Gulf Islands and Port Renfrew Wastewater Facilities Environmental Monitoring Program 2022 Report

Capital Regional District | Parks & Environmental Services, Environmental Protection

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GULF ISLANDS AND PORT RENFREW WASTEWATER FACILITIES
ENVIRONMENTAL MONITORING PROGRAM
2022 REPORT

EXECUTIVE SUMMARY

This report summarizes the 2022 results of the Wastewater and Marine Environment Program (WMEP) for the wastewater treatment plants (WWTP) operated by the Capital Regional District (CRD) in the Gulf Islands and Port Renfrew. Two of these WWTPs (Ganges and Schooner) discharge ultraviolet disinfected, secondary treated effluent; two WWTPs (Cannon and Port Renfrew) discharge secondary treated effluent; and one (Maliview) discharges secondary treated effluent mixed with fine-screened effluent during high flows. The program includes regular monitoring, as stipulated by the BC Ministry of Environment and Climate Change Strategy (ENV), either through permits or registrations under the Municipal Wastewater Regulation (*Environmental Management Act*). In addition, there are monitoring requirements under the federal Wastewater Systems Effluent Regulations (*WSER*) for the Ganges and Schooner treatment plants, as their average daily flow volumes exceed minimum thresholds.

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

GANGES WWTP

Final Effluent

The CRD analyzed wastewater influent and effluent for conventional and priority substances, plus effluent for acute toxicity. In 2022, none of the daily effluent flows from the Ganges WWTP exceeded the allowable maximum. Effluent quality met provincial and federal regulatory requirements for all carbonaceous biochemical oxygen demand (CBOD), total suspended solids (TSS), unionized ammonia, total residual chlorine and fecal coliform bacteria results. Similar to previous years, concentrations of total residual chlorine (used in washing the membranes) exceeded the permitted level in a number of samples, but this was most likely an artefact of taking the measurements using a relatively insensitive field-based test kit.

Of the 193 priority substances analyzed in effluent, 67 parameters were detected at standard detection limits (conventionals, nutrients, metals, total phenols, and pyrene). Effluent concentrations were within similar ranges relative to previous years. Most priority substances in the effluent were below the BC Water Quality Guidelines (BC WQG) before the predicted minimum receiving water dilution of 419:1. Only cyanide strong acid dissociable (SAD) and weak acid dissociable (WAD), cadmium, copper and zinc exceeded BC WQG in undiluted effluent. All substances were below BC WQG after the minimum dilution calculation was applied (the predicted concentration of effluent in the marine water column within the initial dilution zone [IDZ, the area up to 100 metres (m) away from the outfall].

Toxicity Testing

The effluent sample from July 2022 passed the 96-hour Rainbow trout acute toxicity test. This is consistent with previous years, with the exception of 2019 when the processes at the newly upgraded plant were still being optimized. The Daphnia acute toxicity test also passed, consistent with previous testing conducted from 2011-2021.

Sludge (Mixed Liquor)

Ganges WWTP sludge (mixed liquor) met the criteria for BC Organic Matter Recycling Regulations (OMRR) Class A Biosolids in 2022 for all regulated parameters except for copper, which exceeded the criteria in Jan, Feb, Mar, Apr, Jun, Aug, Sep and Oct.

Receiving Water

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

There was one non-routine/emergency event in 2022 that met the criteria to trigger sampling. However, due to staff capacity and weather restrictions, sampling was prevented from happening within a reasonable timeframe to assess the impacts of the event.

Next Steps

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

MALIVIEW WWTP

Wastewater

The Maliview WWTP produces secondary treated effluent when instantaneous flows are equivalent to or less than 60 m^3/d. For instantaneous flows equivalent to or greater than 60 m^3/d, the plant produces a final effluent that is a blend of secondary treated and fine-screened effluents. As such, there are different regulatory limits for this facility depending on whether the flows are above or below 60 m^3/day. The flow-splitting process responds to instantaneous peak flows, rather than daily flows, and bypass events can occur despite total daily flows of less than 60 m^3/d. Bypass events occurred, despite flow being less than 60 m^3/d on 77% of the days in 2022. 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 20% of the days. Exceedance of the allowable maximum of 250 m^3/d for total combined daily flows occurred on 1.6% of the days in 2022. Flow to the secondary treatment plant exceeded 60 m^3/d on 56% of the days in 2022, resulting in a portion of the effluent bypassing the secondary treatment process of the plant to be treated solely by fine screening.

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

Toxicity Testing

Effluent from July 2022 failed the 96-hour trout acute toxicity test, similar to 2021. As this is only the second time toxicity testing has been conducted on Maliview WWTP wastewater, further data will be required prior to drawing any conclusions. The toxicity test was not ammonia stabilized, which may be considered for future years, until the plant upgrades are completed.

Receiving Water

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

There was one non-routine/emergency event in 2022 that met the criteria to trigger sampling. However, due to staff capacity and weather restrictions, sampling was prevented from happening within a reasonable timeframe to assess the impacts of the event.

Next Steps

Investigate ways to eliminate regulatory compliance violations. Staff and consultants are currently preparing a detailed design for a new treatment plant that will resolve flow and effluent quality issues. Construction is expected to begin in 2023 and be completed by 2024.

SCHOONER WWTP

Wastewater

The Schooner WWTP exceeded regulatory limits for flow five times in 2022, representing 1.4% of the year. Fecal coliforms exceeded permitted limits in one monthly sample, representing 8% of the annual monthly sampling events. All other regular, monthly effluent compliance parameters met regulatory criteria in 2022 during regular flow events. Field analyzed samples collected to confirm impact to treatment processes during overflow events were non-compliant for TSS. In addition, effluent bacteriological limits were assumed to be non-compliant during power outages when the UV-disinfection system was not operating.

Toxicity Testing

Effluent from July 2022 passed the 96-hour trout acute toxicity test.

Receiving Water

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

There was one non-routine/emergency event in 2022 that met the criteria to trigger sampling. However, due to staff capacity and weather restrictions, sampling was prevented from happening within a reasonable timeframe to assess the impacts of the event.

Next Steps

Substantial upgrades to the Schooner WWTP and collection system are required to eliminate regulatory compliance violations for this facility. The CRD held a referendum in 2019 to borrow funds to complete the upgrades. The referendum was successful and facility upgrades started in 2023. They are expected to be completed in 2024.

CANNON WWTP

Wastewater

The Cannon WWTP exceeded regulatory limits for flow 12 times in 2022, representing 3% of the year. TSS and CBOD each exceeded permitted limits once in 2022, representing 8% each of the monthly samples. All other effluent compliance parameters met regulatory criteria in 2022.

Toxicity Testing

Effluent from July 2022 failed the 96-hour trout acute toxicity test, unlike in 2021 when the test passed. As this is only the second time toxicity testing has been conducted on Cannon WWTP wastewater, further data will be required prior to drawing any conclusions. The toxicity test was not ammonia stabilized, which may be considered for future years.

Receiving Water

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

There was one non-routine/emergency event in 2022 that met the criteria to trigger sampling. However, due to staff capacity and weather restrictions, sampling was prevented from happening within a reasonable timeframe to assess the impacts of the event.

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. Upgrades to the conveyance system have been completed and construction of a new Schooner WWTP started in 2023. Once Schooner WWTP has been completed (anticipated 2024), the Cannon WWTP will be decommissioned and all flows will be pumped to the new facility.

PORT RENFREW WWTP

Wastewater

The Port Renfrew WWTP exceeded regulatory limits for flow one time in 2022, representing 0.3% of the year. TSS exceeded permitted limits once in 2022, representing 8% of the monthly samples. All other effluent compliance parameters met regulatory criteria in 2022.

Toxicity Testing

Effluent from July 2022 passed the 96-hour trout acute toxicity test.

Receiving Water

Routine receiving water monitoring was last conducted at the Port Renfrew WWTP in 2021. 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.

An outfall blockage occurred at the end of 2022 and extended into 2023. While this event met the criteria to trigger non-routine/emergency receiving environment sampling, sampling did not take place.

Next Steps

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

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Terms & Abbreviations

BC OMRR	Organic Matter Recycling Regulations
BOD	Biochemical Oxygen Demand
CALA	Canadian Association for Laboratory Accreditation
CBOD	Carbonaceous Biochemical Oxygen Demand
CCME	Canadian Council of Ministers of the Environment
CFU	Colony-forming unit
COD	Chemical Oxygen Demand
CRD	Capital Regional District
EIR	Environmental Impact Report
ENV	BC Ministry of Environment and Climate Change Strategy
FC	Fecal Coliform
HC	Health Canada
IDZ	Initial Dilution Zone
MWR	Municipal Wastewater Regulation
NH_3	Ammonia
QA/QC	Quality Assessment/Quality Control
RBC	Rotating Biological Contactor
RSCP	Regional Source Control Program
SAD	Strong Acid Dissociable
TRC	Total residual chlorine
TSS	Total Suspended Solids
UV	Ultraviolet
WAD	Weak acid dissociable (WAD) cyanide
WMEP	Wastewater Marine Environment Program
WQG	Water Quality Guidelines
WSER	Wastewater Systems Effluent Regulations
WWTP	Wastewater Treatment Plant

GULF ISLANDS AND PORT RENFREW
WASTEWATER AND MARINE ENVIRONMENT PROGRAM
2022 REPORT

1.0 INTRODUCTION

This report summarizes the 2022 results of the Wastewater and Marine Environment Program (WMEP) for the wastewater treatment plants (WWTP) operated by the Capital Regional District (CRD) in the Gulf Islands and Port Renfrew. Two of these WWTPs (Ganges and Schooner) discharge ultraviolet disinfected, secondary treated effluent; two plants (Cannon and Port Renfrew) discharge undisinfected, secondary treated effluent; and one plant (Maliview) discharges undisinfected, secondary treated effluent combined with fine-screened effluent during high flows. The locations of these five facilities are presented in Figure 1.1. The WMEP includes regular monitoring, as stipulated by the BC Ministry of Environment and Climate Change Strategy (ENV) either through a permit or registrations under the Municipal Wastewater Regulation (MWR)[1]. In addition, effective January 1, 2013, new monitoring requirements came into effect under the federal Wastewater Systems Effluent Regulations (WSER) for the Ganges WWTP and Schooner WWTP facilities. The three remaining facilities (Maliview, Cannon and Port Renfrew WWTPs) do not require monitoring under the federal WSER, due to their low volumes of discharge. Monitoring is also conducted to assess treatment plant performance and potential for impacts to the marine environment, aquatic life and human health.

1.1 Wastewater Monitoring

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

1.1.1 Compliance and Treatment Plant Performance Monitoring

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

1.1.2 Toxicity Testing

Annual toxicity testing is a requirement under the MWR registrations for the Ganges and Schooner WWTPs and was initiated on a voluntary basis for the remaining facilities beginning in 2021. Effluent from each treatment plant was collected in July 2022 and analyzed for toxicity to Rainbow trout (96-h LC50 test). As in previous years, the Ganges sample was also analyzed for toxicity to *Daphnia*.

1.1.3 Priority Substances

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

1.1.4 Treatment Plant Sludge (Mixed Liquor)

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

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

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

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

Outfall Pipe

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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
Lower Ganges Rd
Bullocks Lake
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 2022 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 (required)**, **Schooner (required), Maliview (voluntary), Cannon (voluntary), Port Renfrew (voluntary)**
	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*

Notes:
*Receiving water sampling was last 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 for such monitoring, with the inter-year frequency of monitoring dependent on the size of the facility. In addition, intra-year sampling frequency was changed from monthly to five sets of daily samples collected over a 30-day period (5-in-30) to allow for a more direct comparison of bacterial indicators to relevant human health protection criteria. In addition, enterococci are now analyzed as well as fecal coliforms, as enterococci persist longer in the marine environment and have a more direct link to human health impacts.

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

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

The 2022 sampling year represents year two of the current round of this four-year monitoring cycle, and routine receiving environment monitoring was not required for any facilities. The next routine 5-in-30 sampling, as per the four-year cycle, will be required in 2024.

Any 2022 non-routine/emergency receiving environment sampling events are described in subsequent sections.

2.0 METHODOLOGY

2.1 Wastewater Monitoring

COMPLIANCE AND TREATMENT PLANT PERFORMANCE MONITORING

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

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

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

TOXICITY TESTING

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

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

PRIORITY SUBSTANCES

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

SLUDGE (MIXED LIQUOR)

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

2.2 Receiving Water Monitoring

RECEIVING WATER SURFACE WATER MONITORING

Routine receiving environment sampling was undertaken in 2020, as agreed upon with ENV, for all facilities except the Port Renfrew WWTP, which was delayed due to staffing issues. Routine receiving environment 5-in-30 sampling at this facility was conducted in 2021 along the shoreline instead of by boat. Routine receiving environment sampling will be conducted next at all five facilities in 2024.

There were several events that met the criteria to trigger non-routine/emergency receiving environment sampling, but staff capacity and weather restrictions prevented sampling from happening within a reasonable timeframe.

3.0 GANGES WWTP

3.1 Introduction

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

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

Table 3.1 Ganges WWTP Regulatory Requirements

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

This registration also has a requirement for receiving water monitoring. Routine monitoring was last required for this facility in 2020 and is next required in 2024 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 which would trigger non-routine or emergency sampling.

The following section reports the results from the Ganges Wastewater Treatment Plant WMEP (Table 3.2).

Table 3.2 Ganges Wastewater Treatment Plant WMEP

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

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

3.2 Results

3.2.1 Wastewater Monitoring

COMPLIANCE AND TREATMENT PLANT PERFORMANCE MONITORING

In 2022, 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 2021). 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 >99% of the TSS and >99% of the fecal coliform bacteria from the influent.

Total residual chlorine was measured nine times in 2022, 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 the same as the federal guideline of 0.02 mg/L. The reliability of test kit results near the detection limit is low. CRD staff are investigating alternative chlorine test methods for use in the future.

Compliance data was reported to ENV on a monthly basis, with individual environmental impact reports (EIR) issued if there was an incident at the plant. There were two EIRs issued at Ganges WWTP in 2022, as a result of:

- Freezing weather resulting in a valve that froze and then burst (January 2); and
- Partial treatment bypasses from high influent flow as a result of snow melt, heavy rain and King tides (December 26-28).

Only the December rain event met the criteria that triggers non-routine/emergency receiving environment sampling, but staff capacity and weather restrictions prevented sampling from happening within a reasonable timeframe.

Table 3.3 Ganges WWTP 2022 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	468	255	668	14,505	31	0
February	388	333	594	11,255	29	0
March	421	349	521	13,064	31	0
April	441	357	647	13,239	30	0
May	434	334	534	13,450	31	0
June	350	263	445	10,494	30	0
July	410	355	495	12,718	31	0
August	430	382	462	13,335	31	0
September	404	350	487	12,118	30	0
October	384	346	449	11,917	31	0
November	415	341	543	12,447	30	0
December	499	339	851	14,983	30	0
Annual	**421**	**255**	**851**	**153,525**	**365**	**0**

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

Table 3.4 Ganges WWTP 2022 Compliance and Treatment Plant Performance Monitoring Annual Summary

Source	Compliance Monitoring				Treatment Plant Performance Monitoring				
	Flow (m^3/d)	TSS (mg/L)	CBOD (mg/L)	Fecal Coliform (CFU/100 mL)	BOD (mg/L)	Ammonia (mg N/L)	Unionized Ammonia @15°C (mg/L N)	Total Residual Chlorine (mg/L)	pH
Influent									
Regulatory limit	---	---	---	---	---	---	---	---	---
Mean	421	322	---	13,020,784	353	---	---	---	---
Minimum	255	192	---	6,000,000	230	---	---	---	---
Maximum	851	484	---	36,000,000	527	---	---	---	---
Regulatory violations (%)	---	---	---	---	---	---	---	---	---
Number of samples	365	12	---	12	12	---	---	---	---
Secondary effluent									
Regulatory limit	---	---	---	---	---	---	1.25	0.02	---
Mean	421	1	---	3,103	---	---	---	---	---
Minimum	255	1	---	373	---	---	---	---	---
Maximum	851	3	---	10,276	---	---	---	---	---
Percent reduction (from influent)	---	100	---	100	---	---	---	---	---
Regulatory violations	---	---	---	---	---	---			---
Number of samples	365	12	---	12	---	---			---
Disinfected secondary effluent									
Regulatory limit	1,198	25	25	1,000	---	---	1.25	0.02	---
Mean	421	1.0	2.3	3.1	2.7	4.07	0.05	0.04	7.3
Minimum	255	<1	<2	<1	<2	0.10	<0.0005	0.01	7.1
Maximum	851	<4	9.1	14	15.6	20	0.10	0.07	7.5
Percent reduction (from influent)	---	100	---	100	99	---	---	---	---
Regulatory violations (%)	0	0	0	0	---	---	0	67	---
Number of samples	365	12	12	12	12	12	12	9	12

TOXICITY TESTING

In 2022, disinfected effluent from July passed the 96-hour Rainbow trout acute toxicity test. This is consistent with previous years, with the exception of 2019, when toxicity tests failed as operations staff were adjusting the performance of the upgraded aeration system and were experiencing challenges with ammonia levels. These issues have now been fully resolved.

As in previous years (2012-2021), disinfected effluent from July passed the 48-hour *Daphnia magna* acute toxicity test, corresponding to an LC50 of >100%. The *Daphnia* test is not required but was conducted to maintain consistency with other CRD discharge monitoring programs where toxicity testing is required.

PRIORITY SUBSTANCES

Of the 193 priority substances analyzed in Ganges WWTP effluent (Appendix A3), 41 parameters were detected at standard detection limits, (conventionals, nutrients, metals, total phenols, and pyrene). Influent results can also be found in Appendix A3.

In 2022, most priority substance concentrations in the Ganges WWTP effluent were below BC WQG (BCMoE&CCS, 2017a and 2019a) in undiluted effluent, before discharge to the environment (Appendix A3). Only cyanide SAD and WAD, cadmium, copper, and zinc exceeded BC WQG in undiluted effluent. All substances were below BC WQG after the near surface dilution factor of 419:1 was applied. This 419:1 dilution factor was determined by oceanographic modelling and is the predicted dilution factor to occur near the surface at the edge of the outfall IDZ (Seaconsult Marine Research Ltd, 1994).

SLUDGE (MIXED LIQUOR)

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

The 2022 Ganges WWTP sludge (mixed liquor) results for regulated parameters had concentrations well below the criteria for Class A Biosolids, except for copper which exceeded regulatory criteria in Jan, Feb, Mar, Apr, Jun, Aug, Sep and Oct. Historically, mercury levels have been elevated at times in Ganges sludge, but these have declined steadily over time (Figure 3.1).

3.2.2 Receiving Water Monitoring

RECEIVING WATER BACTERIA INDICATORS

As noted above, there was one non-routine/emergency event in 2022 that met the criteria to trigger sampling. However, due to staff capacity and weather restrictions, sampling was prevented from happening within a reasonable timeframe to assess the impacts of the event.

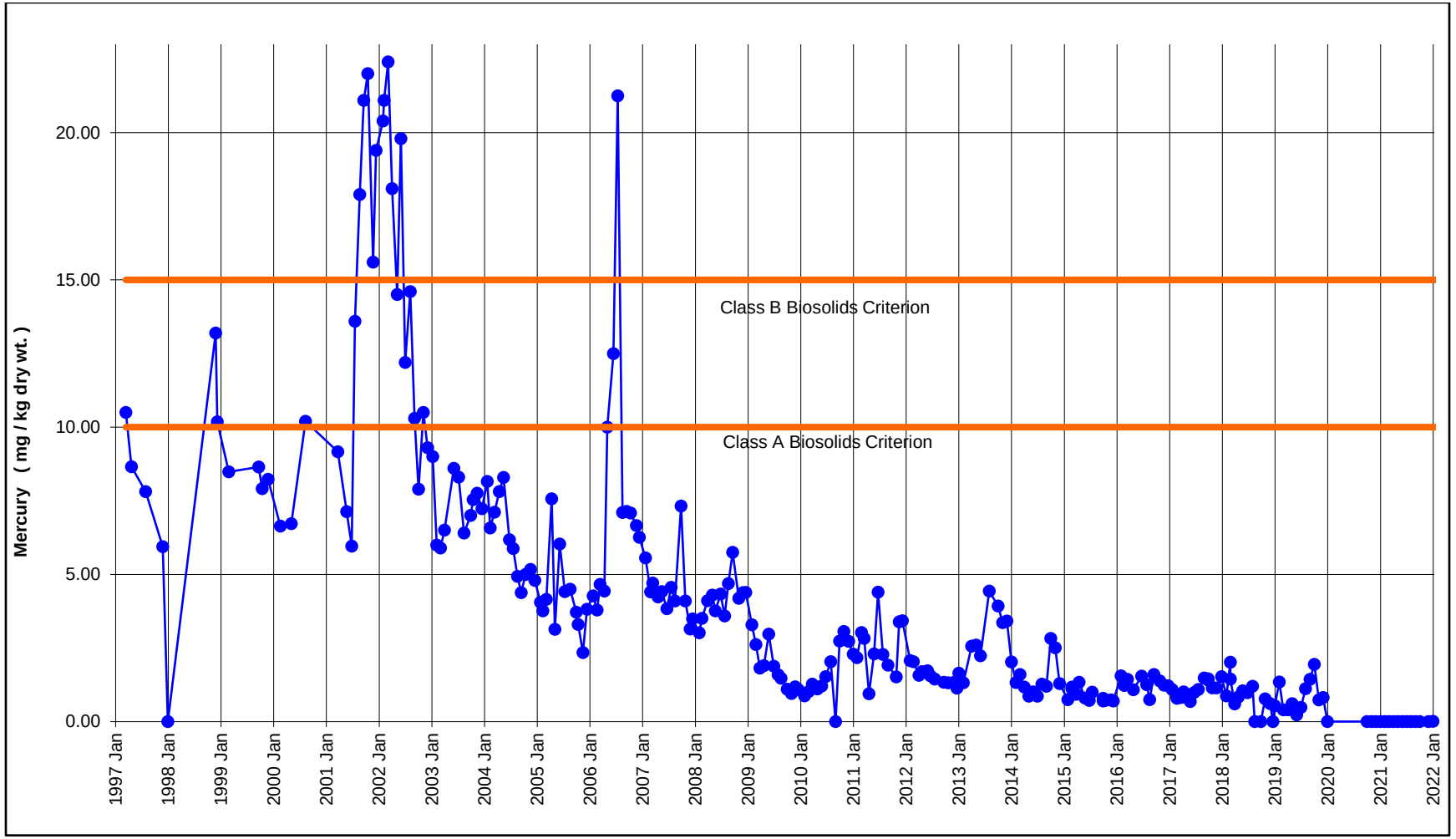

Figure 3.1 Ganges WWTP Mixed Liquor Mercury Levels (1997 to 2022)

3.3 Recommendations

CONTINUE TO SHARE RESULTS WITH THE CRD REGIONAL SOURCE CONTROL PROGRAM

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

4.0 MALIVIEW WWTP

4.1 Introduction

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

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

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

Table 4.1 Maliview WWTP Regulatory Requirements

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

This registration also has a requirement for receiving water monitoring. Routine monitoring was last required for this facility in 2020 and is next required in 2024 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 which would trigger non-routine or emergency sampling.

The following section reports the results from the Maliview Wastewater Treatment Plant WMEP (Table 4.2).

Table 4.2 Maliview Wastewater Treatment Plant WMEP

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

4.2 Results

4.2.1 Wastewater Monitoring

COMPLIANCE AND TREATMENT PLANT PERFORMANCE MONITORING

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

The RBC component of the Maliview WWTP was not designed to treat the volume of effluent that it presently receives, particularly when it is rainy and significant inflow and infiltration (I&I) enters the conveyance system. In addition, the process that splits flow between the RBC and the fine screens responds to instantaneous peak flows, rather than total daily flows. This results in frequent fine-screening events on days that the RBC unit is not operating at full capacity, as measured by the total daily flow. Finally, the strength of influent has been steadily increasing in recent years, often exceeding the treatment specifications of the RBC. All these conditions make it challenging for this facility to be in compliance with provincial regulatory limits.

Total effluent flows discharged from the Maliview WWTP exceeded the permitted allowable maximum of 250 m^3/d on seven days (1.6% of the time) in 2022. Flow bypassed the secondary treatment process and received fine screening only, despite a secondary flow of less than 60 m^3/d, on 280 days (77% of the time).

CRD staff and a contracting engineer are developing a detailed design for an upgrade to the facility to increase capacity and treatment reliability. The chosen solution has been fed into short-, medium- and longer-term upgrade plans. It should also be noted that repairs were made in the summer of 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 six EIRs issued at Maliview WWTP in 2022, as a result of:

- RBC motor drive failure (February 6);
- Effluent quality exceedance (February 22, June 21);
- Toxicity test failure (July 19). As the toxicity sampling is not required by ENV, this EIR was circulated for informational purposes only;
- Transfer pump failure (August 16); and
- Overflows due to heavy rain and snow melt (December 24-28).

Only the December rain event met the criteria that triggers non-routine/emergency receiving environment sampling, but staff capacity and weather restrictions prevented sampling from happening within a reasonable timeframe.

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 68% of the TSS, 79% of fecal coliform and 83% of total BOD. The combined final effluent exceeded low flow (<60 m^3/d) limits for TSS on two sampling days, representing 25% of the low flow sampling events. CBOD did not exceed low flow limits on any of the sampling days. The combined final effluent exceeded high flow (>60 m^3/d) sampling limits for TSS on one sampling day, representing 25% of the high flow sampling events. CBOD did not exceed high flow limits on any of the sampling days.

TOXICITY TESTING

Beginning in 2021, toxicity testing was conducted at each of the Gulf Islands/Port Renfrew facilities in order to maintain consistency across the region. The effluent sample from July 2022 failed the 96-hour Rainbow trout acute toxicity test, as did the sample from July 2021. As this is only the second year of toxicity testing at this facility, further data is required to draw conclusions. The toxicity test was not ammonia stabilized, which may be considered for future years, until the plant upgrades are completed.

Table 4.3 Maliview WWTP 2022 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	62	2	200	1,923
February	9	0	65	248
March	51	16	125	1,593
April	50	20	183	1,487
May	27	0	119	826
June	6	0	42	173
July	0	0	7	10
August	2	0	37	60
September	0	0	6	6
October	0	0	2	3
November	1	0	18	44
December	73	3	273	2,268
Annual	**24**	**0**	**273**	**8,638**

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

Table 4.4 Maliview WWTP 2022 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	58	45	65	1,796
February	67	51	80	1,873
March	62	49	85	1,912
April	60	49	65	1,800
May	60	47	79	1,871
June	57	39	72	1,716
July	36	14	67	1,110
August	25	0	37	787
September	28	19	35	834
October	35	24	47	1,088
November	52	8	80	1,551
December	69	53	96	2,154
Annual	**51**	**0**	**96**	**18,490**

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

Table 4.5 Maliview WWTP 2022 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 (250 m3/d)
	Mean	Min.	Max.	Total				
January	120	60	253	3,719	1	10	30	3
February	74	56	99	2,070	2	24	26	0
March	113	65	185	3,505	0	21	31	0
April	110	76	244	3,287	0	17	30	0
May	87	56	177	2,697	2	15	29	0
June	63	39	113	1,888	13	23	17	0
July	36	14	69	1,120	30	29	1	0
August	27	16	37	847	31	28	0	0
September	28	19	35	840	30	29	0	0
October	35	24	47	1,091	31	29	0	0
November	53	9	98	1,595	21	28	9	0
December	143	66	351	4,422	0	27	31	16.1
Annual Total	**74**	**9**	**351**	**27,076**	**161**	**280**	**204**	**1.6**

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

Table 4.6 Maliview WWTP 2022 Compliance and Treatment Plant Performance Monitoring Annual Summary

Source	Compliance Monitoring				Treatment Plant Performance Monitoring		
	Flow (m^3/d)	TSS (mg/L)	CBOD (mg/L)	FC (CFU/100 mL)	BOD (mg/L)	NH_3 (mg/L N)	pH
Influent							
Regulatory Limit	250	---	---	---	---	---	---
Mean	74	224	237	4,250,902	237	---	---
Minimum	9	67	---	550,000	90	---	---
Maximum	351	540	---	79,000,000	552	---	---
Regulatory Violations (%)	1.6	---	---	---	---	---	---
Number of Samples	365	12.	---	12.	12.	---	---
Secondary Effluent							
Regulatory Limit	60	45	45	---	---	---	---
Mean	51	51	37	281,494	37	31.68	7.4
Minimum	0	13	5	35,000	12	6.88	7.0
Maximum	96	333	129	5,800,000	209	58.30	7.7
Percent Reduction	---	77	84	93	84	---	---
Regulatory Violations (%)	35	0	0	---	---	---	---
Number of Samples	365.	12	12	12	12	12.	12.
Fine-Screened Effluent[1]							
Regulatory Limit	190	---	---	---	---	---	---
Mean	24	---	---	---	---	---	---
Minimum	0	---	---	---	---	---	---
Maximum	273	---	---	---	---	---	---
Percent Reduction	---	---	---	---	---	---	---
Regulatory Violations (%)	1.4	---	---	---	---	---	---
Number of Samples	365	---	---	---	---	---	---
Combined Final Effluent[2]							
Regulatory Limit[3]	250	45 / 130	45 / 130	---	---	---	---
Mean	74	72	41	889,219.52	53	33	7.5
Minimum	9	21	14	54,000.00	17	9	7.0
Maximum	351	300	129	5,400,000.00	199	60	8.1
Percent Reduction	---	68	83	79	77	---	---
Regulatory Violations (%)	1.6	25 / 25	0 / 0	---	---	---	---
Number of Samples	365	8 / 4	8 / 4	12	12	12	12
Discharged Effluent							
Mean	74	61	33	889,220	53	32.4	7.5
Percent Reduction	---	73	---	79	77	---	---

Notes: [1] No fine-screened effluent samples were collected in 2022. 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

As noted above, there was one non-routine/emergency event in 2022 that met the criteria to trigger sampling. However, due to staff capacity and weather restrictions, sampling was prevented from happening within a reasonable timeframe to assess the impacts of the event.

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 the summer of 2019 to the upstream conveyance system to reduce I&I. Since these repairs, the frequency and volume of flow limit exceedances have been substantially reduced; wet weather peak flows have been reduced to almost half of previous years, but extreme wet weather will still lead to overflows. Staff and consultants are developing a detailed design for a new treatment plant that will resolve flow and effluent quality issues. Construction is expected to start in 2023 and be completed in 2024.

5.0 SCHOONER WWTP

5.1 Introduction

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

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

Table 5.1 Schooner WWTP Regulatory Requirements

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

This registration also has a requirement for receiving water monitoring. Routine monitoring was last required for this facility in 2020 and is next required in 2024 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 which would trigger non-routine or emergency sampling.

The following section reports the results from the Schooner Wastewater Treatment Plant WMEP (Table 5.2).

Table 5.2 Schooner Wastewater Treatment Plant WMEP

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

5.2 Results

5.2.1 Wastewater Monitoring

COMPLIANCE AND TREATMENT PLANT PERFORMANCE MONITORING

Flow data are summarized in Table 5.3 and the complete data set is presented in Appendix C1. In 2022, five total daily flows, representing 1.4% 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 2022, fecal coliforms exceeded monthly compliance parameters from one routine sampling event, representing 8.3% of the samples. All other regular monthly compliance parameters at Schooner WWTP were within compliance limits. However, samples collected to confirm impact to treatment processes during an overflow event (February 28) and field analyzed were non-compliant for TSS (TSS=165 mg/L). In addition, while samples were not collected during the power outages described below, it is assumed that the provincial fecal coliform limit was exceeded during these events, as the UV system cannot operate during power outages. The treatment plant removed approximately 95% of the TSS, >99% of the fecal coliform and 96% of the total BOD it received. Chlorine is not used at this facility, so is not monitored with respect to federal WSER requirements.

Compliance data was reported to ENV on a monthly basis, with EIRs issued if there was an incident at the plant. There were 19 EIRs issued at Schooner WWTP in 2022, as a result of:

- 12 system-wide BC Hydro failures resulting in no UV disinfection for the duration (January 6, April 4, 5, 18, May 18, September 7, 15, November 29, December 3, 20, 26, 30);
- heavy rainfall resulting in flow exceedance (January 7, 12, December 26-28);
- equipment failure and effluent quality exceedance (January 2); and
- fecal coliform exceedance following an emergency hauling and dumping of Chart Drive pump station effluent (August 23).

Only the December rain event met the criteria that triggers non-routine/emergency receiving environment sampling, but staff capacity and weather restrictions prevented sampling from happening within a reasonable timeframe.

TOXICITY TESTING

As in previous years (2012-2021), the disinfected effluent sample from July 2022 passed the 96-hour Rainbow trout acute toxicity test.

Table 5.3 Schooner WWTP 2022 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	475	323	949	14,724	6
February	324	269	405	9,062	0
March	403	288	585	12,500	0
April	315	214	582	9,455	0
May	230	177	300	7,128	0
June	185	147	228	5,542	0
July	163	126	222	5,066	0
August	149	127	190	4,604	0
September	126	103	150	3,791	0
October	132	106	258	4,089	0
November	182	128	355	5,456	0
December	282	136	787	8,742	10
Annual	**247**	**103**	**949**	**90,159**	**1.4**

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

Table 5.4 Schooner WWTP 2022 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	247	264	---	5,370,921	169	---	---	---	---
Minimum	103	62	---	1,600,000	44	---	---	---	---
Maximum	949	687	---	23,000,000	295	---	---	---	---
Regulatory violations (%)	1.4	---	---	---	---	---	---	---	---
Number of samples	365	12	---	12	12	----	---	---	---
Secondary Effluent									
Regulatory Limit	---	---	---	---	---	---	---	---	---
Mean	247	17	---	44,197	---	---	---	---	---
Minimum	103	3	---	5,200	---	---	---	---	---
Maximum	949	45	---	670,000	---	---	---	---	---
Percent Reduction	---	93%	---	99%	---	---	---	---	---
Regulatory violations	---	---	---	---	---	---	---	---	---
Number of samples	365	12	---	12	---	---	---	---	---
Disinfected Secondary Effluent									
Regulatory Limit	640	Max: 45 Avg: 25	Max: 45 Avg: 25	200	---	---	1.25	0.02	---
Mean	247	14	5	30	7	3	0.046	---	6.7
Minimum	103	5	<4	<1	<4	<0.1	<0.0005	---	6.0
Maximum	949	40	22	201	31	29	0.051	---	7.4
Percent Reduction	---	95	---	100	96	---	---	---	---
Regulatory violations (%)	137	0	0	8.3	---	---	0	---	---
Number of samples	365	12	12	12	12	12	1		12

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

5.2.2 Receiving Water Monitoring

As noted above, there was one non-routine/emergency event in 2022 that met the criteria to trigger sampling. However, due to staff capacity and weather restrictions, sampling was prevented from happening within a reasonable timeframe to assess the impacts of the event.

5.3 Recommendations

INVESTIGATE WAYS TO ELIMINATE REGULATORY COMPLIANCE VIOLATIONS

Substantial upgrades to the Schooner WWTP and collection system would be required for this facility to eliminate all regulatory compliance violations. Staff are undertaking upgrades in a phased manner over a five- to seven-year period. Phase 1 included several conveyance system upgrades. Phase 2 has started, with construction of a new Schooner WWTP starting in 2023 with anticipated completion by 2024.

6.0 CANNON WWTP

6.1 Introduction

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

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

Table 6.1 Cannon WWTP Regulatory Requirements

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

This registration also has a requirement for receiving water monitoring. Routine monitoring was last required for this facility in 2020 and is next required in 2024 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 which would trigger non-routine or emergency sampling.

The following section reports the results from the Cannon Wastewater Treatment Plant WMEP (Table 6.2).

Table 6.2 Cannon Wastewater Treatment Plant WMEP

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

6.2 Results

6.2.1 Wastewater Monitoring

COMPLIANCE AND TREATMENT PLANT PERFORMANCE MONITORING

In 2022, 12 total daily flows, representing 3.3% of the year, from the Cannon WWTP exceeded the allowable maximum (Table 6.3, Appendix D1). Flow exceedances occurred in January 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 2022, TSS and CBOD each exceeded compliance parameters on the May monthly compliance sampling, representing 8% each of the monthly sampling events.

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

Compliance data was reported to ENV on a monthly basis, with EIRs issued if there was an incident at the plant. There were 11 EIRs issued at Cannon WWTP in 2022, as a result of:

- heavy rainfall resulting in flow exceedance (January 7-9, 12, December 25-29);
- TSS and CBOD exceedance (May 17); and
- toxicity test failure (July 19). As the toxicity sampling is not required by ENV, this EIR was circulated for informational purposes only.

Only the December rain event met the criteria that triggers non-routine/emergency receiving environment sampling, but staff capacity and weather restrictions prevented sampling from happening within a reasonable timeframe.

TOXICITY TESTING

Beginning in 2021, toxicity testing was conducted at each of the Gulf Islands/Port Renfrew facilities in order to maintain consistency across the region. The undisinfected secondary effluent sample from July 2022 failed the 96-hour Rainbow trout acute toxicity test, unlike in 2021 when it passed. As this is only the second time toxicity testing has been conducted on Cannon WWTP wastewater, further data will be required prior to drawing any conclusions. The toxicity test was not ammonia stabilized, which may be considered for future years, until WWTP upgrades are completed.

Table 6.3 Cannon WWTP 2022 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	56	30	110	1,741	16
February	40	23	50	1,130	0
March	48	32	67	1,474	0
April	39	17	50	1,158	0
May	35	15	55	1,074	0
June	31	17	40	936	0
July	38	21	51	1,174	0
August	36	26	43	1,128	0
September	30	14	42	900	0
October	23	9	31	724	0
November	30	12	45	887	0
December	46	46	117	1,434	23
Annual	**38**	**9**	**117**	**13,760**	**3**

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

Table 6.4 Cannon WWTP 2022 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	38	153	---	12,126,352	225	---	---
Minimum	9	35	---	1,800,000	48	---	---
Maximum	117	570	---	170,000,000	441	---	---
Permit Violations (%)	3	---	---	---	---	---	---
Number of Samples	365	12	---	12	12	---	---
Secondary Effluent							
Regulatory Limit	68	60	45	---	---	---	---
Mean	38	13	10	34,626	21	8.1	6.9
Minimum	9	2	<4	370	3	<0.10	6.2
Maximum	117	62	65	1,800,000	120	25	7.4
Percent Reduction	---	92	---	100	91	---	---
Permit Violations (%)	3	8	8	---	---	---	---
Number of Samples	365	12	12	12	12	12	12

6.2.2 Receiving Water Monitoring

As noted above, there was one non-routine/emergency event in 2022 that met the criteria to trigger sampling. However, due to staff capacity and weather restrictions, sampling was prevented from happening within a reasonable timeframe to assess the impacts of the event.

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. As noted in Section 5.3, upgrades to the Magic Lake system are being completed in a phased approach. Phase 1 began in 2023 and included upgrades to the conveyance system and the construction of a new Schooner WWTP. Once the new Schooner WWTP has been commissioned (anticipated in 2024), the Cannon WWTP will be decommissioned and all flows will be pumped to the Schooner WWTP.

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 WWTP Regulatory Requirements

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

This registration also has a requirement for receiving water monitoring. Routine monitoring was last required for this facility in 2020 and is next required in 2024 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 which would trigger non-routine or emergency sampling.

The following section reports the results from the Port Renfrew Wastewater Treatment Plant WMEP (Table 7.2).

Table 7.2 Port Renfrew Wastewater Treatment Plant WMEP

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

7.2 Results

7.2.1 Wastewater Monitoring

COMPLIANCE AND TREATMENT PLANT PERFORMANCE MONITORING

Flow data are summarized in Table 7.3 and the complete data set is presented in Appendix E1. In 2022, 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. TSS exceeded the permitted value once in 2022, representing 8% of the monthly sampling events. All other compliance parameters were below regulatory limits. The treatment plant removed approximately 89% of the TSS, 93% 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 three EIRs issued at Port Renfrew WWTP in 2022, as a result of:

- overflow due to heavy rain (January 13);
- TSS exceedance (June 12); and
- outfall blockage (December 27, 2022 to March 24, 2023).

The outfall blockage was of duration long enough to trigger non-routine/emergency receiving environment sampling. Sampling for indicator bacteria was conducted on March 13, 2023, with all results below the recreational guideline of 200 CFU/100mL.

TOXICITY TESTING

Beginning in 2022, toxicity testing was conducted at each of the Gulf Islands/Port Renfrew facilities in order to maintain consistency across the region. The undisinfected secondary effluent sample from July 2022 passed the 96-hour Rainbow trout acute toxicity test.

Table 7.3 Port Renfrew WWTP 2022 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	77	35	245	2,460	3.1
February	53	31	124	1,481	0
March	64	32	144	1,979	0
April	57	40	131	1,709	0
May	55	38	89	1,720	0
June	44	33	65	1,320	0
July	44	38	62	1,363	0
August	41	34	49	1,266	0
September	37	29	48	1,112	0
October	36	23	130	1,118	0
November	47	23	154	1,402	0
December	67	22	207	2,006	0
Annual	**52**	**22**	**245**	**18,937**	**0.3**

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

Table 7.4 Port Renfrew WWTP 2022 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	52	404	---	8,561,389	264	---	---
Minimum	22	56	---	1,700,000	<72	---	---
Maximum	245	2360	---	73,000,000	556	---	---
Permit Violations (%)	0.3	---	---	---	---	---	---
Number of Samples	365	12	---	12	12	---	---
Secondary Effluent							
Regulatory Limit	220	60	45	---	---	---	---
Mean	52	45	5	24,200	18	2.56	6.4
Minimum	22	9	<4	1,200	5	<0.1	5.3
Maximum	245	298	9	510,000	57	16	7.3
Percent Reduction	---	89	---	100	93	---	---
Permit Violations (%)	0.3	8	0	---	---	---	---
Number of Samples	365	12	12	11	11	11	11

7.2.2 Receiving Water Monitoring

RECEIVING WATER BACTERIA INDICATORS

As noted above, an outfall blockage started in 2022 and extended into 2023. Sampling for indicator bacteria was conducted on March 13, 2023, with all results below the recreational guideline of 200 CFU/100mL.

7.3 Recommendations

MAINTAIN EFFECTIVENESS AND RELIABILITY OF THE TREATMENT PROCESS

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

8.0 REFERENCES

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APPENDIX A

GANGES WWTP

Appendix A1 Ganges WWTP Effluent Flow 2022 (m^3/day)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	394	391	504	399	445	399	445	449	402	378	400	474
2	255	406	515	384	475	420	364	448	409	346	406	445
3	506	360	459	491	489	406	468	458	436	354	462	418
4	549	396	418	608	431	263	441	462	412	388	492	396
5	453	344	383	647	378	344	414	445	381	376	390	401
6	590	353	373	474	453	344	395	437	403	403	497	432
7	668	371	404	444	485	344	390	420	426	363	420	442
8	563	406	353	412	386	344	398	437	395	370	412	474
9	437	369	411	390	441	344	414	448	381	370	416	456
10	428	376	415	427	454	344	363	443	419	360	427	628
11	596	368	419	406	378	344	366	440	389	376	423	484
12	657	346	386	412	334	344	412	438	388	394	406	464
13	593	333	360	418	375	344	397	438	439	389	389	469
14	554	383	432	446	426	344	408	398	422	390	375	433
15	419	361	456	378	534	344	400	404	487	381	413	448
16	405	353	405	405	453	344	413	455	419	353	426	397
17	448	378	466	357	427	344	368	435	427	374	387	415
18	467	368	474	463	378	344	389	439	390	406	383	409
19	443	341	438	517	445	344	413	419	372	412	346	385
20	488	343	386	444	478	344	408	435	405	406	342	339
21	443	352	492	454	464	344	398	423	423	368	365	398
22	444	402	521	393	482	344	399	382	428	359	459	440
23	403	393	463	385	451	344	414	438	410	355	425	401
24	440	396	429	382	398	344	388	441	416	376	395	554
25	426	376	424	455	425	343	355	425	381	417	412	664
26	446	415	420	424	340	344	423	419	376	387	341	777
27	370	477	395	412	467	272	400	416	401	449	370	851
28	386	594	420	427	465	383	484	396	381	407	391	679
29	377	---	349	401	457	370	495	416	374	367	460	644
30	441	---	389	538	435	368	454	444	350	407	543	661
31	416	---	410	---	447	---	438	434	---	414	---	579
Min	255	333	349	357	334	263	355	382	350	346	341	339
Max	668	594	521	647	534	420	495	462	487	449	543	851
Mean	468	384	425	440	435	348	410	432	405	384	412	499
Total Flow	14,505	10,751	13,169	13,193	13,496	10,448	12,714	13,382	12,142	11,895	12,373	15,457

Annual Min	**255**
Annual Max	**851**
Annual Mean	**421**

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

Appendix A2 Ganges WWTP Compliance and Treatment Plant Performance 2022

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	192	230	9,800,000	1	680	<1	<2	<2	<1	0.16	<0.0005	0.02	7.2
February	395	351	6,400,000	1	640	<2	<2.28	<2	<1	1.39	<0.1	0.05	7.1
March	317	233	6,000,000	01	436	<2	<2.88	<3.26	<1	4.59	<0.1	0.04	7.1
April	210	254	20,000,000	1.5	4,095	<2	<2	<2	<1	14.6	<0.1	---	7.2
May	228	400	8,100,000	01	4,907	<2	<2	<2	4	19.8	<0.1	---	7.4
June	283	327	9,000,000	1	373	---1	2.04	2.4	2	0.134	<0.1	0.02	7.5
July	308	323	24,000,000	2.05	1,071	<2	<4	<4	13	0.618	<0.1	---	7.3
August	304	329	28,000,000	2.5	4,837	<2	<2	2.17	<1	<0.1	<0.1	0.01	7.2
September	484	527	21,000,000	01	1,283	<2	15.6	9.1	<2	<0.1	<0.1	0.06	7.5
October	376	380	36,000,000	02	10,276	<1.18	<4	<4	<1	7.01	<0.102	0.03	7.5
November	395	441	7,100,000	2	1,004	<4	<4	<4	14	<0.1	<0.1	0.07	7.3
December	372	439	12,000,000	1.75	7,635	<2	<4	<4	<1	0.284	<0.1	0.03	7.4
Mean	322	353	13,020,784	1.48	3,103	<1	<3.9	1.1	0.9	5.5	0.02	0.04	7.3
Min	192	230	6,000,000	1	373	<1	<2	<2	<1	0.1	<0.0005	0.01	7.1
Max	484	527	36,000,000	2.5	10,276	<4	15.6	9.1	14	19.8	0.102	0.07	7.5
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	
	155	148	---	0.624	---	0.42	---	---	---	2.3	0.01	0.02	---

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

Appendix A3 Ganges WWTP Priority Substances Analyzed in Influent and Effluent 2022

Parameter	Units	MDL	Ganges Influent	Ganges Effluent	Effluent Diluted	Loading (kg/year)	BC WQG	CCME / HC WQG
CONVENTIONALS								
alkalinity (as CaCO3)	mg/L	1	<1	<1	n/d	n/d		
alkalinity - Bicarbonate	mg/L	1	260	91	0.22	n/a		
biochemical oxygen demand (BOD)	mg/L	150	2,200	<2	n/d	n/d		
carbonaceous biochemical oxygen demand (CBOD)	mg/L	150	1,000	<2	n/d	n/d		
chemical oxygen demand (COD)	mg/L	100	11,700	42	0.10	5,963,370		
chloride	mg/L	1	100	96	0.23	14.7		
cyanide-SAD	mg/L	0.005	<0.005	0.004	0.00001	591		
cyanide-WAD	mg/L	0.005	0.007	0.004	0.00001	584	0.001	
hardness (as CaCO3)	mg/L	0.5	134	53.9	0.13	7,652,992		
oil & grease, mineral	mg/L	2	24	<2	n/d	n/d		
oil & grease, total	mg/L	1	330	<1	n/d	n/d		
total organic carbon	mg/L	10	310	19	0.05	2,697,715		
pH	pH	0	7.73	7.96	0.019	n/a		
conductivity	µS/cm	2	930	510	1.2	n/a		
sulfide	mg/L	0.004	0.54	0.023	0.00005	3,266		
total suspended solids	mg/L	4.2	2500	<1	n/d	3,266		
BACTERIOLOGY								
Enterococci	CFU/100 mL	10	5,900,000	<2	n/d	n/d	35 geomean / 70 single sample	35 geomean / 70 single sample
Fecal Coliforms	CFU/100 mL	10	17,000,000	4	0.01	0.001		
NUTRIENTS								
N - NH3 (as N)	mg/L	0.38	45	0.87	0.002	123,527	19.7	
N - NH3 (as N)- unionized @ 15°C	mg/L	0.0005	0.03	0.003	0.00001	369		
N - TKN (as N)	mg/L	1	78	36	0.09	5,154,056		
N - TN	mg/L	1	78	37	0.09	5,239,247		
P - PO4 - total (as P) total	µg/L	5	20,500	114	0.27	16,186		
METALS - TOTAL								
aluminum	µg/L	3	1,660	25	0.06	3,493		
antimony	µg/L	0.02	0.93	0.17	0.0004	24.3		
arsenic	µg/L	0.02	2.0	0.30	0.0007	42.5	12.5	12.5
barium	µg/L	0.05	75	9.23	0.02	1,311		
beryllium	µg/L	0.01	0.03	<0.01	n/d	n/d	100	
cadmium	µg/L	0.005	1.1	0.13	0.0003	18.0	0.12	0.12

Parameter	Units	MDL	Ganges Influent	Ganges Effluent	Effluent Diluted	Loading (kg/year)	BC WQG	CCME / HC WQG
calcium	mg/L	0.25	40	15	0.04	2,087,180		
chromium	µg/L	0.1	7.9	0.36	0.0009	51.1		
cobalt	µg/L	0.01	1.4	0.13	0.0003	19.0		
copper	µg/L	0.1	553	6.1	0.01	860	<2 (lt), 3 (st)	
iron	µg/L	5	2,480	67	0.16	9,570		
lead	µg/L	0.02	15	0.29	0.0007	40.7	≤2 (lt), 140 (st)	
magnesium	mg/L	0.25	8.0	4.2	0.01	594,917		
manganese	µg/L	0.1	186	56	0.13	7,951		
mercury	µg/L	0.038	<0.038	<0.0019	n/d	0.27		0.16
molybdenum	µg/L	0.05	3.5	0.09	0.0002	13.3		
nickel	µg/L	0.1	9.05	1.7	0.004	240	8.3	
potassium	mg/L	0.25	25	19	0.04	2,669,318		
selenium	µg/L	0.04	1.8	0.12	0.0003	16.9	2	
silver	µg/L	0.01	4.1	<0.01	n/d	1.42	1.5 (lt), 3 (st)	7.5
thallium	µg/L	0.002	0.04	<0.002	n/d	0.28		
tin	µg/L	0.2	1.2	0.56	0.001	79.5		
zinc	µg/L	1	721	54	0.13	7,667	10 (lt), 55 (st)	
METALS - OTHER								
chromium III	mg/L	0.00099	0.008	<0.00099	n/d	n/d	56	
Chromium VI	mg/L	0.00099	<0.00099	<0.00099	n/d	n/d		
dibutyltin	µg/L	0.001	0.008	<0.001	n/d	n/d		
dibutyltin dichloride	µg/L	0.001	0.01	<0.001	n/d	n/d		
methyl mercury	µg/L	0.05	4.2	<0.05	n/d	n/d		
monobutyltin	µg/L	0.001	0.02	0.01	0.00003	1.56		
monobutyltin trichloride	µg/L	0.001	0.03	0.02	0.00004	2.56		
tributyltin	µg/L	0.001	0.005	<0.001	n/d	n/d	0.001	
tributyltin chloride	µg/L	0.001	0.005	<0.001	n/d	n/d		
ALDEHYDES								
acrolein	µg/L	10	<10	<10	n/d	n/d		
CHLORINATED PHENOLICS								
2,4 + 2,5 dichlorophenol	µg/L	0.5	<0.5	<0.5	n/d	n/d		
2-chlorophenol	µg/L	0.5	<0.5	<0.5	n/d	n/d		
2,4,6-trichlorophenol	µg/L	0.5	<0.5	<0.5	n/d	n/d		
4-chloro-3-methylphenol	µg/L	1	<1	<1	n/d	n/d		
pentachlorophenol	µg/L	0.5	<0.5	<0.5	n/d	n/d		

Parameter	Units	MDL	Ganges Influent	Ganges Effluent	Effluent Diluted	Loading (kg/year)	BC WQG	CCME / HC WQG
PHENOLIC COMPOUNDS								
total phenols	mg/L	0.0015	0.09	0.002	0.000005	298		
NON-CHLORINATED PHENOLICS								
2,4-dimethylphenol	µg/L	2.5	<2.5	<2.5	n/d	n/d		
2,4-dinitrophenol	µg/L	6.5	<6.5	<6.5	n/d	n/d		
2-methyl-4,6-dinitrophenol	µg/L	2.5	<2.5	<2.5	n/d	n/d		
2-nitrophenol	µg/L	2.5	<2.5	<2.5	n/d	n/d		
4-nitrophenol	µg/L	2.5	<2.5	<2.5	n/d	n/d		
phenol	µg/L	2.5	13.4	<2.5	n/d	n/d		
POLYCYCLIC AROMATIC HYDROCARBONS (PAH)								
2-chloronaphthalene	µg/L	0.25	<0.25	<0.25	n/d	n/d		
2-methylnaphthalene	µg/L	0.01	<0.01	<0.01	n/d	n/d	0.0202	
acenaphthene	µg/L	0.01	<0.01	<0.01	n/d	n/d	6	
acenaphthylene	µg/L	0.01	<0.01	<0.01	n/d	n/d		
anthracene	µg/L	0.01	<0.01	<0.01	n/d	n/d		
benzo(a)anthracene	µg/L	0.01	0.22	<0.01	n/d	n/d		
benzo(a)pyrene	µg/L	0.005	<0.005	<0.005	n/d	n/d	0.01	
benzo(b)fluoranthene	µg/L	0.01	0.03	<0.01	n/d	n/d		
benzo(b)fluoranthene + benzo(j)fluoranthene	µg/L	0.01	0.06	<0.01	n/d	n/d		
benzo(g,h,i)perylene	µg/L	0.02	<0.02	<0.02	n/d	n/d		
benzo(k)fluoranthene	µg/L	0.01	0.02	<0.01	n/d	n/d		
chrysene	µg/L	0.01	0.02	<0.01	n/d	n/d	0.1	
dibenzo(a,h)anthracene	µg/L	0.02	<0.02	<0.02	n/d	n/d		
fluoranthene	µg/L	0.01	0.01	<0.01	n/d	n/d		
fluorene	µg/L	0.01	<0.01	<0.01	n/d	n/d	12	
indeno(1,2,3-c,d)pyrene	µg/L	0.02	<0.02	<0.02	n/d	n/d		
naphthalene	µg/L	0.01	<0.01	<0.01	n/d	n/d	1	1.4
phenanthrene	µg/L	0.01	0.01	<0.01	n/d	n/d		
pyrene	µg/L	0.01	0.02	0.015	0.00004	2.13		
PAH-high molecular weight	µg/L	0.02	0.35	<0.02	n/d	n/d		
PAH-low molecular weight	µg/L	0.01	0.01	<0.01	n/d	n/d		
total PAHs	µg/L	0.02	0.36	<0.02	n/d	n/d		
SEMIVOLATILE ORGANICS								
bis(2-ethylhexyl)phthalate	µg/L	5	<5	<5	n/d	n/d		
butylbenzyl phthalate	µg/L	2.5	<2.5	<2.5	n/d	n/d		

Parameter	Units	MDL	Ganges Influent	Ganges Effluent	Effluent Diluted	Loading (kg/year)	BC WQG	CCME / HC WQG
diethyl phthalate	µg/L	0.25	<0.25	<0.25	n/d	n/d		
dimethyl phthalate	µg/L	0.25	<0.25	<0.25	n/d	n/d		
di-n-butyl phthalate	µg/L	2.5	<2.5	<2.5	n/d	n/d		
di-n-octyl phthalate	µg/L	0.25	<0.25	<0.25	n/d	n/d		
MISC SEMIVOLATILE ORGANICS								
bis(2-chloroethoxy)methane	µg/L	0.25	<0.25	<0.25	n/d	n/d		
bis(2-chloroethyl)ether	µg/L	0.25	<0.25	<0.25	n/d	n/d		
bis(2-chloroisopropyl)ether	µg/L	0.25	<0.25	<0.25	n/d	n/d		
hexachlorobutadiene	µg/L	0.25	<0.25	<0.25	n/d	n/d		
hexachlorocyclopentadiene	µg/L	0.25	<0.25	<0.25	n/d	n/d		
hexachloroethane	µg/L	0.25	<0.25	<0.25	n/d	n/d		
isophorone	µg/L	0.25	<0.25	<0.25	n/d	n/d		
nitrobenzene	µg/L	0.25	<0.25	<0.25	n/d	n/d		
N-nitrosodimethylamine	µg/L	1	<1	<1	n/d	n/d		
N-nitrosodi-n-propylamine	µg/L	1	<1	<1	n/d	n/d		
VOLATILE ORGANIC COMPOUNDS								
MONOCYCLIC AROMATIC HYDROCARBONS								
1,2,4-trichlorobenzene	µg/L	0.2	<0.2	<0.2	n/d	n/d		5.4
1,2-dichlorobenzene	µg/L	0.5	<0.5	<0.5	n/d	n/d		42
1,2-diphenylhydrazine	µg/L	0.05	<0.05	<0.05	n/d	n/d		
1,3-dichlorobenzene	µg/L	0.5	<0.5	<0.5	n/d	n/d		
1,4-dichlorobenzene	µg/L	0.5	<0.5	<0.5	n/d	n/d		
2,6-dinitrotoluene	µg/L	0.25	<0.25	<0.25	n/d	n/d		
3,3-dichlorobenzidine	µg/L	0.5	<0.5	<0.5	n/d	n/d		
4-bromophenyl phenyl ether	µg/L	0.05	<0.05	<0.05	n/d	n/d		
4-chlorophenyl phenyl ether	µg/L	0.25	<0.25	<0.25	n/d	n/d		
benzene	µg/L	0.4	<0.4	<0.4	n/d	n/d	110	110
ethylbenzene	µg/L	0.4	<0.4	<0.4	n/d	n/d	250	25
m & p xylenes	µg/L	0.4	<0.4	<0.4	n/d	n/d		
o-xylene	µg/L	0.4	<0.4	<0.4	n/d	n/d		
styrene	µg/L	0.5	<0.5	<0.5	n/d	n/d		
toluene	µg/L	0.4	4.6	<0.4	n/d	n/d		215
xylenes	µg/L	0.4	<0.4	<0.4	n/d	n/d		
CHLORINATED ALIPHATIC								
1,1,1,2-tetrachloroethane	µg/L	0.5	<0.5	<0.5	n/d	n/d		

Parameter	Units	MDL	Ganges Influent	Ganges Effluent	Effluent Diluted	Loading (kg/year)	BC WQG	CCME / HC WQG
1,1,1-trichloroethane	µg/L	0.5	<0.5	<0.5	n/d	n/d		
1,1,2,2-tetrachloroethane	µg/L	0.5	<0.5	<0.5	n/d	n/d		
1,1,2-trichloroethane	µg/L	0.5	<0.5	<0.5	n/d	n/d		
1,1-dichloroethane	µg/L	0.5	<0.5	<0.5	n/d	n/d		
1,1-dichloroethene	µg/L	0.5	<0.5	<0.5	n/d	n/d		
1,2-dichloroethane	µg/L	0.5	<0.5	<0.5	n/d	n/d		
1,4-dioxane	µg/L	1	<1	<1	n/d	n/d		
2,4-dinitrotoluene	µg/L	0.25	<0.25	<0.25	n/d	n/d		
alpha-terpineol	µg/L	5	<5	<5	n/d	n/d		
bromomethane	µg/L	1	<1	<1	n/d	n/d		
chlorobenzene	µg/L	0.5	<0.5	<0.5	n/d	n/d		
chlorodibromomethane	µg/L	1	<1	<1	n/d	n/d		
chloroethane	µg/L	1	<1	<1	n/d	n/d		
chloroethene	µg/L	0.5	<0.5	<0.5	n/d	n/d		
chloromethane	µg/L	1	<1	<1	n/d	n/d		
ALIPHATIC								
1,2-dibromoethane	µg/L	0.2	<0.2	<0.2	n/d	n/d		
1,2-dichloropropane	µg/L	0.5	<0.5	<0.5	n/d	n/d		
acrylonitrile	µg/L	1	<1	<1	n/d	n/d		
cis-1,2-dichloroethene	µg/L	1	<1	<1	n/d	n/d		
cis-1,3-dichloropropene	µg/L	1	<1	<1	n/d	n/d		
dibromomethane	µg/L	0.9	<0.9	<0.9	n/d	n/d		
methyl tertiary butyl ether	µg/L	4	<4	<4	n/d	n/d	440	5,000
tetrabromomethane	µg/L	50	<50	<50	n/d	n/d		
tetrachloroethene	µg/L	0.5	<0.5	<0.5	n/d	n/d		
tetrachloromethane	µg/L	0.5	<0.5	<0.5	n/d	n/d		
trans-1,2-dichloroethene	µg/L	1	<1	<1	n/d	n/d		
trans-1,3-dichloropropene	µg/L	1	<1	<1	n/d	n/d		
trichloroethene	µg/L	0.5	<0.5	<0.5	n/d	n/d		
trichlorofluoromethane	µg/L	4	<4	<4	n/d	n/d		
trichloromethane	µg/L	1	11	<1	n/d	n/d		
TRIHALOMETHANES								
bromodichloromethane	µg/L	1	<1	<1	n/d	n/d		
dichlorodifluoromethane	µg/L	2	<2	<2	n/d	n/d		
tribromomethane	µg/L	1	<1	<1	n/d	n/d		

Parameter	Units	MDL	Ganges Influent	Ganges Effluent	Effluent Diluted	Loading (kg/year)	BC WQG	CCME / HC WQG
KETONES								
dimethyl ketone	µg/L	15	91	<15	n/d	n/d		
methyl ethyl ketone	µg/L	50	<50	<50	n/d	n/d		

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 2022

Regulated Parameters (mg/kg dry)	Class A Biosolids Limit (mg/kg dry)*	# of samples	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
Metals															
arsenic	75	11	2.56	1.76	2.52	1.75	1.5	<30	<250	<60	<63	<100	<30	---	---
cadmium	20	11	1.17	1.59	2.39	1.22	0.963	<5	<42	<10	<11	<17	<5	---	---
chromium	1,060	11	8.4	6.23	9.53	3.61	7.7	<10	<83	<20	<21	<33	<10	---	---
cobalt	151	11	2.2	1.66	2.58	1.35	1.25	<20	<170	<40	<42	<67	<20	---	---
copper	757	11	1120	1070	1470	832	681	785	497	975	955	1550	474	---	946
lead	505	11	16.8	14.1	19.9	12.6	9.94	<30	<250	106	<63	<100	<30	---	38.0
mercury	5	11	0.008	0.01	0.01	0.212	0.489	<0.04	0.2	<0.04	<0.042	0.66	<0.02	---	0.15
molybdenum	20	11	4.33	3.55	5.18	<0.5	3.25	<20	<170	<40	<42	<67	<20	---	---
nickel	181	11	15.5	12.2	17.8	10.6	9.27	<20	<170	<40	<42	<67	<20	---	---
selenium	14	11	2.2	2.09	2.38	0.707	1.97	<100	<830	<200	<210	<330	<100	---	---
thallium	5	5	0.0379	0.03	0.06	0.032	<0.05	---	---	---	---	---	---	---	0.04
vanadium	656	11	5.54	3.41	5.52	3.1	3	<10	<83	<20	<21	<33	<10	---	---
zinc	1,868	11	537	510	678	491	383	449	292	697	728	1,150	287	---	564
Unregulated Parameters (mg/kg dry)	**Class A Biosolids Limit (mg/kg dry)***	**# of samples**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Mean**
Conventionals															
moisture	n/a	11	98.5	98.6	98.6	99.0	99.0	99.0	99.3	100.3	99.3	99.3	99.3	---	99
Metals															
aluminum	n/a	11	2,930	2,010	3,030	1,820	1,670	1,320	1,030	1,900	2,059	3,290	918	---	1998
antimony	n/a	11	0.705	0.600	0.890	<0.25	0.730	<50	<420	<100	<106	<170	<50	---	---
barium	n/a	11	75.4	57.3	95.2	63.4	45.7	52.1	36.8	81.5	75.5	124.0	43.0	---	68.0
beryllium	n/a	11	0.0490	0.0400	<0.2	<0.05	<0.2	<3	<25	<6	<6.3	<10	<3	---	---
bismuth	n/a	11	20.5	17.2	23.9	16.1	16.5	<50	<420	<100	<106	<170	<50	---	---
boron	n/a	11	34.8	34.4	<100	29.0	18.7	26.0	<83	55.0	46.0	116.0	31.0	---	44.0
calcium	n/a	11	12,900	10,700	15,100	12,300	9,180	9,860	6,720	15,100	20,430	36,700	7,220	---	14201
iron	n/a	11	3,750	2,770	4,400	3,230	3,530	2,130	1,840	3,480	4,560	6,660	1,610	---	3451
lithium	n/a	11	2.47	1.63	2.42	1.50	1.27	<20	<170	<40	<42	<67	<20	---	---
magnesium	n/a	11	8,230	7,100	10,700	7,240	4,410	5,420	3,930	10,100	11,110	17,900	3,880	---	8184
manganese	n/a	11	184	158	224	159	115	121	79	155	172	297	97	---	160
phosphorus	n/a	9	31,200	27,900	41,100	36,800	24,876	28,400	18,700	42,700	48,400	79,400	16,700	---	37,167

Unregulated Parameters (mg/kg dry)	Class A Biosolids Limit (mg/kg dry)*	# of samples	Jan	Feb+	Mar	Apr	May	Jun^	Jul	Aug	Sep	Oct	Nov^	Dec	Mean
potassium	n/a	11	19,500	17,900	24,000	18,300	11,400	12,800	9,370	23,500	23,900	40,900	8,980	---	19,141
silicon	n/a	10	2,730	1,770	2,810	1,220	564	873	521	1,090	1,415	2,190	611	---	1,523
silver	n/a	11	3.25	2.77	3.88	0.40	1.91	<10	<83	<20	<21	<33	<10	---	---
sodium	n/a	11	5,900	6,130	6,260	5,400	4,160	6,510	5,000	12,200	13,730	22,500	6,470	---	8,569
strontium	n/a	11	63.8	51.9	74.2	59.1	39.7	43.7	37.2	65.3	86.7	143.0	33.6	---	63.0
sulphur	n/a	10	8,740	7,570	7,670	3,600	4,563	5,620	4,180	9,130	11,000	18,400	4,090	---	8,000
tin	n/a	11	2.01	1.39	2.12	2.50	12.40	<30	<250	<60	<63	<100	<30	---	---
titanium	n/a	11	21.3	12.2	18.4	2.5	19.8	<5	<42	<10	17.4	19.0	<5	---	13.0
zirconium	n/a	11	0.587	0.380	0.790	0.091	1.340	<20	<170	<40	<42	<67	<20	---	---

Notes:
Shading indicates exceedance of regulatory limit.

+ represents the mean of two field replicate samples.

^ ---November sample was not collected.

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

APPENDIX B

MALIVIEW WWTP

Appendix B1 Maliview WWTP Effluent Flow 2022 (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	31	62	93	14	65	79	125	61	185	27	61	88	119	58	177	0	65	65	0	38	38	0	24	24	0	25	25	0	29	29	0	40	40	34	85	119
2	32	61	93	10	60	70	86	69	155	26	61	86	83	58	141	0	61	61	0	41	41	0	29	29	0	26	26	0	29	29	0	45	45	12	83	94
3	84	58	141	12	56	68	81	67	148	20	62	82	71	59	129	0	58	58	0	39	39	0	23	23	0	25	25	0	34	34	0	39	39	3	64	66
4	118	55	173	8	59	67	60	67	127	44	64	108	59	58	117	0	59	59	7	49	56	0	28	28	0	27	27	0	30	30	0	52	52	26	78	104
5	105	55	160	5	66	70	48	65	113	183	61	244	58	57	114	3	60	63	3	67	69	0	27	27	0	26	26	0	29	29	7	77	84	26	78	103
6	78	57	135	6	62	68	36	64	100	109	62	171	59	57	115	12	71	83	0	59	59	0	29	29	0	31	31	0	26	26	3	33	35	23	75	97
7	84	60	144	5	63	68	35	63	98	67	64	130	56	53	109	5	69	74	0	57	57	0	27	27	0	25	25	0	27	27	18	80	98	24	64	88
8	186	60	246	0	51	51	28	62	90	48	65	113	40	54	94	1	68	69	0	48	48	0	26	26	0	28	28	0	43	43	0	73	73	34	63	96
9	109	61	170	0	59	59	28	62	90	43	62	105	33	56	89	1	64	64	0	50	50	0	19	19	0	32	32	0	43	43	0	61	61	42	62	103
10	83	61	144	0	73	73	34	63	97	39	59	98	24	47	71	24	63	87	0	37	37	0	22	22	0	29	29	0	38	38	0	53	53	55	62	117
11	69	52	121	0	80	80	20	63	83	77	60	137	20	60	79	42	72	113	0	40	40	0	27	27	0	31	31	0	43	43	0	49	49	179	57	236
12	143	58	201	4	79	83	19	62	81	62	49	111	16	61	77	28	70	98	1	15	16	0	27	27	0	33	33	0	41	41	0	46	46	96	62	157
13	200	54	253	8	76	83	23	66	89	51	60	111	10	59	69	20	69	88	0	37	37	0	26	26	0	21	21	0	33	33	0	44	44	57	59	115
14	125	56	181	8	75	83	27	63	90	47	59	106	14	59	73	6	56	62	0	36	36	0	27	27	0	32	32	0	27	27	0	53	53	45	63	108
15	81	59	140	6	71	77	16	49	65	38	60	97	15	57	72	7	68	74	0	37	37	0	37	37	0	30	30	0	32	32	0	54	54	38	60	97
16	63	58	121	12	68	80	40	85	125	34	62	96	30	56	86	6	60	65	0	38	38	11	21	32	6	24	30	0	35	35	1	8	9	30	64	93
17	51	56	107	8	66	74	49	58	107	26	62	88	25	69	94	7	59	66	0	38	38	37	0	37	0	31	31	0	46	46	0	46	46	27	53	80
18	27	57	84	7	64	71	73	58	130	22	63	85	28	68	96	4	58	62	0	39	39	13	20	32	0	32	32	0	24	24	0	45	45	26	61	86
19	23	62	84	20	66	86	67	61	127	69	64	133	8	66	73	4	56	60	0	36	36	0	32	32	0	35	35	0	30	30	0	52	52	26	63	89
20	22	65	87	7	79	86	45	65	110	72	62	133	3	79	82	6	56	61	0	37	37	0	30	30	0	31	31	0	38	38	0	46	46	18	91	109
21	51	63	114	6	78	84	37	64	101	52	62	113	7	68	75	1	55	55	0	32	32	0	28	28	0	32	32	0	38	38	0	45	45	15	63	78
22	41	60	101	7	77	84	79	61	140	65	61	126	7	64	70	0	48	48	0	30	30	0	28	28	0	25	25	0	37	37	0	40	40	13	66	79
23	31	59	90	5	70	75	118	58	176	53	59	112	11	62	73	0	48	48	0	27	27	0	16	16	0	30	30	0	33	33	0	55	55	13	64	77
24	22	56	78	9	68	77	89	57	146	41	58	99	7	63	70	0	46	46	0	26	26	0	26	26	0	28	28	0	36	36	0	50	50	12	69	81
25	15	45	60	3	65	67	59	57	116	37	61	97	2	61	63	0	39	39	0	30	30	0	27	27	0	28	28	2	35	36	0	54	54	197	67	264
26	13	57	70	5	59	64	49	57	106	41	49	89	0	56	56	0	46	46	0	14	14	0	34	34	0	30	30	0	37	37	6	62	67	225	85	309
27	5	57	62	13	59	71	55	57	112	33	59	92	0	56	56	0	44	44	0	22	22	0	28	28	0	19	19	0	38	38	0	69	69	250	96	346
28	6	56	62	65	66	131	56	57	112	27	60	86	9	71	80	0	48	48	0	25	25	0	26	26	0	22	22	1	41	42	1	62	63	273	79	351
29	2	59	61	---	---	---	47	50	97	23	60	83	6	68	74	0	48	48	0	25	25	0	29	29	0	26	26	0	38	38	0	63	63	185	70	254
30	3	59	62	---	---	---	37	64	101	20	57	76	4	66	70	0	40	40	0	23	23	0	26	26	0	27	27	0	38	38	10	64	74	125	95	220
31	24	65	88	---	---	---	34	63	96	---	---	---	7	55	61	---	---	---	0	26	26	0	26	26	---	---	---	0	47	47	---	---	---	150	62	212
Min	2	45	60	0	51	51	16	49	65	20	49	76	0	47	56	0	39	39	0	14	14	0	0	16	0	19	19	0	24	24	0	8	9	3	53	66
Max	200	65	253	65	80	131	125	85	185	183	65	244	119	79	177	42	72	113	7	67	69	37	37	37	6	35	35	2	47	47	18	80	98	273	96	351
Mean	62	58	120	9	67	76	51	62	113	50	60	110	27	60	87	6	57	63	0	36	36	2	25	27	0	28	28	0	35	35	1	52	53	73	69	143
Total Flows	1,923	1,796	3,719	248	1,873	2,121	1,593	1,912	3,505	1,487	1,800	3,287	826	1,871	2,697	173	1,716	1,888	10	1,110	1,120	60	787	847	6	834	840	3	1,088	1,091	44	1,551	1,595	2,268	2,154	4,422

Annual Min	**0**	**0**	**9**
Annual Max	**273**	**96**	**351**
Annual Mean	**24**	**51**	**74**

Notes:
F-S: Fine-screened; Sec: Secondary; T-C: Total combined.
Shading indicates exceedance of regulatory limit (250m^3/day T-C).

Appendix B2 Maliview WWTP Compliance and Treatment Plant Performance 2022

Date	Influent			Secondary Effluent (Undisinfected)						Secondary Effluent Final Combined (secondary + screened)							
	TSS (mg/L)	BOD (mg/L)	FC (CFU/ 100 mL)	TSS (mg/L)	BOD (mg/L)	CBOD (mg/L)	FC (CFU/ 100 mL)	NH_3 (mg/L N)	pH	TSS (mg/L)	TSS Applicable Limit (mg/L)	BOD (mg/L)	CBOD (mg/L)	CBOD Applicable Limit (mg/L)	FC (CFU/ 100 mL)	Ammonia (mg/L N)	pH
January	133	140	2,600,000	23	30	6	87,000	12	7.3	105	130	31	14	130	4,000,000	15	7.4
February	272	286	1,500,000	333	209	129	210,000	26	7.3	300	130	199	129	130	1,500,000	25	7.2
March	160	189	1,500,000	13	12	5	35,000	9	7.2	77	45	78	42	45	460,000	9	7.3
April	94	90	2,200,000	23	17	10	60,000	7	7.0	29	130	28	24	130	2,400,000	17	7.0
May	193	110	5,600,000	24	18	12	60,000	16	7.4	94	130	17	14	130	54,000	16	7.5
June	244	243	4,300,000	38	28	29	320,000	32	7.6	62	45	45	42	45	380,000	33	7.6
July	283	232	12,000,000	20	16	14	5,800,000	44	7.5	21	45	18	15	45	5,400,000	42	7.5
August	540	552	4,200,000	30	27	27	950,000	51	7.5	27	45	25	32	45	960,000	52	7.5
September	184	237	9,500,000	19	29	20	770,000	58	7.7	27	45	30	23	45	720,000	58	7.7
October	330	491	79,000,000	26	30	25	1,100,000	55	7.5	28	45	29	28	45	2,100,000	60	7.7
November	190	145	5,400,000	36	37	20	480,000	52	7.5	32	45	36	34	45	370,000	50	7.5
December	67	125	550,000	22	20	16	150,000	17	7.5	60	130	105	94	130	620,000	20	8.1
Mean	224	237	4,250,902	51	37	28	281,494	32	7.4	72	0	53	41	0	889,220	33	7.5
Min	67	90	550,000	13	12	5	35,000	7	7.0	21	0	17	14	0	54,000	9	7.0
Max	540	552	79,000,000	333	209	129	5,800,000	58	7.7	300	0	199	129	0	5,400,000	60	8.1
n	12	12	12	12	12	12	12	12	12	12	0	12	12	0	12	12	12
Mean Daily Loading	kg/day			kg/day				kg/day	---	kg/day	---			---		kg/day	---
	17	---	---	2.6	---	---	---	1.6	---	5.3	---	---	---	---	---	2.5	---

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

APPENDIX C

SCHOONER WWTP

Appendix C1 Schooner WWTP Effluent Flow 2022 (m^3/day)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	347	382	473	341	300	190	177	169	137	128	258	166
2	327	363	454	340	278	182	173	190	133	130	161	159
3	452	349	408	329	295	166	169	164	150	121	144	184
4	514	374	374	389	268	197	222	137	150	115	181	179
5	463	405	366	582	266	198	209	158	148	121	355	181
6	437	380	354	295	266	192	182	148	144	121	266	148
7	502	369	320	404	251	195	178	152	133	117	224	156
8	949	361	323	343	256	198	179	145	117	145	197	198
9	607	352	343	340	241	224	174	150	138	149	186	176
10	545	317	288	322	222	210	187	143	103	147	165	188
11	485	322	300	353	214	221	187	134	125	128	160	187
12	590	301	348	311	217	228	169	143	121	108	162	172
13	775	311	299	356	231	217	158	127	118	119	165	158
14	609	310	345	311	204	211	172	150	118	123	170	150
15	528	300	432	323	209	204	159	157	111	138	149	136
16	484	316	363	321	246	179	166	155	118	122	134	170
17	455	297	469	311	256	164	163	157	123	153	128	165
18	426	281	457	307	228	162	163	128	130	116	146	179
19	447	305	428	304	215	181	146	146	130	113	135	177
20	423	301	399	277	235	161	126	138	128	122	141	173
21	494	305	585	269	219	179	136	143	116	126	151	170
22	445	308	580	274	224	164	146	141	115	142	132	179
23	441	287	569	262	209	166	151	156	115	138	194	186
24	416	290	482	274	210	170	154	128	122	119	182	571
25	410	277	421	287	193	171	152	134	130	106	160	609
26	366	288	463	292	187	158	133	139	134	109	195	647
27	356	269	415	251	189	177	139	146	117	137	195	787
28	333	342	398	253	207	154	136	177	123	125	187	665
29	323	---	365	214	220	176	147	160	123	133	171	480
30	345	---	338	220	177	147	150	159	121	160	262	573
31	430	---	341	---	195	---	163	130	---	258	---	473
Min	323	269	288	214	177	126	126	127	103	106	128	136
Max	949	405	585	582	300	222	222	190	150	258	355	787
Mean	475	324	403	315	230	163	163	149	126	132	182	282
Total Flows	14,724	9,062	12,500	9,455	7,128	5,542	5,066	4,604	3,791	4,089	5,456	8,742

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

Annual Min	**103**
Annual Max	**949**
Annual Mean	**247**

Appendix C2 Schooner WWTP Compliance and Treatment Plant Performance 2022

Date	Influent			Secondary Effluent		Secondary Effluent Disinfected						
	TSS (mg/L)	BOD (mg/L)	FC (CFU/ 100 mL)	TSS (mg/L)	FC (CFU/ 100 mL)	TSS (mg/L)	BOD (mg/L)	CBOD (mg/L)	FC (CFU/ 100 mL)	NH_3 (mg/L N)	pH	Unionized NH_3 (mg/L)
Regulatory Limit						45 max / 25 mean		45 max / 25 mean	200			1.25
January	188	44	1,700,000	3	8,000	6	2.9	<2	<1	0.07	6.9	0.0
February	68	52	7,000,000	12	34,000	7	2.85	<2	12	0.22	6.5	<0.1
March	110	59	1,600,000	10	92,000	9	4.12	<3.3	33	2.3	6.9	<0.1
April	687	252	3,600,000	14	62,000	18	7.46	5.9	13	0.26	6.7	<0.1
May	62	98	5,000,000	19	89,000	18	4.7	6.6	41	<0.1	7.1	<0.1
June	144	111	3,700,000	8	15,500	9	5.7	4.2	2	0.54	6.3	<0.1
July	356	167	14,000,000	5	5,200	5	<4	<4	9	0.83	6.5	<0.1
August	428	286	12,000,000	45	110,000	40	30.5	22	201	29	7.4	<0.1
September	206	288	10,000,000	8	25,000	8	4.9	<4	27	0.53	6.0	<0.1
October	560	295	23,000,000	25	670,000	14	8.91	5.6	14	1.9	6.6	<0.102
November	158	181	4,200,000	37	63,000	14	6.97	<4	3	0.16	6.9	<0.1
December	206	195	2,800,000	21	43,000	14	8.22	6.6	5	<0.1	7.1	<0.1
Mean	182	133	3,950,869	12	33,371	13	6	5	30	3.1	7.0	0.004
Min	36	16	640,000	3	5,400	2	<2	2	<1	0.0	6.8	<0.0005
Max	650	270	13,000,000	27	210,000	43	13	12	201	16	7.3	0.02
n	12	12	12	12	12	12	11	11	12	12	12	12
Mean Daily Loading	kg/day			kg/day		kg/day				kg/day		kg/day
	53	---	---	3.6	---	3.7	---	---	---	0.9	---	0.001

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

APPENDIX D

CANNON WWTP

Appendix D1 Cannon WWTP Effluent Flow 2022 (m^3/day)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	46	46	54	43	43	32	36	43	32	31	30	31
2	44	43	48	39	40	29	41	43	32	30	23	27
3	53	41	48	42	39	30	44	38	28	26	22	32
4	65	46	32	48	37	33	51	38	33	30	28	33
5	65	47	44	17	37	30	48	27	36	11	45	31
6	51	47	45	36	37	36	40	43	38	29	29	29
7	39	50	39	43	37	29	39	38	29	27	35	31
8	110	41	35	50	40	27	25	40	28	26	34	32
9	77	26	35	46	39	26	39	37	42	26	31	33
10	71	41	39	46	34	33	38	36	42	28	30	35
11	63	40	37	47	31	25	40	41	35	31	30	36
12	57	41	43	42	29	39	37	38	34	25	29	30
13	93	41	43	41	25	40	35	26	30	28	33	27
14	77	46	45	35	25	32	36	38	28	23	37	27
15	65	41	53	43	33	31	33	43	27	21	29	28
16	60	40	44	45	41	31	40	39	27	22	27	27
17	57	28	48	43	43	33	38	37	14	25	24	27
18	52	37	58	46	35	35	41	36	30	22	26	33
19	52	39	52	40	15	34	35	38	34	9	12	32
20	49	45	54	38	18	35	35	26	28	21	28	31
21	55	47	63	37	55	31	35	39	26	19	30	32
22	38	43	67	36	44	31	21	40	29	21	28	34
23	56	35	45	22	39	17	38	34	31	24	37	36
24	53	36	60	39	36	30	40	37	30	20	33	104
25	47	35	53	38	32	32	49	40	31	19	30	108
26	43	23	54	34	28	36	39	35	29	18	33	95
27	42	39	54	35	30	33	37	27	19	20	35	117
28	40	46	49	32	33	36	27	32	24	13	32	95
29	30	---	48	32	35	32	37	36	27	22	29	71
30	40	---	42	23	33	18	38	33	27	27	18	60
31	51	---	43	---	31	---	42	30	---	30	---	70
Min	30	23	32	17	15	17	21	26	14	9	12	27
Max	110	50	67	50	55	40	51	43	42	31	45	117
Mean	56	40	48	39	35	31	38	36	30	23	30	46
Total Flows	1,741	1,130	1,474	1,158	1,074	936	1,174	1,128	900	724	887	1,434

Annual Min	**9**
Annual Max	**117**
Annual Mean	**38**

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

Appendix D2 Cannon WWTP Compliance and Treatment Plan Performance 2022

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	36	48	5,800,000	8	8	4.7	58,000	16	7.4
February	106	205	3,600,000	3	3	<2	7,200	6.7	6.8
March	35	72	1,800,000	8	11	5.7	810,000	<0.1	6.6
April	103	313	5,800,000	2	6	2.4	200,000	2.0	6.8
May	88	92	2,900,000	62	120	65	1,800,000	1.2	6.2
June	162	441	58,000,000	4	7	2.9	6,800	8.6	7.4
July	570	390	98,000,000	7	18	<4	680,000	18	7.4
August	67	179	48,000,000	5	12	4.3	10,000	24	7.4
September	92	313	9,900,000	6	6	<4	370	<0.1	6.4
October	99	246	8,100,000	17	16	5.5	36,000	0.21	7.1
November	108	255	170,000,000	12	23	13	11,000	17	7.2
December	364	145	4,300,000	17	19	12	3,600	1.8	6.4
Mean	153	225	12,126,352	13	21	10	34,626	8.1	6.9
Min	35	48	1,800,000	2	3	2	370	0.1	6.2
Max	570	441	170,000,000	62	120	65	1,800,000	24.5	7.4
N	12	12	12	12	12	12	12	12.0	12
Mean Daily Loading	kg/day			kg/day				kg/day	
	5.7	---	---	0.5	---	---	---	0.3	---

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

APPENDIX E

PORT RENFREW WWTP

Appendix E1 Port Renfrew WWTP Effluent Flow 2022 (m^3/day)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	56	47	90	44	42	38	46	39	37	32	47	43
2	63	44	90	54	51	43	50	36	39	34	43	36
3	111	54	72	110	49	54	52	48	38	30	58	45
4	88	87	49	131	65	54	62	36	46	28	154	38
5	65	68	49	65	86	54	52	41	38	27	82	34
6	99	54	47	56	79	47	47	41	31	25	95	34
7	118	47	38	49	54	45	49	43	35	23	62	36
8	84	46	32	63	49	40	40	41	33	32	48	66
9	72	36	34	56	49	57	48	41	33	32	38	67
10	73	40	36	51	42	65	46	41	35	31	34	82
11	187	38	34	47	47	62	42	45	32	25	39	62
12	245	43	45	47	88	49	39	42	33	30	41	43
13	119	40	47	44	66	43	40	47	29	25	34	35
14	82	42	144	40	61	38	38	49	34	25	29	30
15	67	33	109	45	89	38	45	47	37	32	25	32
16	54	31	72	49	69	40	48	41	42	31	26	28
17	47	36	76	47	51	42	57	38	41	27	23	32
18	60	35	63	64	72	38	41	41	45	25	25	29
19	57	54	83	61	59	40	43	49	48	25	27	25
20	114	57	120	63	50	36	40	41	39	23	30	22
21	63	50	132	66	50	37	38	41	38	23	27	28
22	67	36	78	54	52	34	38	45	41	23	46	31
23	60	38	80	46	47	33	43	43	43	27	36	40
24	46	34	61	52	44	38	39	38	38	32	30	188
25	35	42	53	51	47	45	39	34	39	43	39	122
26	38	67	56	61	45	41	39	36	36	41	60	187
27	35	117	56	58	50	41	48	41	38	63	61	207
28	35	124	49	44	50	43	41	41	36	47	43	120
29	43	---	42	44	45	41	39	35	34	38	40	88
30	78	---	47	49	38	38	41	34	29	130	66	101
31	56	---	42	---	38	---	43	38	---	76	---	121
Min	35	31	32	40	38	33	38	34	29	23	23	22
Max	245	124	144	131	89	65	62	49	48	130	154	207
Mean	78	51	65	57	56	44	44	41	37	36	47	66
Total Flows	2,413	1,438	2,025	1,711	1,724	1,313	1,371	1,268	1,117	1,102	1,407	2,049

Annual Min	**22**
Annual Max	**245**
Annual Mean	**52**

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

Appendix E2 Port Renfrew WWTP Compliance and Treatment Plant Performance 2022

Date	Influent			Secondary Effluent					
	TSS (mg/L)	BOD (mg/L)	FC (CFU/ 100 mL)	TSS (mg/L)	BOD (mg/L)	CBOD (mg/L)	FC (CFU/ 100 mL)	NH_3 (mg/L N)	pH
Regulatory Limit				60		45			
January	270	140	3,800,000	15	21	4	25000	1.2	6.4
February	218	198	20,000,000	17	17	7.8	510000	0.18	6.4
March	110	<72	1,700,000	9	5	<4	31000	<0.1	6.4
April	148	230	4,000,000	14	13	5.4	1200	0.18	6.5
May	143	180	2,100,000	12	7	6.1	4500	<0.1	6.7
June	352	399	28,000,000	298	57	4	99100	0.73	6.3
July	308	271	73,000,000	22	---	4	---	---	---
August	380	444	10,000,000	33	20	<10	11000	0.66	6.2
September	2360	>556	22,000,000	31	16	8	46000	1.1	5.3
October	376	427	25,000,000	46	17	9.1	59000	16	7.3
November	131	136	4,100,000	11	13	<4	6000	7.6	7.0
December	56	153	3,100,000	26	15	4	44000	0.28	5.4
Mean	404	267	8,561,389	45	18	5	24,200	2.6	6.4
Min	56	<72	1,700,000	9	5	<4	1,200	<0.1	5.3
Max	2,360	556	73,000,000	298	57	9	510,000	16.2	7.3
N	12	12	12	12	11	12	11	11	11
Mean Daily Loading	kg/day			kg/day				kg/day	
	21	---	---	0.6	---	---	---	0.13	---

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