.000224	---	0.0008	0.000507	<0.0002	0.000	0.0002	0.0003	0.0003	0.000
thorium	n/a	0.0001	<0.001	0	<0.001	<0.001	<0.001	---	<0.0001	<0.001	<0.001	0.000	<0.001	<0.001	<0.001	0.000
tin	n/a	0.006	0.008	0.002	0.006	0.008	0.004	---	0.053	0.024	0.005	0.001	0.054	0.017	0.012	0.018
titanium	n/a	0.128	0.315	0.063	0.16	0.092	<0.05	---	0.039	0.314	0.064	0.002	0.064	0.683	0.212	0.207
tungsten	n/a	0.002	<0.01	0	<0.01	<0.01	<0.01	---	0.010	<0.01	<0.01	0.000	<0.01	<0.01	<0.01	0.006
uranium	n/a	0.0013	0.0013	0.0001	0.0013	0.0009	0.0008	---	0.0017	0.0013	0.0003	0.000	0.0006	0.0013	0.0012	0.001
vanadium	n/a	0.043	0.039	0.003	0.036	0.023	0.023	---	0.053	0.026	0.015	0.001	0.015	0.027	0.042	0.031
zirconium	n/a	0.002	0.004	0.0004	0.002	0.002	0.001	---	0.004	0.007	0.002	0.0001	0.004	0.013	0.004	0.004

Notes:
Shading indicates exceedance of regulatory limit

+ represents the mean of two field replicate samples.

std dev = standard deviation of the two field replicate samples

--- indicates sludge not collected due to facility construction.

^ June 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 A5 Ganges Harbour WWTP Receiving Water 2020 (all data presented in CFU/100 mL)

Station	Site	Depth	Feb-25		Mar-04		Mar-06		Mar-09		Mar-19	
			Enterococci	Fecal Coliform	Enterococci	Fecal Coliform	Enterococci	Fecal Coliform	Enterococci	Fecal Coliform	Enterococci	Fecal Coliform
Gan-01	100m NE	top	<1	<1	<1	<1	<1	<1	<1	1	<1	<1
		middle	<1	2	<1	<1	<1	<1	<1	<1	<1	<1
Gan-02	100m SE	top	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
		middle	<1	<1	1	<1	<1	<1	<1	<1	<1	<1
Gan-03	100m SW	top	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
		middle	<1	1	<1	<1	1	<1	<1	<1	<1	1
Gan-04	100m NW	top	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
		middle	<1	<1	<1	1	<1	<1	<1	<1	<1	<1
Gan-05	200m NW	top	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Gan-06	200m NE	top	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

APPENDIX B

MALIVIEW WWTP

Appendix B1 Maliview WWTP Effluent Flow Data 2020 (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	40	61	101	180	64	244	19	61	80	6	63	69	5	64	68	3	53	56	5	39	44	0	41	41	0	44	44	0	37	37	0	62	62	21	88	109
2	45	60	105	236	63	298	25	62	86	4	62	66	3	63	65	0	53	53	10	38	48	0	43	43	0	32	32	0	36	36	0	62	62	12	90	102
3	47	59	106	125	68	193	22	63	84	5	60	65	8	63	71	0	50	50	9	37	46	2	51	53	0	35	35	0	36	36	0	56	56	11	89	100
4	115	57	172	61	69	130	23	63	86	6	60	66	8	63	70	0	50	50	16	36	52	1	47	47	0	32	32	0	36	36	36	85	121	7	86	93
5	93	59	152	57	69	126	21	61	81	9	61	70	4	60	64	0	49	49	12	39	50	0	42	42	0	35	35	0	43	43	21	99	120	7	82	89
6	85	56	141	131	61	192	16	61	77	8	59	67	2	62	63	0	50	50	15	36	51	0	44	44	0	35	35	0	25	25	12	94	106	6	80	86
7	106	61	166	113	59	171	22	60	82	5	46	50	1	60	60	0	51	51	11	35	46	0	45	45	0	33	33	0	34	34	7	91	98	11	78	89
8	164	61	225	109	58	167	33	63	96	2	62	64	0	56	56	0	50	50	7	34	41	0	46	46	0	34	34	0	35	35	3	79	82	12	66	78
9	111	62	173	82	58	139	19	58	77	3	70	73	1	58	58	1	15	15	10	43	52	1	46	47	0	32	32	0	34	34	3	82	84	48	87	134
10	70	63	133	55	64	119	14	62	76	2	58	59	1	61	61	0	48	48	0	45	45	0	42	42	0	*	*	0	36	36	0	63	63	53	86	138
11	118	57	175	28	79	107	7	64	71	4	56	60	3	62	65	0	55	55	0	46	46	0	42	42	0	24	24	0	46	46	0	77	77	32	85	117
12	106	61	166	13	81	94	8	62	70	2	54	56	0	57	57	0	52	52	0	50	50	0	46	46	0	33	33	0	65	65	0	77	77	26	83	108
13	83	63	146	11	81	92	6	62	67	3	56	59	2	61	63	10	56	66	1	49	50	0	40	40	0	32	32	0	81	81	13	74	86	17	84	101
14	58	65	123	14	71	85	4	64	67	3	55	58	4	63	66	6	61	67	0	48	48	0	46	46	0	38	38	0	84	84	71	87	158	30	84	113
15	46	64	110	19	65	83	8	61	68	0	54	54	1	62	63	6	60	65	0	45	45	0	25	25	0	36	36	0	96	96	37	86	123	23	87	109
16	41	64	105	21	66	87	7	61	68	1	53	54	2	61	63	0	58	58	0	43	43	0	40	40	0	15	15	0	85	85	67	86	153	39	88	127
17	39	62	101	22	63	85	2	45	46	0	50	50	3	63	65	0	57	57	0	42	42	0	38	38	0	48	48	0	68	68	96	90	186	51	88	139
18	39	58	96	21	61	82	3	55	57	0	48	48	17	65	82	0	55	55	0	38	38	0	38	38	0	32	32	0	66	66	96	95	191	57	88	145
19	101	55	156	15	61	76	3	56	59	4	57	61	11	59	70	0	51	51	0	45	45	0	38	38	0	35	35	5	80	85	79	95	174	53	87	139
20	114	53	166	14	59	73	1	53	54	4	57	61	7	55	62	1	52	53	0	40	40	0	39	39	0	36	36	0	70	70	61	97	158	77	86	162
21	102	61	163	13	58	71	4	55	59	0	55	55	9	55	63	2	55	57	1	37	37	1	33	34	0	41	41	0	72	72	32	97	129	73	87	159
22	81	68	149	13	59	71	5	54	58	0	54	54	4	53	57	3	57	59	0	43	43	0	47	47	0	32	32	0	61	61	30	96	126	102	72	174
23	129	50	179	15	59	74	7	54	60	15	52	67	3	54	57	0	46	46	0	38	38	2	41	43	0	31	31	0	57	57	13	96	109	113	89	202
24	223	66	289	23	60	82	3	54	56	12	66	78	4	51	55	0	48	48	0	30	30	0	44	44	0	40	40	0	63	63	14	78	91	78	86	164
25	136	68	204	24	25	49	3	54	57	8	64	72	3	54	56	0	46	46	0	38	38	0	27	27	0	49	49	0	74	74	25	87	112	60	85	145
26	101	69	170	20	58	77	4	57	61	10	63	73	4	44	48	0	45	45	0	39	39	0	37	37	0	67	67	0	74	74	31	91	121	56	85	140
27	94	67	161	17	56	73	4	58	61	13	63	76	0	59	59	0	42	42	26	14	40	0	36	36	0	58	58	0	69	69	19	90	109	82	84	165
28	80	43	123	19	58	77	7	58	65	6	60	65	0	57	57	1	42	43	9	33	42	0	36	36	0	49	49	0	61	61	18	89	106	56	85	140
29	119	66	185	17	60	76	4	60	63	6	67	73	0	52	52	2	34	36	0	42	42	0	39	39	0	39	39	0	59	59	19	89	107	60	83	143
30	126	64	190	---	---	---	7	58	64	7	65	71	1	54	55	12	31	43	0	32	32	0	38	38	0	45	45	0	59	59	18	86	104	50	83	133
31	94	63	156	---	---	---	7	46	53	---	---	---	1	52	53	---	---	---	0	40	40	0	43	43	---	---	---	0	63	63	---	---	---	115	83	198
Min	39	43	96	11	25	49	1	45	46	0	46	48	0	44	48	0	15	15	0	14	30	0	25	25	0	15	15	0	25	25	0	56	56	6	66	78
Max	223	69	289	236	81	298	33	64	96	15	70	78	17	65	82	12	61	67	26	50	52	2	51	53	0	67	67	5	96	96	96	99	191	115	90	202
Average	93	61	154	51	62	113	10	58	68	5	58	63	3	58	61	1	49	50	4	39	43	0	40	41	0	38	38	0	58	58	27	84	111	46	84	130
Total Flows	2,898	1,879	4,777	1,481	1,806	3,286	310	1,794	2,103	142	1,745	1,886	104	1,794	1,898	45	1,464	1,508	128	1,206	1,334	5	1,252	1,257	0	1,088	1,088	5	1,798	1,803	815	2,528	3,343	1,430	2,606	4,036

Annual Min	0	14	15
Annual Max	236	99	298
Annual Average	20	57	78

Notes: F-S: Fine-screened; Sec: Secondary; T-C: Total combined.
Shading indicates exceedance of regulatory limit (250m^3/day)
*indicates power outage, resulting in no/faulty flow data recorded

Appendix B2 Maliview WWTP Compliance and Treatment Plant Performance 2020

Date	Influent			Secondary Effluent (Undisinfected)						Secondary Effluent (Disinfected)							
	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	88	87	44,000,000	18	19	10	110,000	9.0	7.1	19	130	17	15	130	89,000	9.0	7.2
February	79	130	1,100,000	23	19	14	120,000	17.0	7.4	22	130	24	17	130	140,000	18.0	7.4
March	390	320	4,500,000	20	23	16	100,000	36.0	7.5	22	45	23	15	45	140,000	31.0	7.5
April	160	370	2,900,000	21	39	33	210,000	43.0	7.7	29	130	44	32	130	240,000	42.0	7.8
May	656	350	5,600,000	65	75	73	1,500,000	34.0	7.3	93	130	83	78	130	1,600,000	32.0	7.4
June	134	140	9,100,000	26	25	23	580,000	40.0	7.4	24	45	26	23	45	470,000	42.0	7.4
July	870	690	150,000,000	28	22	22	2,100,000	77.0	7.6	65	45	25	19	45	3,000,000	76.0	7.7
August	290	180	10,000,000	27	26	26	1,100,000	53.0	7.6	28	45	31	26	45	1,100,000	53.0	7.6
September	128	310	4,400,000	30	43	47	1,600,000	53.0	7.5	33	45	51	46	45	2,600,000	51.0	7.5
October	29	24	1,400,000	71	41	40	3,100,000	23.0	7.4	47	45	53	41	45	3,000,000	23.0	7.4
November	68	100	2,600,000	29	17	20	250,000	15.0	7.4	61	45	19	20	45	270,000	15.0	7.4
December	103	34	2,500,000	24	22	12	130,000	15.0	7.3	55	130	13	17	130	11,000,000	18.0	7.6
Mean	314	335	4,578,413	52	52	28	455,401	36	7.5	42	---	34	29	---	733,027	34	7.5
Min	65	64	240,000	8	11	6	9,600	5	7.0	19	---	13	15	---	89,000	9	7.2
Max	1,070	770	74,000,000	226	230	180	11,000,000	59	7.9	93	---	83	78	---	11,000,000	76	7.8
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	kg/day	kg/day	kg/day	---	kg/day	---	kg/day	kg/day	---	kg/day	kg/day	---
	20	21	---	3	---	---	---	2	---	3.2	---	---	---	---	---	2.66	---

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
Shaded cells indicate exceedance of regulatory limit

Appendix B3 Maliview Estates WWTP Receiving Water 2020 (all data presented as CFU/100 mL)

Station	Site	Depth	Feb-25		Mar-04		Mar-06		Mar-09		Mar-19	
			Enterococci	Fecal Coliform	Enterococci	Fecal Coliform	Enterococci	Fecal Coliform	Enterococci	Fecal Coliform	Enterococci	Fecal Coliform
Mal-02	100m SW	top	10	140	<1	<1	<1	<1	<1	2	<1	<1
		middle	1	43	<1	<1	<1	4	<1	2	<1	1
Mal-03	100m NW	top	<1	2	<1	<1	<1	<1	<1	<1	<1	<1
		middle	1	1	1	1	<1	2	1	1	<1	<1
Mal-04	100m NE	top	<1	1	<1	<1	<1	1	<1	1	<1	<1
		middle	1	3	<1	<1	1	<1	<1	<1	<1	<1
Mal-05	100m SE	top	1	27	<1	<1	<1	<1	<1	1	<1	<1
		middle	1	<1	<1	1	<1	<1	1	2	<1	<1
Mal-08	200m NW	top	1	<1	<1	<1	<1	1	<1	1	<1	<1
Mal-12	200m SE	top	3	63	<1	<1	<1	<1	<1	1	<1	<1

APPENDIX C

SCHOONER WWTP

Appendix C1 Schooner WWTP Effluent Flow Data 2020 (m^3/day)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	300	684	322	269	173	171	164	165	165	152	184	298
2	307	891	300	291	172	146	185	194	151	146	196	264
3	306	586	294	270	179	155	154	179	147	166	174	252
4	441	496	286	259	203	151	177	196	156	143	323	246
5	380	529	284	265	170	149	183	159	171	173	340	250
6	347	876	288	255	175	154	194	167	178	156	310	266
7	433	696	283	234	155	150	155	200	184	155	284	224
8	560	639	279	247	173	173	151	162	164	146	251	250
9	455	571	279	243	159	157	133	213	164	159	246	340
10	357	499	270	256	180	169	180	168	141	166	228	336
11	380	439	280	243	178	149	152	168	156	251	216	306
12	383	447	240	244	173	140	165	158	154	253	211	277
13	399	393	245	246	175	178	171	166	149	293	237	293
14	362	363	243	243	157	158	152	178	149	375	416	332
15	326	363	369	226	169	164	165	161	170	288	346	329
16	310	342	257	217	166	157	152	193	131	238	348	348
17	326	328	241	221	181	154	134	180	149	213	482	341
18	295	326	246	207	217	147	150	177	137	197	529	374
19	326	301	234	197	191	147	154	170	144	379	451	371
20	362	273	243	193	165	155	149	188	153	273	399	423
21	376	297	231	197	172	165	163	153	150	229	338	446
22	367	275	249	199	159	156	147	170	140	206	325	440
23	490	284	249	230	170	153	142	191	147	206	313	440
24	819	304	241	217	163	148	156	184	188	254	309	440
25	651	302	262	201	180	146	154	160	179	267	301	551
26	537	269	248	200	179	164	153	175	283	230	323	508
27	475	272	228	201	164	165	175	158	231	225	305	520
28	450	261	239	195	157	172	157	184	192	192	294	496
29	473	268	271	184	152	184	165	169	181	204	299	472
30	510	---	282	175	164	148	136	179	155	164	292	474
31	470	---	293	---	173	---	164	181	---	177	---	665
Min	295	261	228	175	152	140	133	153	131	143	174	224
Max	819	891	369	291	217	184	194	213	283	379	529	665
Average	418	434	267	228	172	158	159	176	165	215	309	373
Total Flows	12,973	12,574	8,276	6,825	5,344	4,725	4,932	5,446	4,959	6,676	9,270	11,572

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

Annual Min	**131**
Annual Max	**891**
Annual Average	**256**

Appendix C2 Schooner WWTP Compliance and Treatment Plant Performance 2020

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)	pH	Unionized NH_3 (mg/L)
Regulatory Limit						45 max / 25 average		45 max / 25 average	200			1.25
January	236	98	1,100,000	17	86,000	21	4	4	21	0.24	6.8	<0.0005
February	404	160	5,900,000	6	50,000	5	3	2	9	1.80	7.0	0.0019
March	140	180	5,900,000	6	67,000	10	5	4	10	0.82	7.1	0.00069
April	160	75	5,000,000	8	170,000	8	7	6	10	11.00	7.8	0.026
May	460	240	16,000,000	5	170,000	8	5	4	6	0.20	7.2	<0.0005
June	164	160	18,000,000	17	28,000	5	3	2	13	0.19	7.1	<0.0005
July	164	110	9,200,000	26	83,000	5	5	4	37	4.30	7.1	0.018
August	820	690	24,000,000	7	6,300	5	3	5	13	0.18	7.1	<0.0005
September	446	750	12,000,000	4	33,000	4	3	2	65	0.10	6.9	<0.0005
October	258	210	5,800,000	7	120,000	11	6	4	73	0.11	6.8	<0.0005
November	117	34	3,800,000	17	92,000	13	4	4	5	0.18	6.8	<0.0005
December	384	260	5,800,000	15	47,000	12	5	5	11	0.09	6.8	<0.0005
Mean	313	247	7,176,950	11	59,791	9	4	4	23	1.60	7.0	0.004
Min	117	34	1,100,000	4	6,300	4	3	2	5	0.09	6.8	<0.0005
Max	820	750	24,000,000	26	170,000	21	7	6	73	11.0	7.8	0.026
N	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	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day
	55.8	---	---	1.1	---	1.1	---	---	---	0.05	---	0.0001

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
*TSS data is comprised of routine, monthly sampling results. Three field-analyzed samples were non-compliant. These samples were taken on: January 22nd with a TSS of 685 mg/L, January 31st with a TSS of 204 mg/L and February 5th with a TSS of 216 mg/L.

Appendix C3 Schooner Way WWTP Receiving Water 2020 (all data presented as CFU/100 mL)

Station	Site	Depth	Feb-25		Mar-04		Mar-06		Mar-09		Mar-19	
			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)	Enterococci (CFU/100 mL)	Fecal Coliform (CFU/100 mL)	Enterococci (CFU/100 mL)	Fecal Coliform (CFU/100 mL)
Sch-03	100m SE	top	<1	1	<1	<1	<1	<1	<1	1	<1	<1
		middle	1	<1	<1	<1	<1	<1	<1	2	<1	<1
Sch-04	100m WSW	top	<1	<1	<1	1	<1	<1	<1	<1	<1	1
		middle	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sch-05	100m NW	top	<1	1	<1	<1	<1	<1	<1	<1	<1	<1
		middle	<1	<1	2	<1	2	<1	<1	<1	<1	<1
Sch-06	100m S	top	<1	<1	<1	<1	1	1	<1	<1	<1	<1
		middle	<1	<1	<1	<1	1	<1	2	<1	<1	<1
Sch-10	200m SSE	top	1	<1	2	<1	<1	<1	<1	<1	<1	<1
Sch-14	200m W	top	<1	<1	<1	<1	1	1	<1	<1	<1	<1

APPENDIX D

CANNON WWTP

Appendix D1 Cannon WWTP Effluent Flow Data 2020 (m^3/day)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	61	94	54	42	30	40	40	28	34	29	34	52
2	63	110	49	43	45	36	45	38	33	28	38	47
3	50	81	49	33	47	36	42	44	19	30	32	47
4	76	70	48	41	46	36	36	40	27	30	55	43
5	70	77	45	42	45	34	53	44	30	32	39	29
6	68	119	45	43	44	35	46	29	29	28	53	44
7	73	82	45	38	43	35	41	35	33	26	45	42
8	88	88	46	28	44	36	44	37	29	25	49	40
9	70	76	46	39	45	34	42	36	25	17	46	52
10	61	68	46	39	46	37	40	37	24	40	41	53
11	43	62	43	36	44	36	42	36	17	55	28	50
12	68	57	27	36	44	55	46	31	24	63	37	48
13	64	52	38	35	33	37	39	30	38	60	41	46
14	57	53	41	40	44	41	32	34	33	61	71	55
15	51	51	60	35	43	41	33	22	26	56	60	54
16	49	55	42	34	45	42	31	34	27	46	57	63
17	50	55	42	19	44	37	28	33	29	45	73	59
18	49	53	41	34	52	34	33	31	26	44	84	54
19	58	46	38	33	44	40	37	29	26	65	75	67
20	59	42	43	33	47	37	32	30	26	52	66	76
21	54	28	40	32	46	39	29	28	29	46	50	87
22	53	42	43	32	28	39	28	23	27	31	54	41
23	57	43	44	38	41	38	27	31	25	44	50	70
24	103	49	28	42	40	32	31	33	35	51	52	70
25	86	44	38	41	43	36	31	28	36	56	52	80
26	80	43	35	40	43	36	33	28	52	51	41	74
27	70	43	35	37	37	50	32	32	49	44	53	73
28	67	39	37	38	38	42	31	34	47	36	48	69
29	68	43	41	35	26	43	28	30	38	36	48	69
30	70	---	42	37	41	49	38	34	33	34	48	67
31	68	---	44	---	38	---	26	38	---	33	---	77
Min	43	28	27	19	26	32	26	22	17	17	28	29
Max	103	119	60	43	52	55	53	44	52	65	84	87
Average	65	61	42	37	42	39	36	33	31	42	51	58
Total Flows	2,004	1,765	1,315	1,095	1,296	1,163	1,116	1,017	926	1,294	1,520	1,797

Annual Min	**17**
Annual Max	**119**
Annual Average	**45**

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

Appendix D2 Cannon WWTP Compliance and Treatment Plan Performance 2020

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	130	210	40,000,000	6	5	4.4	4,100	0.15	6.5
February	144	180	5,200,000	12	22	10	200,000	0.32	6.2
March	16	65	78,000,000	6	8	5.8	220,000	0.68	6.7
April	56	110	1,100,000	17	11	6.2	5,800	0.76	7.1
May	382	490	5,500,000	12	48	6.2	14,000	7.10	7.2
June	26	75	77,000,000	6	17	3.2	40,000	4.90	7.2
July	72	360	6,100,000	8	27	3.5	100,000	8.40	7.4
August	94	280	11,000,000	5	21	2.3	52,000	2.20	7.2
September	115	240	6,500,000	20	19	11	97,000	0.58	6.6
October	25	99	13,000,000	4	10	3.7	29,000	5.20	7.1
November	36	30	9,900,000	3	3	<2	2,500	0.06	2.0
December	61	590	12,000,000	44	4	2.8	3,000	0.05	6.6
Mean	96	227	11,452,491	12	16	16.2	25,158	2.5	6.5
Min	16	30	1,100,000	3	3	<2	2,500	0.05	2.0
Max	382	590	78,000,000	44	48	11	220,000	8.4	7.4
N	12	12	12	12	12	12	12	12	12
Mean Daily Loading	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day
	4.3	---	---	0.5	---	---	---	0.11	---

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 D3 Cannon Crescent WWTP Receiving Water 2020 (all data presented as CFU/100mL)

Station	Site	Depth	Feb-25		Mar-04		Mar-06		Mar-09		Mar-19	
			Enterococci	Fecal Coliform	Enterococci	Fecal Coliform	Enterococci	Fecal Coliform	Enterococci	Fecal Coliform	Enterococci	Fecal Coliform
Can-01	100m NW	top	<1	1	1	<1	<1	<1	<1	<1	<1	<1
		middle	1	1	<1	1	1	1	2	<1	<1	<1
Can-02	100m NE	top	<1	<1	<1	1	<1	<1	1	<1	<1	<1
		middle	<1	<1	<1	<1	<1	<1	1	1	<1	<1
Can-03	100m SE	top	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
		middle	<1	<1	<1	<1	<1	<1	3	<1	<1	<1
Can-04	100m SW	top	<1	<1	2	<1	<1	<1	<1	<1	<1	<1
		middle	<1	<1	1	<1	<1	<1	<1	<1	<1	1
Can-05	200m NW	top	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Can-06	200m NE	top	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

APPENDIX E

PORT RENFREW WWTP

Appendix E1 Port Renfrew WWTP Effluent Flow Data 2020 (m^3/day)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	258	199	48	63	46	47	32	41	44	37	54	47
2	120	117	38	50	42	40	39	50	35	41	48	38
3	100	70	54	45	55	40	38	54	42	36	39	34
4	162	58	55	42	58	40	47	53	36	44	163	34
5	97	64	50	41	49	39	60	44	35	45	112	43
6	101	87	59	35	44	35	46	38	47	31	84	36
7	144	76	49	34	52	43	35	46	41	28	57	148
8	196	86	44	31	46	43	35	41	34	28	55	170
9	90	70	36	31	32	48	40	49	32	27	46	84
10	75	53	29	27	41	60	37	60	30	52	42	64
11	120	38	47	29	44	57	34	49	39	106	43	69
12	84	37	48	27	43	51	62	36	34	116	49	50
13	100	32	43	29	44	43	50	34	41	86	75	64
14	66	48	33	27	45	48	41	42	34	108	100	66
15	56	58	35	27	46	62	36	43	30	69	72	67
16	46	105	34	23	41	46	26	42	29	50	69	72
17	54	82	28	23	45	40	56	48	37	79	102	90
18	51	58	30	29	59	45	37	44	26	64	93	133
19	79	39	31	40	55	37	46	42	29	82	95	127
20	78	34	28	36	44	34	52	46	47	53	78	104
21	86	34	28	30	42	45	34	66	38	40	68	119
22	110	30	29	23	40	43	35	81	33	34	59	73
23	106	45	29	30	45	34	36	63	42	33	50	52
24	216	49	35	26	45	29	42	49	81	44	50	49
25	123	46	36	23	45	41	36	50	79	50	102	61
26	86	37	33	34	44	34	39	44	131	46	76	98
27	90	34	33	37	39	38	38	40	101	32	59	78
28	95	33	47	55	34	43	38	42	71	52	64	63
29	72	41	71	40	38	33	35	48	49	104	57	64
30	131	---	75	37	36	26	38	46	49	66	48	157
31	103	---	77	---	45	---	35	46	---	67	---	54
Min	46	30	28	23	32	26	26	34	26	27	39	34
Max	258	199	77	63	59	62	62	81	131	116	163	170
Average	106	61	42	34	45	42	40	48	46	56	70	78
Total Flows	3,294	1,757	1,312	1,024	1,382	1,263	1,255	1,477	1,393	1,749	2,105	2,409

Annual Min	**23**
Annual Max	**258**
Annual Average	**56**

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

Appendix E2 Port Renfrew WWTP Compliance and Treatment Plant Performance 2020

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	136	90	2,000,000	8	8	4	92,000	0.15	6.6
February	186	84	2,500,000	9	10	5	560,000	0.24	6.7
March	224	230	6,800,000	16	36	4	1,600,000	0.11	6.8
April	100	220	5,500,000	14	47	28	350,000	1.60	6.2
May	33	41	11,000,000	7	2	5	11,000	0.08	6.7
June	162	220	10,000,000	42	18	4	6,800	0.08	6.7
July	192	260	6,300,000	56	23	4	8,800	4.30	4.8
August	414	380	23,000,000	44	25	10	100,000	5.00	4.8
September	242	310	13,000,000	15	10	4	57,000	1.90	4.7
October	191	83	1,400,000	10	10	3	7,200	0.08	6.3
November	106	330	1,800,000	18	17	5	170,000	0.08	6.2
December	130	82	910,000	13	5	4	14,000	0.07	6.5
Mean	176	194	4,596,113	21	18	7	59,205	1.1	6.1
Min	33	41	910,000	7	2	3	6,800	0.07	4.7
Max	414	380	23,000,000	56	47	28	1,600,000	5.0	6.8
N	12	12	12	12	12	12	12	12	12
Mean Daily Loading	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day	kg/day
	9.8	---	---	0.67	---	---	---	0.06	---

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