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Wastewater

The 2021 Greater Vancouver Sewerage and Drainage District Environmental Management and Quality Control Annual Report

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AEM	Ambient Environment Monitoring
AVS/SEM	Acid Volatile Sulfide / Simultaneously Extracted Metals
BCEDQA	British Columbia Environmental Data Quality Assurance
BIAMP	Burrard Inlet Ambient Monitoring
BOD or BOD_5*	Biochemical Oxygen Demand
CALA	Canadian Association for Laboratory Accreditation
CBOD or $CBOD_5$*	Carbonaceous Biochemical Oxygen Demand
CDOM	Colored Dissolved Organic Matter
CEPT	Chemically Enhanced Primary Treatment
CSO	Combined Sewer Overflow
CTD	Conductivity, Temperature, Depth
CWS-MMWE	Canada-Wide Strategy for the Management of Municipal Wastewater Effluent
DAFT	Dissolved Air Floatation Thickener
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
EMS	Environmental Management System
EPH	Extractable Petroleum Hydrocarbons
ERRIS	Effluent Regulatory Reporting Information System
FREMP	Fraser River Environmental Monitoring Program
FTV	Flow Through Vessel
GVS&DD	Greater Vancouver Sewerage and Drainage District
HRT	Hydraulic Retention Time
IDZ	Initial Dilution Zone
ILWRMP	Integrated Liquid Waste and Resource Management Plan
ISO/IEC	International Organization for Standardization/International Electrotechnical Commission
LWS	Liquid Waste Services
LWS-EMQC	Liquid Waste Services – Environmental Management & Quality Control
MCRT	Average Mean Cell Residence Time
MLD	Million (Mega) Liters Per Day
MLSS	Mixed Liquor Suspended Solids
MOECCS	Ministry of Environment and Climate Change Strategy
MPN	Most Probable Number
OC	Operational Certificate
OCP	Organochlorine pesticides
OMRR	Organic Matter Recycling Regulation

* both acronyms are used in this report for the purpose of consistency with nomenclature used in the respective authorization mechanisms: WSER or OC

PAA	Peracetic Acid
PAH	Polycyclic Aromatic Hydrocarbons
PBDE	Polybrominated Diphenylethers
PCB	Polychlorinated Biphenyls
PFC	Perfluorinated Compounds
PPCP	Pharmaceuticals and Personal Care Products
QA/QC	Quality Assurance / Quality Control
REM	Receiving Environment Monitoring
SBS	Sodium Bisulphite Solution
$SCBOD_5$	Soluble Carbonaceous Biochemical Oxygen Demand
SHS	Sodium Hypochlorite Solution
SSO	Sanitary Sewer Overflow
TA	Transitional Authorization
TBS	Thickened Bottom Sludge
TF	Trickling Filter
TOC	Total Organic Carbon
TPS	Thickened Primary Sludge
TSPS	Thickened Screened Primary Sludge
TSS or SS	Total Suspended Solids
VOC	Volatile Organic Carbons
WQO	Water Quality Objective
WSER	Wastewater Systems Effluent Regulation
WWTP	Wastewater Treatment Plant

PREFACE

The Environmental Management and Quality Control Division (the Division) of the Liquid Waste Services Department is responsible for monitoring and reporting on the influent, effluent, and process streams quality of the region's five wastewater treatment plants (WWTPs), in addition to the operations of the collection system and environmental health of the water bodies that receive discharges from the liquid waste management system for the Greater Vancouver Sewerage and Drainage District (GVS&DD).

This Annual Report summarizes the information gathered through the various GVS&DD monitoring programs carried out by the Division in 2021 and provides an evaluation of the operational effectiveness of the wastewater treatment plants. Some of the information in the report is the result of joint efforts of the Environmental Management and Quality Control Division and the Operations and Maintenance Division.

The report is posted on Metro Vancouver's website at the following location: http://www.metrovancouver.org/services/liquid-waste/about/reports/Pages/default.aspx and a hard copy is available in the Metro Vancouver library.

EXECUTIVE SUMMARY

INTRODUCTION

Background and Purpose

The Greater Vancouver Sewerage and Drainage District (GVS&DD, or the District) operates five wastewater treatment plants (WWTPs) in the region. Three of the five plants provide secondary treatment (Annacis Island, Lulu Island and Northwest Langley) and discharge treated effluent into the lower Fraser River. The other two WWTPs (Iona Island and Lions Gate) provide primary treatment and discharge treated effluent to Strait of Georgia and First Narrows of Burrard Inlet, respectively.

The purpose of this report is to document the performance of the collection system and WWTPs in 2021 and to summarize the findings of numerous environmental management initiatives.

This report provides an overview of the information collected as a result of Environmental Management & Quality Control's environmental monitoring, modeling and assessment programs, including monitoring of the collection system, WWTP influent, effluent and biosolids quality, and environmental health of regional water bodies. Other programs and projects discussed in this report are in support of ongoing commitments under the Integrated Liquid Waste and Resource Management Plan (ILWRMP, or the Plan) or compliance with federal or provincial regulatory requirements.

Overview of the Liquid Waste Management Regulatory Framework and Monitoring Process

Under the provisions of the Environmental Management Act, the BC Minister of Environment and Climate Change Strategy approved Metro Vancouver's ILWRMP in May 2011. The Plan has three goals: protect public health and the environment; use liquid waste as a resource; and effective, affordable and collaborative management. Metro Vancouver manages its liquid waste in accordance with the ILWRMP and WWTP-specific Operational Certificates (OCs). These Certificates outline wastewater treatment and performance criteria and authorize the GVS&DD to discharge treated effluent from its WWTPs to the receiving waters. Treatment residuals are managed in accordance with Organic Matter Recycling Regulations.

The federal Wastewater Systems Effluent Regulations (WSER) under the Fisheries Act came into effect on July 18, 2012. The WSER contains provisions that authorize the deposit of treated wastewater into Canadian waters. GVS&DD is required to comply with WSER and monitor and report effluent quality on a quarterly basis.

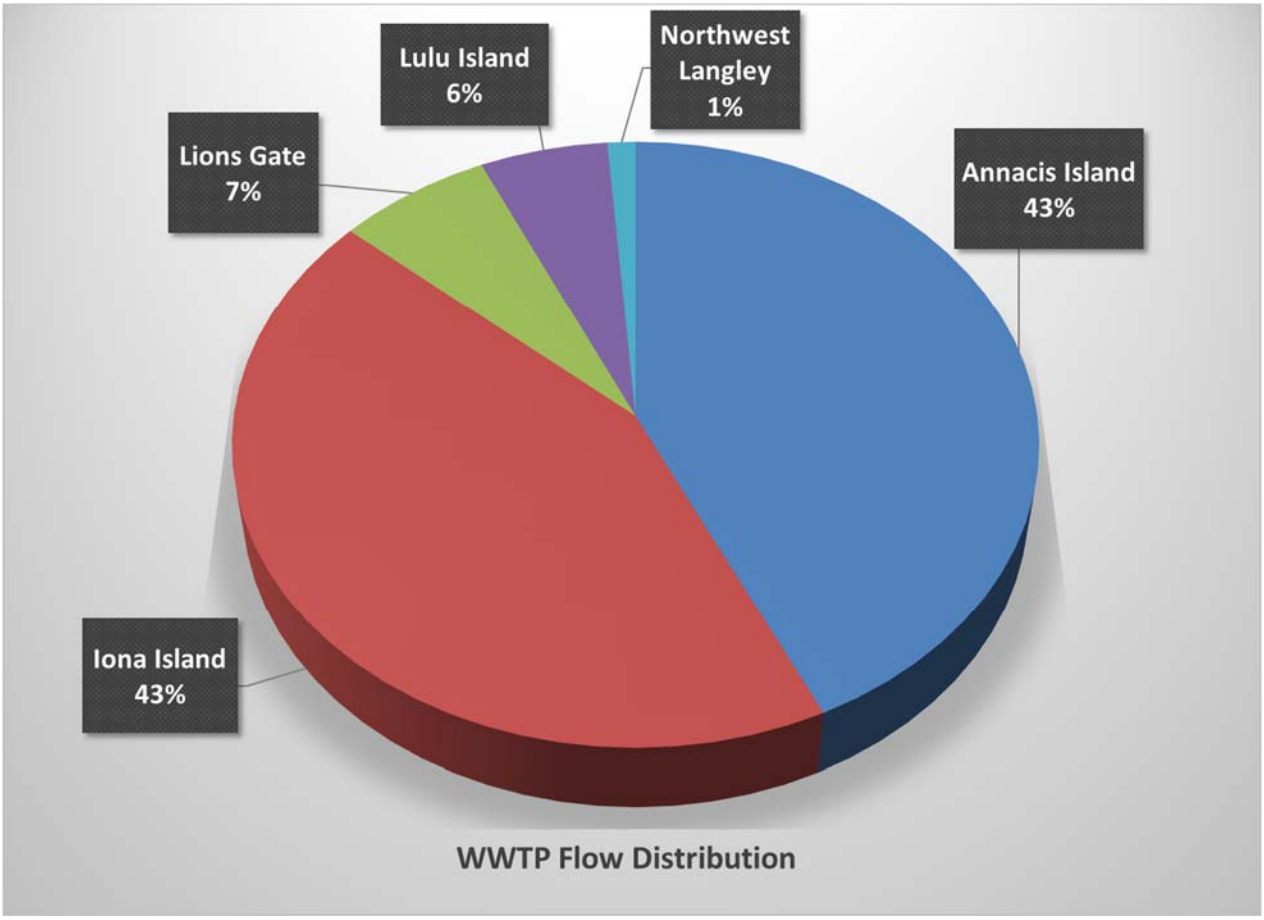
The District's objective is to maintain ongoing compliance with OCs, WSER and other applicable regulatory requirements, and by doing so continue to protect human health and the environment.

Most of the monitoring, laboratory analytical services and data analyses upon which WWTP performance is assessed were provided by the Environmental Management & Quality Control Division of Metro Vancouver Liquid Waste Services.

WASTEWATER TREATMENT PLANTS PERFORMANCE

In 2021, 451 billion litres of wastewater was treated at the GVS&DD's five WWTPs. Of this total, 224 billion litres received primary treatment at Iona Island and Lions Gate WWTPs, with the remaining 227 billion litres treated at the three secondary WWTPs at Annacis Island, Lulu Island and Northwest Langley, as shown in the graph below.

Distribution of Wastewater Treated in Metro Vancouver in 2021



Treatment Plant Performance Review

Metro Vancouver treatment plant performance is assessed annually to ensure:

- Plant operation is in accordance with design objectives and specifications; and
- All applicable regulatory requirements are met.

During 2021, the overall performance of the District's five WWTPs exceeded design performance expectations. Individual treated effluent flows for each WWTP and quantities of Biochemical Oxygen Demand (BOD_5) and total suspended solids (TSS) removed in 2021 are summarized in the table below.

Individual treated effluent flows for each WWTP and quantities of BOD_5 and TSS removed in 2021

Total for 2021	Annacis Island WWTP	Iona Island WWTP	Lions Gate WWTP	Lulu Island WWTP	Northwest Langley WWTP	Total
Effluent Flow, ML	196,180	194,045	30,204	25,526	5,777	451,732
BOD_5, Tonnes Removed	35,086	10,557	1,852	6,462	1,535	55,492
TSS, Tonnes Removed	31,657	15,106	3,961	5,356	1,360	57,439

Wastewater Treatment Plant Operational Certificates

The OCs issued by the Ministry of Environment and Climate Change Strategy (MOECCS) under the provisions of the Environmental Management Act include daily compliance levels for flow and daily loadings for BOD_5 (or Carbonaceous Biochemical Oxygen Demand ($CBOD_5$), where applicable) and Total Suspended Solids (TSS). The loading parameters listed as "maximum daily discharge loadings" are used to calculate the annual discharge authorization fees as required by the Permit Fees Regulation and are based on a calendar year.

Among other OC conditions, requirements are listed for disinfection of the effluent at all WWTPs except Iona Island, so that fecal coliform water quality objectives for the receiving water body are met at the edge of the Initial Dilution Zone (IDZ) as defined by the Municipal Wastewater Regulation. When chlorine is used for disinfection, it must be removed from the effluent before discharge to the receiving waters.

The OC requirements for BOD_5 and TSS were met throughout 2021. OCs require Metro Vancouver to report all treatment process interruptions to the MOECCS. In 2021, GVS&DD submitted reports for 16 environmental incidents and 1 missed sampling event to the regulators. Reported events can be generally grouped into 2 categories: Category 1 includes instances of disinfection or dechlorination system interruptions, plant bypasses and other unauthorized discharges. Category 2 events were the results of daily discharge loadings for TSS or $CBOD_5$ above the maximum load limits, as well as a daily rate of effluent discharge above the maximum limits. These events typically have no significant environmental impact.

Each event is carefully reviewed and a probable cause, mitigation measures and potential environmental effects are assessed based on dilution dispersion modeling of effluent plume transport and predicted downstream concentrations, or on field observations.

Integrated Liquid Waste and Resource Management Plan (ILWRMP)

The ILWRMP commits GVS&DD to operate the secondary WWTPs to meet the National Performance Standards for effluent specified by the Canada-wide Strategy for the Management of Municipal Wastewater Effluent (CWS-MMWE). These National Performance Standards for effluent quality are also included into the Wastewater Systems Effluent Regulation. The concentrations of $CBOD_5$ and TSS at all

secondary WWTPs stayed below the maximum average of ≤ 25 mg/L as specified by the National Performance Standards. Averaging periods for Annacis Island and Lulu Island WWTP are monthly, and for Northwest Langley WWTP, quarterly.

Wastewater Systems Effluent Regulations (WSER)

Quarterly monitoring reports were submitted through Environment and Climate Change Canada's (ECCC's) Effluent Regulatory Reporting Information System (ERRIS) in 2021. As required by WSER, the effluent monitoring data reported were: number of days that effluent was deposited; total volume of effluent deposited in m^3; average effluent $CBOD_5$ in mg/L; and the average effluent concentration of suspended solids in mg/L. Reporting of effluent acute lethality for secondary treatment plants is required on a quarterly basis[1] for Annacis Island and Lulu Island WWTPs, and on an annual basis for the Northwest Langley WWTP.

In 2021, all District's secondary WWTPs met the applicable WSER requirements for all regulated parameters: TSS, $CBOD_5$, un-ionized ammonia and total residual chlorine. Non-acute lethality of effluent requirement was consistently met by the Northwest Langley WWTP but not throughout an entire year at the Annacis Island and Lulu Island WWTPs.

GVS&DD's primary treatment plants (Iona Island and Lions Gate WWTPs) were issued Transitional Authorizations (TA) under WSER on September 5, 2014. In 2021, the Iona Island WWTPs met the applicable WSER requirements for regulated parameters: TSS, $CBOD_5$ and un-ionized ammonia.

The Lions Gate TA expired on December 30, 2020. The monthly average limits of 115 mg/L $CBOD_5$ and 76 mg/L TSS specified in the TA for this WWTP were only applicable up to the end of 2020. Starting January 2021, the applicable monthly average limits defined in WSER are 25 mg/L $CBOD_5$ and 25 mg/L TSS. Due to a delay constructing the North Shore WWTP, the Lions Gate WWTP was not able to meet the $CBOD_5$ and TSS limits in 2021, although it met the limits for total residual chlorine and un-ionized ammonia. The requirement to report acute lethality results was met by the Lions Gate WWTP.

Effluent Toxicity Monitoring

In 2021, all effluent samples from all WWTPs passed the OC required Rainbow Trout acute lethality test using ECCC test protocols with the following exceptions: two Annacis Island WWTP samples; one Lulu Island WWTP sample, one Iona Island WWTP sample, and three Lions Gate WWTP samples. In the Annacis Island effluent samples, the toxicity in one sample was attributed to ammonia and in the other was undetermined. In the Lulu Island effluent sample, the toxicant was undetermined. The Iona Island effluent sample required oxygen in excess of that specified by the ECCC method. In all the three Lions Gate samples, toxicity was attributed to anionic surfactants.

In addition, acute toxicity testing of *Daphnia magna* was conducted monthly (or quarterly for Northwest Langley WWTP) as recommended by the CWS-MMWE. All samples from the secondary WWTPs passed the *Daphnia magna* acute toxicity test. For the primary WWTPs, all Iona Island and eleven Lions Gate

[1] Due to toxicity testing results, frequency was increased to monthly at Annacis Island WWTP in September and at Lulu Island WWTP in December.

WWTP samples passed the *Daphnia magna* test, and the toxicity in the remaining sample was attributed to anionic surfactants.

Some chronic toxicity was observed in effluent samples tested in 2021 for two freshwater and three marine test species; however, chronic toxicity was not predicted to occur at the initial dilution zone (IDZ) boundary except for the water flea, *Ceriodaphnia dubia*, in two of the five Lulu Island WWTP effluent samples tested in 2021. For all other WWTP effluent samples and test species chronic toxicity would not be predicted at the IDZ boundary.

Biosolids Monitoring Program

Process Requirements and Biosolids Management

The Organic Matter Recycling Regulation (OMRR) governs the management of biosolids and compost as soil amendments in the Province of British Columbia. Under this regulation, sampling frequencies and criteria values for fecal coliforms and metals as specified for Class A and Class B biosolids are based on several parameters including: type of treatment process (pathogen reduction requirements, vector attraction reduction); the amount of dry solids produced on a monthly basis; and the intended use of the biosolids. The GVS&DD's biosolids management program ensures that any biosolids not meeting class specifications are identified, tracked and managed appropriately.

Biosolids Quality

About 14,900 tests were performed on biosolids in 2021. Metal and fecal coliform counts in biosolids were generally well within the Class A criteria for Annacis Island WWTP, and within Class B criteria for Lions Gate and Lulu Island WWTPs. Iona Island WWTP land-dried biosolids met the Class B criteria. Thickened waste secondary sludge from Northwest Langley WWTP was trucked to Annacis Island WWTP for digestion.

ENVIRONMENTAL MANAGEMENT PROGRAMS

Environmental management programs form a major part of the Metro Vancouver's integrated approach to managing liquid waste. The purpose of these programs is to characterize environmental conditions of relevant water bodies in the region in order to understand the relative contribution and significance of discharges from the regional and municipal systems, determine if the applicable regulatory requirements are being met, and to warn of possible environmental issues. Environmental management programs include environmental monitoring, human health and ecological risk assessments, and environmental simulation and forecasting.

Overflow Quality Monitoring and Environmental Risk Assessments

Municipal wastewater in the region is conveyed and treated in the District's WWTPs. However, discharges of untreated wastewater into regional water bodies are sometimes unavoidable mostly due to insufficient system capacity during wet weather, power outages, and the legacy of combined sewer systems.

Combined Sewer Overflows

In 2021, the Combined Sewer Overflow (CSO) Monitoring Program characterized the overflow water quality at six selected CSO locations: Angus Drive, English Bay, MacDonald, Manitoba, New

Westminster Tank and Westridge. In addition, receiving environment monitoring program reports were completed for English Bay, Borden, Heather and South Hill CSOs and field work was completed for the Willingdon and Westridge CSOs receiving environment monitoring programs.

Sanitary Sewer Overflows

Metro Vancouver continued monitoring the receiving environment water quality after each sanitary sewer overflow and provided results to regulatory agencies and municipalities.

Environmental Monitoring in the Regional Waterbodies

Metro Vancouver monitors environmental health of the regional water bodies:

- near WWTP outfalls in the receiving environment, at the IDZ boundary, and
- in major water bodies within the ambient environment further away from WWTPs and other point source discharges to assess background conditions.

In previous annual reports, Metro Vancouver reported separately on WWTP receiving environment monitoring (REM) and ambient environment monitoring (AEM) programs. Metro Vancouver has modified its programs to a more holistic water body approach and in 2021 continued with amalgamated receiving and ambient environment monitoring programs for Burrard Inlet water and sediment quality, and for Fraser River water quality. A summary of the monitoring program findings for the regional water bodies is provided below.

Strait of Georgia

The 2020 Iona Island WWTP Deep Sea Outfall monitoring program included sediment and initial dilution zone monitoring. The assessment of the 2020 monitoring results completed in 2021 indicate that the applicable objectives or guidelines were met at the IDZ boundary, except for dissolved oxygen and boron, for which results were consistent with typical concentrations in Canadian coastal marine waters. Methylmercury and PBDE concentrations in the effluent were elevated relative to guidelines but were consistent with previous monitoring studies indicating that water quality conditions are stable. Work continued on a multi-year collaboration with UBC to better understand the transport and deposition of substances of interest in the Strait of Georgia.

Burrard Inlet

Burrard Inlet Environment Monitoring program included both water and sediment quality monitoring. The assessment of 2020 monitoring results completed in 2021 indicated that site specific water quality objectives at the boundary of the IDZ for the Lions Gate WWTP were met with the exception of dissolved oxygen, boron, and minimal number of measurements for turbidity, TSS and temperature which were not attributed to the discharge from Lions Gate WWTP.

The lower dissolved oxygen concentrations may be related to natural conditions and long-term regional changes, while boron concentrations are consistent with those in Canadian coastal waters. Turbidity, TSS and temperature were determined to be related to background conditions.

The results of the 2020 Sediment Effects Survey were similar to prior years. The Lions Gate WWTP discharges appear to have contributed to conditions more favourable for infaunal recruitment, growth, and reproduction. However, there was no correlation between wastewater quality indicators and biota results, suggesting that both nutrient and contaminant distributions in Burrard Inlet are confounded by activities and sources other than the Lions Gate WWTP.

Fraser River

In 2021, the report was completed for the 2021 Fraser River water quality monitoring program. As Metro Vancouver is transitioning to a more holistic integrated approach to its monitoring programs, what formerly were two separate monitoring programs, the Receiving Environment Monitoring Program (REM) for the Fraser River wastewater treatment plants (WWTP) (referred to as Annacis IDZ) and the Fraser River Ambient Monitoring Program (FRAMP), were operated in 2021 as a single program under the name of Fraser River Environmental Monitoring Program (FREMP). A new ambient monitoring site, upstream of the Metro Vancouver – Fraser Valley Regional District boundary, was added in the 2021 FREMP to characterize background water quality entering Metro Vancouver.

In 2021, the concentrations of all parameters met their corresponding applicable WQOs or guidelines at the Annacis Island WWTP IDZ boundary and Fraser River ambient environment monitoring sites, with the exception of dissolved aluminum in one of fifteen Annacis IDZ reference area samples.

Recreational Water Quality Monitoring Program

Metro Vancouver monitored the bacteriological quality of recreational waters in the region at 114 sampling sites from 41 locations. In 2021, the bacteriological water quality for primary-contact recreation was met for most bathing beaches from May through September. Swimming advisories were issued by the Health Authorities as a result of observed *E. coli* concentrations exceeding the single sample maximum water quality guideline at English Bay (4 days) and the exceedance of the 30-day geometric mean guideline at Wreck Beach Trail 7 – Oasis (10 days) and Deep Cove (12 days).

1.0 WASTEWATER TREATMENT MONITORING PROGRAM

1.1 LABORATORY PROGRAMS

In 2021, the Environmental Management & Quality Control Division carried out all routine monitoring programs as required by the Ministry of Environment & Climate Change Strategy (MOECCS) and Environment and Climate Change Canada (ECCC) relating to the discharge of primary and secondary treated effluent from the Greater Vancouver Sewerage and Drainage District's (GVS&DD's) wastewater treatment plants.

As specified in the Operational Certificates (OCs) issued by the MOECCS for each treatment plant, the GVS&DD is required to monitor and report data monthly for effluent quality, treated sludge, and receiving waters.

The federal Wastewater Systems Effluent Regulations (WSER) under the Fisheries Act came into effect on July 18, 2012. The GVS&DD is required to monitor and report effluent monitoring data quarterly. The effluent quality standards and limits as specified in WSER for the Annacis Island, Lulu Island, Lions Gate and Northwest Langley WWTP and in the transitional authorization for the Iona Island WWTP were in force throughout the year.

Environmental Management & Quality Control (EMQC) Laboratory staff conducted analyses of samples collected at various stages of treatment for process control at each wastewater treatment plant (WWTP); they also provided analytical services for Residuals Management and Regulation & Enforcement purposes. The EMQC Laboratory maintained a high level of analytical and technical support for special projects at all WWTPs.

The total number of results issued by the laboratory sections for all GVS&DD programs was 210,000 analyses in 2021.

Monitoring programs carried out in 2021 provided a comprehensive set of influent and effluent characteristics for each WWTP and included all the monitoring requirements specified in the WWTP OCs and WSER. The full set of parameters for influent and effluent monitoring programs are presented in Table 1.1. Parameters indicated with a "C" are the specific authorized discharge parameters listed in the OC for each WWTP, whereas parameters indicated with an "M" are required for monitoring of effluent characteristics. Parameters indicated with a "W" are required for WSER reporting. Parameters designated "R" are monitored on a routine basis for wastewater characterization.

TABLE 1.1 WASTEWATER TREATMENT PLANT MONITORING PARAMETERS FOR INFLUENT AND EFFLUENT

				Monitoring Requirements				
Parameter	**Test Lab Location**	**Sample Type**	**Testing Frequency**	**ANNACIS OC ME-00387**	**IONA OC ME-00023**	**LIONS GATE OC ME-00030**	**LULU OC ME-00233**	**NW Langley OC ME-04339**
TKN	Chemistry	Composite	1/mo	R	R	R	R	R
NO_3/NO_2 N	" "	Grab	1/mo	R	R	R	R	R
Total Ammonia N*	" "	Grab	1/wk	M(1/wk)	M(2/mo)	M(2/mo)	M(1/wk)	M(1/mo)
Total Ammonia N**	" "	Composite	3/wk	W	W	W	W	W(1/wk)
Un-ionized Ammonia	" "	Composite	3/wk	W	W	W	W	W(1/wk)
pH at 15°C**	WWTP	Composite	3/wk	W	W	W	W	W(1/wk)
MBAS	Chemistry	Grab	1/mo	R	R	R	R	R
SO_4	" "	Composite	1/mo	R	R	R	M	M
Alkalinity	" "	Composite	1/mo	R	R	R	R	R
Hardness (Total)	" "	Composite	1/mo	M	M	M	M	M
Total Phosphorous	" "	Composite	1/mo	R	R	R	R	R
Dissolved Phosphorous	" "	Composite	1/mo	R	R	R	R	R
96 hour LC50	Consultant	Grab		M(1/mo) W(1/quarter)	M(1/mo)	M(1/mo) W(1/mo)	M(1/mo) W(1/quarter)	M(1/quarter) W(1/year)
Oil & Grease	Chemistry	Grab	1/mo	R	R	R	R	R
Phenol	" "	Grab	1/mo	M	M	R	M	M
Total Cyanide	" "	Grab	1/mo	R	R	R	R	R
Total Aluminum	" "	Composite	1/mo	M	M	M	M	M
Total Arsenic	" "	Composite	1/mo	M	M	M	R	M
Total Barium	" "	Composite	1/mo	M	M	M	M	M
Total Boron	" "	Composite	1/mo	M	M	M	M	M
Total Cadmium	" "	Composite	1/mo	M	M	M	M	R
Total Cobalt	" "	Composite	1/mo	M	R	R	R	M
Total Chromium	" "	Composite	1/mo	R	R	R	R	R
Total Copper	" "	Composite	1/mo	M	M	M	M	M
Total Iron	" "	Composite	1/mo	M	M	M	M	M
Total Lead	" "	Composite	1/mo	M	M	M	M	M
Total Manganese	" "	Composite	1/mo	M	M	R	M	M
Total Mercury	" "	Composite	1/mo	M	M	R	M	M
Total Molybdenum	" "	Composite	1/mo	M	M	M	M	M
Total Nickel	" "	Composite	1/mo	M	M	M	M	M
Total Selenium	" "	Composite	1/mo	M	M	M	R	R
Total Sliver	" "	Composite	1/mo	M	M	M	M	M
Total Zinc	" "	Composite	1/mo	M	R	M	M	M
Dissolved Aluminum	" "	Composite	1/mo	R	R	R	R	R
Dissolved Barium	" "	Composite	1/mo	R	R	R	R	R
Dissolved Boron	" "	Composite	1/mo	R	R	R	R	R
Dissolved Cadmium	" "	Composite	1/mo	R	R	R	R	R
Dissolved Cobalt	" "	Composite	1/mo	R	R	R	R	R
Dissolved Chromium	" "	Composite	1/mo	R	R	R	R	R
Dissolved Copper	" "	Composite	1/mo	R	R	R	R	R
Dissolved Iron	" "	Composite	1/mo	R	R	R	R	R
Dissolved Lead	" "	Composite	1/mo	R	R	R	R	R
Dissolved Manganese	" "	Composite	1/mo	R	R	R	R	R
Dissolved Molybdenum	" "	Composite	1/mo	R	R	R	R	R
Dissolved Nickel	" "	Composite	1/mo	R	R	R	R	R
Dissolved Selenium	" "	Composite	1/mo	R	R	R	R	R
Dissolved Silver	" "	Composite	1/mo	R	R	R	R	R
Dissolved Zinc	" "	Composite	1/mo	R	R	R	R	R
pH	WWTP	Grab	1 to 5/wk	M	M	M	M	M
BOD_5***	" "	Composite	2 to 3/wk	-	C***	C***	-	-
$CBOD_5$***	" "	Composite	3/wk	C***/W	W	W	C***/W	C (1/wk) W(1/wk)
Suspended Solids	" "	Composite	7/wk	C(5/wk) W(3/wk)	C(5/wk) W(3/wk)	C(5/wk) W(3/wk)	C(5/wk) W(3/wk)	C (1/wk) W(1/wk)
Volatile Suspended Solids	" "	Composite	7/wk	R	R	R	R	R
COD***	" "	Composite	5/wk	M***	M***	M***	M***	R
Conductivity	" "	Composite	5 to 7/wk	R	R	R	R	R
Chloride	" "	Composite	1/wk	R	R	R	R	R
Residual Chlorine****	" "	Grab	7/wk	C/W	-	C/W	C/W	C/W
Dissolved Oxygen	" "	Grab	1/mo to 5/wk	R	R	R	R	R
Temperature	" "	Grab	1/mo to 5/wk	M	M	M	M	M
Fecal Coliform (effluent)****	Microbiology	Grab	1 to 5/wk	M(1/wk)	-	M(1/wk)	M(1/wk)	M(1/mo)

Composite sample are collected over a 24 hour period

* Ammonia and pH are done on weekly grabs for all WWTP for CEPA monitoring.

** Data used to calculate un-ionized ammonia

*** COD is reported five times per week with BOD_5 once per week

**** During chlorination season only.

C = Operational Certificate authorized discharge parameter

W = Wastewater System Effluent Regulations (WSER)

M = Operational Certificate Effluent Monitoring Requirement

R = Routine Monitoring, Influent and Effluent

( ) = Operational Certificate Reporting Requirements

1.2 OVERVIEW OF THE WASTEWATER TREATMENT PLANT REPORTING PROCESS

ANNUAL REPORTING

The 2021 GVS&DD Environmental Management and Quality Control Annual Report presents a detailed summary of the performance of each of the region's five WWTPs.

Sections 3.0 to 7.0 of this Annual Report provide the following information about each WWTP:

- An overview of the authorized discharge monitoring parameters that the WWTP adheres to as a requirement of its OC;
- A detailed review of instances where those parameters were not met, including probable cause and mitigation measures;
- Data describing the WWTP's overall performance during 2021, including the amount of wastewater treated, average daily flows, quality of effluent, and reduction in levels of biochemical oxygen demand (BOD_5) and total suspended solids (TSS); and
- A performance review of solids treatment and secondary processes, if applicable.

MONTHLY REPORTING FOR OPERATIONAL CERTIFICATES

In accordance with the OC requirements, all routine data reports for each WWTP are posted on Metro Vancouver's website and updated on a monthly basis at the following location: http://www.metrovancouver.org/services/liquid-waste/environmental-management/operational-certificates/Pages/default.aspx

QUARTERLY REPORTING FOR WASTEWATER SYSTEMS EFFLUENT REGULATIONS (WSER)

As per the WSER under the Fisheries Act, the monitoring provisions were in effect throughout the year. Quarterly monitoring reports were submitted to ECCC through electronic Effluent Regulatory Reporting Information System (ERRIS) within 45 days after the end of each quarter.

2.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

The mission of the Metro Vancouver Laboratory is to provide high-quality analytical services to Metro Vancouver and its member municipalities. Analytical services currently include chromatography, spectroscopy, flow injection colorimetry, gravimetry, and titrimetry. The Metro Vancouver Laboratory performs routine tests and quality control tests on a wide range of environmental samples, including water, wastewater, receiving water, and solid waste. In addition, the Laboratory provides full analytical reporting for process control.

To fulfill this commitment, the Metro Vancouver Laboratory is accredited by the Canadian Association for Laboratory Accreditation (CALA). The International Standard to which the Metro Vancouver Laboratory is accredited is ISO/IEC 17025 (General Requirements for the Competence of Testing and Calibration Laboratories). Accreditation under ISO/IEC 17025 is a demonstration of confidence in the Laboratory's technical competence. Accreditation provides formal recognition of the competence of a laboratory to manage and perform specific tests. Furthermore, the accreditation program is based on satisfactory participation in a site assessment plus satisfactory compliance with the CALA Proficiency Testing Requirements for accreditation.

The Liquid Waste Services – Environmental Management & Quality Control (LWS-EMQC) Laboratory is made up of the Chemistry and WWTP Process Control Laboratory sections. The Chemistry Laboratory section, located at the Annacis Island WWTP, performs chemical and physical tests. The WWTP Process Control Laboratory section maintains a laboratory facility at each WWTP. These laboratory facilities carry out analyses for regulatory and process control requirements for the five WWTPs.

In 2021, over 287,000 analytical results were produced by the LWS-EMQC Laboratory. This number of tests encompasses all analytical programs, including the Quality Assurance/Quality Control program carried out by the Liquid Waste Services Laboratory sections. The Laboratory conducted 77,000 tests on QA/QC samples. This represents 27% of the total analytical workload. These analyses were part of an ongoing QA/QC program to fulfill Metro Vancouver's commitment to quality and requirements for accreditation.

In order to maintain laboratory accreditation, the Metro Vancouver Laboratory is required to undergo a site reassessment every two years where conformance to the ISO/IEC 17025 standard is assessed. An assessment based on ISO/IEC 17025 covers the overall Quality Management System of the Laboratory and assesses the technical competence of the Laboratory to conduct specific tests. Following a successful site audit, the CALA Accreditation Council grants accreditation to the Laboratory. In September 2021, a team of CALA auditors conducted a site assessment of the LWS-EMQC Laboratory. The auditors concluded that the EMQC Laboratory has met the requirements of ISO/IEC 17025. As a result, a panel of the CALA Accreditation Council has given approval to the LWS-EMQC Laboratory for the 2021–2023 maintenance of accreditation.

During the year 2021, the LWS-EMQC Laboratory participated in the following inter-laboratory analytical performance evaluation/certification programs:

- The British Columbia Environmental Data Quality Assurance (BCEDQA) Program. The LWS-EMQC Laboratory has been participating in this program since May 1991.
- The CALA Proficiency Testing Program. The LWS-EMQC Laboratory has been participating in this program since June 1996.

The goal of participating in proficiency testing (PT) studies is to demonstrate ongoing technical competence, providing an assessment of reliability. In 2021, the LWS-EMQC Laboratory achieved an average PT score of 93, and 95% of the PT scores fell within the range of 83–99. The PT score is normalized to a scale from 1–100. A PT score of 100 implies a perfect result. Acceptable composite PT scores equal to or exceed 70.

3.0 ANNACIS ISLAND WWTP

3.0 ANNACIS ISLAND WWTP

3.1 EFFLUENT QUALITY

The quality of effluent from the Annacis Island WWTP in 2021, along with the discharge monitoring parameters listed in OC 387, is summarized in Table 3.1.

TABLE 3.1 ANNACIS ISLAND WWTP – 2021 PERFORMANCE SUMMARY

Operational Certificate 387, April 23, 2004

				Number of Times Criteria Not Met											
Parameters	**Testing Frequency**	**OC Limits**	**Max. Value for the Year**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Total Discharge Flow (MLD)	Daily	1050	1062	0	0	0	0	0	0	0	0	0	0	1***	0
$CBOD_5$ (mg/L)*	3/week	45	21	0	0	0	0	0	0	0	0	0	0	0	0
Suspended Solids (mg/L)	5/week	45	30	0	0	0	0	0	0	0	0	0	0	0	0
$CBOD_5$ (Tonnes/Day)*	3/week	17.0	10.4	0	0	0	0	0	0	0	0	0	0	0	0
Susp. Solids (Tonnes/Day)	5/week	20.0	17.2	0	0	0	0	0	0	0	0	0	0	0	0
Chlorine Residual (mg/L)**	Daily	<0.1	<0.02	0	0	0	0	0	0	0	0	0	0	0	0
Disinfection	-	-	-	0	0	0	0	1***	0	0	0	0	0	0	0
Plant Bypass	-	-	-	0	0	0	0	0	0	0	0	0	0	1***	0
Secondary Bypass	-	2ADW	-	0	0	0	0	0	0	0	0	0	0	0	0

* $CBOD_5$ reported 1/week when COD are reported 5/week

** Effluent disinfected between April 1 and October 31

*** The event was managed by the WWTP according to the Emergency Procedures clause of the OC.

3.2 PERFORMANCE REVIEW AND OPERATIONAL SUMMARY

The MOECCS, under the provisions of the Environmental Management Act and in accordance with Metro Vancouver's Integrated Liquid Waste and Resource Management Plan (ILWRMP), issued OC 387 on April 23, 2004. The OC included the authorized levels shown in Table 3.2.

TABLE 3.2 ANNACIS ISLAND WWTP – OPERATIONAL CERTIFICATE AUTHORIZED LEVELS

Daily authorized rate of discharge	1,050,000 cubic meters/day, maximum
5-day carbonaceous biochemical oxygen demand ($CBOD_5$)	45 mg/L, maximum
Total suspended solids (non-filterable residue) (TSS)	45 mg/L, maximum

The maximum daily discharge loadings for $CBOD_5$ and TSS are used for the calculation of the annual OC fees. For 2021, the maximum authorized daily loadings were 17.0 tonnes/day for $CBOD_5$ and 20.0 tonnes/day for TSS.

DISCHARGE MONITORING

A total of 28 parameters and two daily loading results for the final effluent are posted on Metro Vancouver's website on a monthly basis. Specific discharge monitoring levels apply to six parameters: total daily discharge flow, $CBOD_5$, TSS, chlorine residual, and maximum daily loadings for $CBOD_5$ and TSS.

3.2.1 PERFORMANCE REVIEW

EFFLUENT BYPASSES

> Operational Certificate 387 Requirement:
>
> "For flows less than two times dry weather flow, wastewater bypassing the designated treatment works is prohibited unless the approval of the Regional Waste Manager is obtained and confirmed in writing. Wastewater flows exceeding the capacity of the secondary treatment works may bypass those works when flows are greater than two times measured dry weather flow, provided that primary effluent standards are maintained for the effluent not receiving secondary treatment."

There was no bypassing of the secondary treatment process in 2021.

PLANT BYPASSES

There was one instance of plant bypass reported to the MOECCS in 2021. The event was managed by the WWTP according to the Emergency Procedures clause of the OC. See Table 3.4 for a detailed summary of the event, including probable causes, mitigation measures and potential environmental effects.

DISINFECTION

> Operational Certificate 387 Requirement:
>
> "The effluent shall be disinfected between April 1 and October 31 so that the Fraser River fecal coliform water quality objective is not exceeded at the edge of the initial dilution zone as described in the Municipal Sewage Regulation.
>
> If chlorine is used, the effluent shall be dechlorinated prior to discharge to reduce the chlorine residual below the detection limit."

The effluent from the Annacis Island WWTP was disinfected between April 1 and October 31 using sodium hypochlorite solution (SHS) and dechlorinated using sodium bisulphite solution (SBS). The average SHS dosage as chlorine was 2.3 mg/L and the average SBS dosage as SO_2 was 1.5 mg/L.

There was one instance of disinfection interruption reported to the MOECCS in 2021. The event was managed by the WWTP according to the Emergency Procedures clause of the OC. See Table 3.4 for a detailed summary of the event, including probable causes, mitigation measures and potential environmental effects.

The Fraser River fecal coliform Water Quality Objective (WQO) of 200 MPN/100 mL at the edge of the Initial Dilution Zone (IDZ) was predicted to have been met from April through October as shown in Table 3.3.

TABLE 3.3 ANNACIS ISLAND WWTP – PREDICTED 30 DAY FECAL COLIFORM GEOMETRIC MEAN AT THE IDZ

Final Effluent	April	May	June	July	August	September	October
Max 30 day Geometric Mean*	28	30	46	56	42	58	48
Dilution Factor**	40	40	40	40	40	40	40
IDZ Result ***	0.7	0.8	1.2	1.4	1.1	1.5	1.2
WQO (Met or Not Met)	Met	Met	Met	Met	Met	Met	Met

* Geometric mean (MPN/100mL) over a 30-day period (effluent).

** Lowest seasonal average dilution factor: 25-h average dilution factor based on peak plant flow and low river flow conditions.

*** IDZ Result – determined by calculation of geometric mean of fecal coliform levels in the receiving water due to discharges of final effluent, for 30-day periods at the edge of the IDZ.

There were five instances unauthorized discharges and one instance of a missed sampling event reported to the MOECCS in 2021. See Table 3.4 for a detailed summary of the events, including probable causes, mitigation measures, and potential environmental effects.

TABLE 3.4 ANNACIS ISLAND WWTP – CATEGORY 1 EVENTS REPORTED TO THE MOECCS

Plant	Date	Description	Quantity Discharged	Duration	Probable Cause	Mitigation Measures	Potential Environmental Effects
Annacis Island	Feb 17	Treated secondary effluent discharge	Approximately 3,300 litres	1028.2 minutes	PVC pipe fitting damaged likely due to differential settlement between the conveyance piping and the cleanout access box.	The damaged pipe fitting was repaired.	Adverse effects to flora and to aquatic and terrestrial habitats were not observed. Fauna were not observed.
Annacis Island	Mar 28	Potable water discharge	Approximately 1,716,000 litres	228.0 minutes	Standpipe disconnected from the Plant's Fire Protection System	The damaged pipe was repaired	Adverse effects to flora, fauna and to aquatic and terrestrial habitats were not observed.
Annacis Island	Apr 21	Secondary clarifier influent discharge	Approximately 15,110 litres	20.2 minutes	Power disruption stopped operation of a sump pump installed in a manhole to collect intermittent flow of secondary clarifier influent to another portion of the plant for treatment.	Restored power to sump pump installed at the manhole.	Adverse effects to flora and to aquatic and terrestrial habitats were not observed. Fauna were not observed.

Annacis Island	May 11	Disinfected and dechlorina-ted final effluent discharge	Approximately 274 litres	230.4 minutes	Unknown.	The accumulated liquid was contained and transferred back to the Chlorine Contact Tank using a pump installed by contractor.	Adverse effects to flora and to aquatic and terrestrial habitats were not observed. Fauna were not observed.
Annacis Island	May 13	Missed sampling event	Not applicable	Not applicable	Final effluent grab not tested for ammonia during the week of May 9 – 15, 2021.	Procedural error.	Not applicable
Annacis Island	May 27	Discharge of treated wastewater that may not have been fully disinfected **	2.05 million litres	6.02 minutes	Loss of power from BC Hydro.	Not applicable	The applicable Health Canada Recreational Water Quality Guidelines were predicted to have been met at designated primary recreation areas. The applicable BC MOECCS Water Quality Guidelines for fecal coliforms were predicted to have been met at known registered water license diversion points. The applicable BC MOECCS Ambient Water Quality Guideline for chlorine were expected to have been met in the Fraser River.*
Annacis Island	Nov 15	Treated final effluent discharge **	Approximately 642 litres	864 minutes	High flow conditions caused intermittent leaks from the expansion joint in the concrete wall of the chlorine contact tank.	Polyurethane foam was injected into the expansion joint.	Flora or fauna were not observed. Adverse effects to aquatic and terrestrial habitats were not observed.
Annacis Island	Nov 15	Plant bypass**	0.79 million litres	1 minute	Severe rain event caused high influent flow conditions.	Not applicable	The applicable MOECCS Water Quality Objectives for TSS and dissolved oxygen were expected to have been met in the Fraser River*

* Based on dilution dispersion modelling of the receiving environment.

**The event was managed by the WWTP according to the Emergency Procedures clause of the OC.

DAILY DISCHARGE LIMITS

There was one exceedance of daily discharge limits specified by the OC reported to the MOECCS in 2021. See Table 3.5 for a detailed summary of the event, including probable causes, mitigation measures, and potential environmental effects.

TABLE 3.5 ANNACIS ISLAND WWTP – CATEGORY 2 EVENTS REPORTED TO THE MOECCS

Plant	Date	Description	Quantity Discharged	Duration	Probable Cause	Mitigation Measures	Potential Environmental Effects
Annacis Island	Nov 15	Exceedance of the maximum daily authorized rate of secondary treated effluent**	Maximum daily authorized rate of discharge exceeded by 11,992 m^3	Not applicable	Severe rain event caused high influent flow conditions.	Not applicable	The applicable MOECCS Water Quality Objectives for TSS and dissolved oxygen were expected to have been met in the Fraser River*

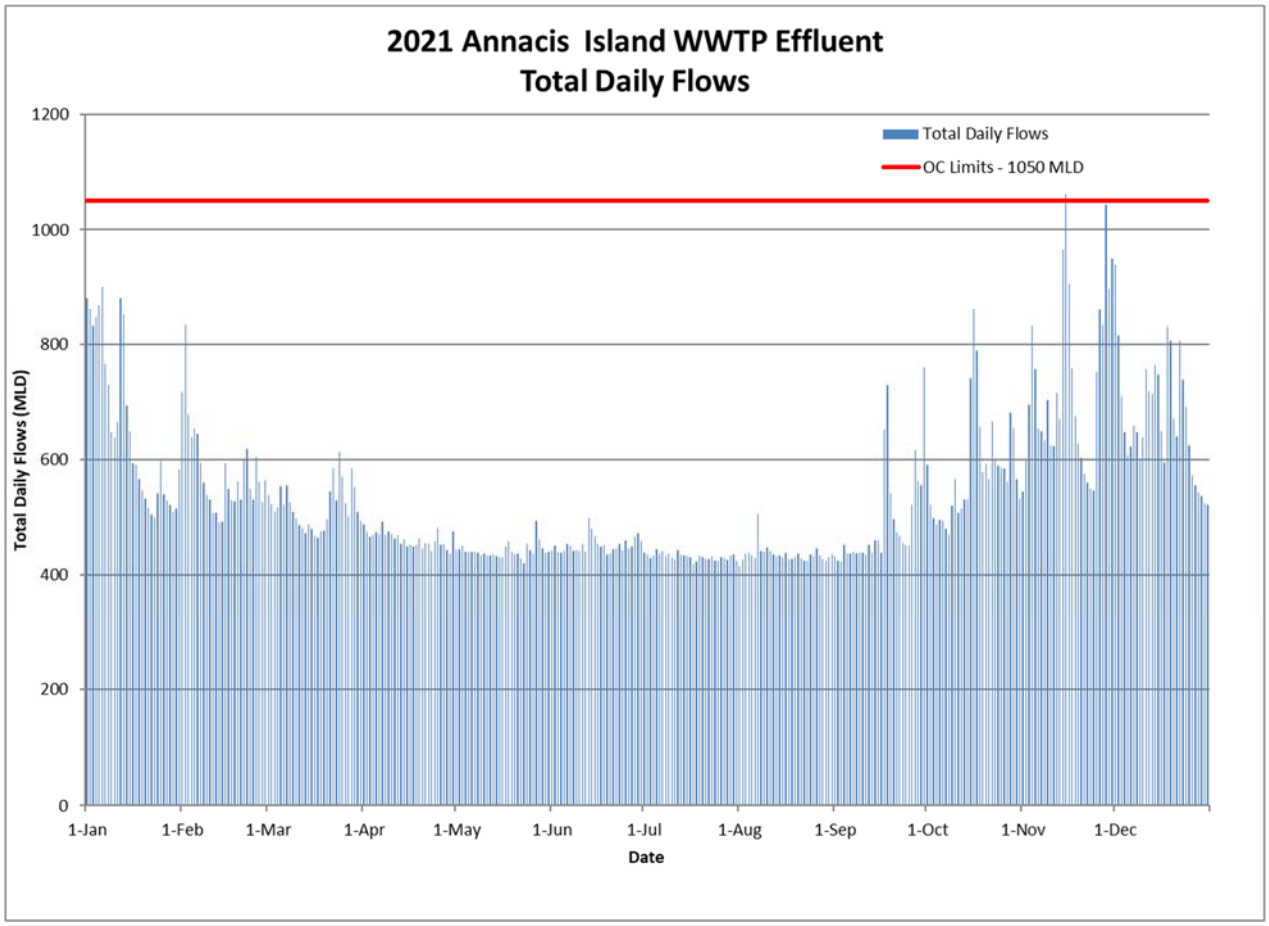
* Based on dilution dispersion modelling of the receiving environment.

**The event was managed by the WWTP according to the Emergency Procedure clause of the OC.

3.2.2 OPERATIONAL SUMMARY

A total of 196,180 ML of wastewater was treated at the Annacis Island WWTP in 2021. The average daily flow of 537 MLD was 0.4% lower than in 2020. The highest daily average flow of 1,062 MLD occurred on November 15 and a peak instantaneous flow of 1,213 MLD was recorded on November 28 (Figure 3.1).

FIGURE 3.1 ANNACIS ISLAND WWTP – 2021 EFFLUENT TOTAL DAILY FLOWS



Influent SS and BOD_5 loadings were 2.5% lower and 3.4% higher, respectively, than in 2020 (Table 3.6). Influent SS concentrations ranged from 67 to 260 mg/L with an average of 180 mg/L. Influent BOD_5 concentrations ranged from 58 to 301 mg/L with an average of 197 mg/L.

TABLE 3.6 ANNACIS ISLAND WWTP – 2012–2021 ANNUAL AVERAGE DATA FOR FLOW, SS AND BOD_5

ANNACIS WWTP

YEAR	FLOWS MLD	Suspended Solids mg/L		Suspended Solids Tonnes/year		BOD_5 mg/L	$CBOD_5$ mg/L	BOD_5 Tonnes/year	$CBOD_5$ Tonnes/year
		INF	EFF	INF	EFF	INF	EFF	INF	EFF
2012	494	175	10	30873	1871	186	6	32480	1148
2013	470	189	10	31848	1683	197	7	32829	1107
2014	488	178	8	30557	1566	183	7	31503	1309
2015	468	190	8	31370	1414	198	7	32186	1240
2016	492	182	10	31552	1897	190	8	32016	1437
2017	503	187	17	32850	3093	192	12	33661	2137
2018	511	191	16	33916	3168	210	12	36845	2284
2019	538	205	14	39613	2682	214	11	41557	2208
2020	539	184	13	34663	2614	190	10	35679	1942
2021	537	180	11	33807	2151	197	9	36876	1790

The final effluent SS ranged from 4 to 30 mg/L with an average of 11 mg/L (Figure 3.2). The final effluent $CBOD_5$ ranged from <4 to 21 mg/L with an average of 9 mg/L. (Figure 3.3). Effluent SS loadings of 2,151 tonnes/year were 17.7% lower than 2020. Effluent $CBOD_5$ loadings of 1,790 tonnes/year were 7.8% lower than in 2020. In 2021, the average reduction of SS was 93% and the average reduction of BOD_5 was 95%.

FIGURE 3.2 ANNACIS ISLAND WWTP – 2021 EFFLUENT TSS CONCENTRATIONS

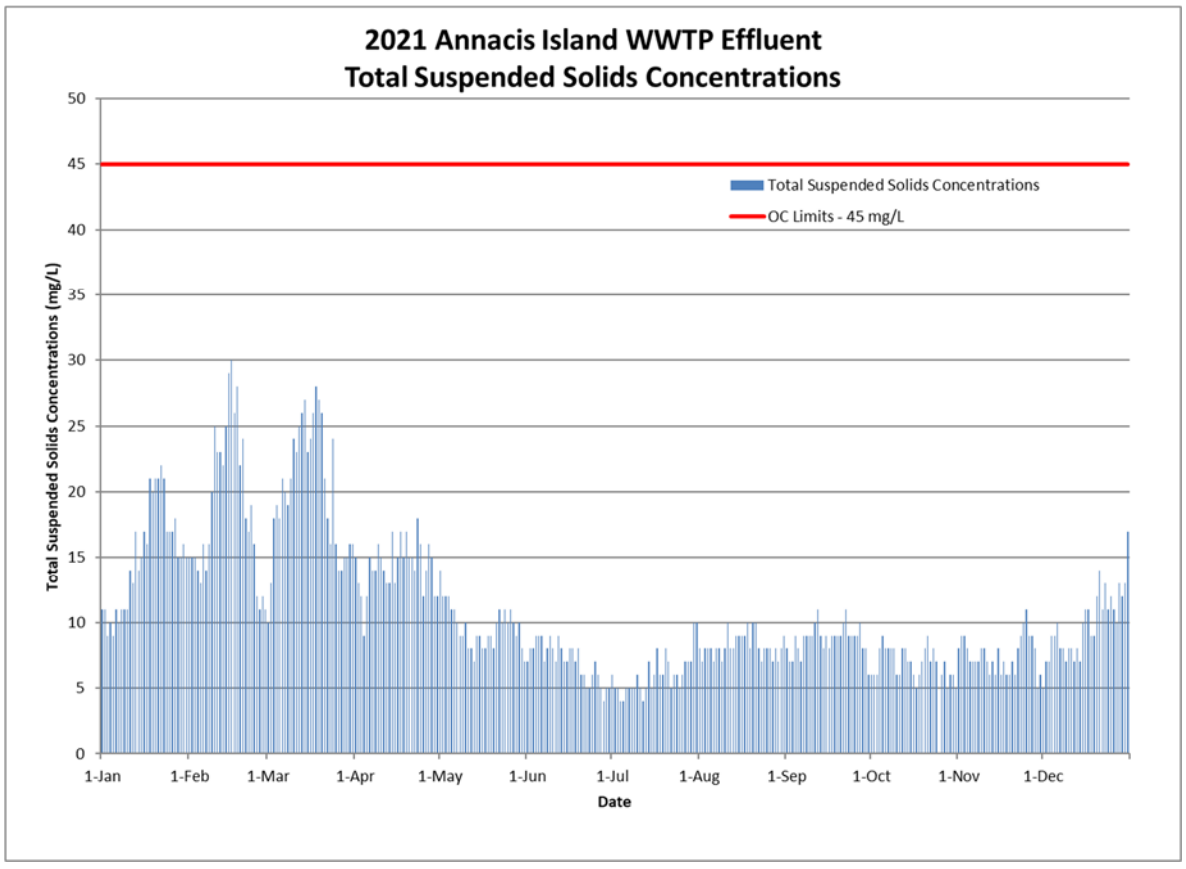
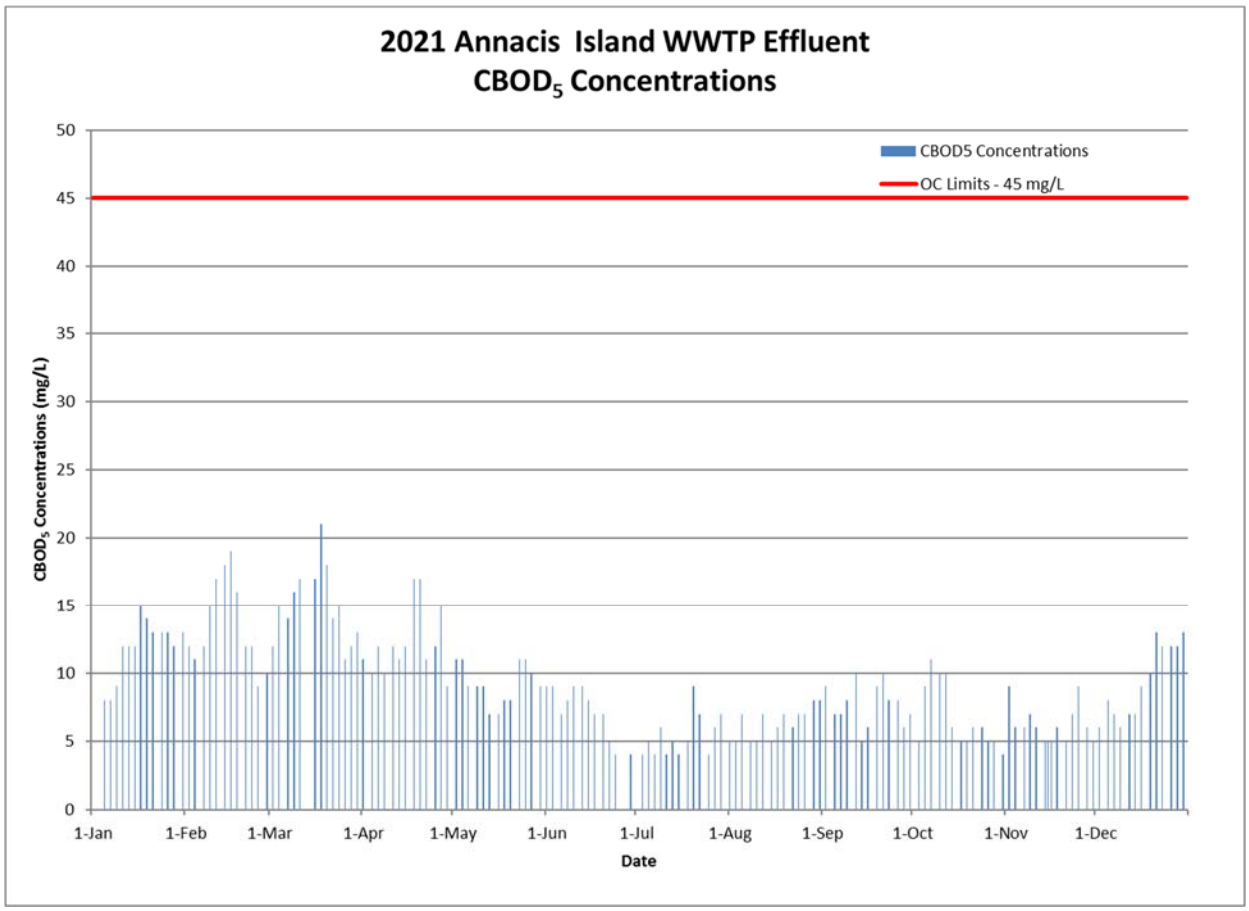


FIGURE 3.3 ANNACIS ISLAND WWTP – 2021 EFFLUENT TOTAL $CBOD_5$ CONCENTRATIONS



3.3 WASTEWATER SYSTEMS EFFLUENT REGULATIONS (WSER)

The WSER specifies the limits for substances that are authorized to be deposited by any wastewater system. The effluent quality standards and limits for the Annacis Island WWTP are shown in Table 3.8.

TABLE 3.8 ANNACIS ISLAND WWTP – WSER AUTHORIZED LEVELS

Monthly average carbonaceous biochemical oxygen demand (CBOD)	25 mg/L
Monthly average concentration of suspended solids (SS)	25 mg/L
Monthly average concentration of total residual chlorine	0.02 mg/L

Quarterly monitoring reports were submitted through ECCC's Effluent Regulatory Reporting Information System (ERRIS). The effluent monitoring data reported were number of days that effluent was deposited, total volume of effluent deposited in cubic meters, average concentration of CBOD in mg/L, average concentration of SS in mg/L, and acute lethality.

In 2021, WSER effluent quality standards and limits for CBOD and SS were met at the Annacis Island WWTP as summarized in Table 3.9.

TABLE 3.9 ANNACIS ISLAND WWTP – 2021 WSER MONITORING REPORT

	Number of days that effluent was deposited	Total volume of effluent deposited (m^3)	Average CBOD (mg/L)	Average concentration of suspended solids (mg/L)	Average concentration of total residual chlorine (mg/L)
January	31	20,394,352	12	15	
February	28	16,230,218	14	19	
March	31	16,048,694	15	20	
April	30	13,863,711	12	14	<0.02
May	31	13,686,010	9	10	<0.02
June	30	13,549,194	7	7	<0.02
July	31	13,377,023	5	6	<0.02
August	31	13,496,298	6	8	<0.02
September	30	14,775,871	8	9	<0.02
October	31	18,013,481	7	7	<0.02
November	30	21,856,563	6	8	
December	31	20,888,296	9	10	

Acute Lethality Test Results

Sample Collection Date/Time	EPS 1 / RM / 13	EPS 1 / RM / 50	Was sample acutely lethal?
2/9/2021 8:30	Multi-Concentration Test	Yes	No
5/5/2021 8:30	Multi-Concentration Test	Yes	No
8/4/2021 8:30	Multi-Concentration Test	Yes	No
9/2/2021 8:30	Multi-Concentration Test	Yes	Yes
9/14/2021 8:30	Multi-Concentration Test	Yes	No
10/5/2021 8:30	Multi-Concentration Test	Yes	No
10/13/2021 8:15	Multi-Concentration Test	Yes	No
11/3/2021 7:30	Multi-Concentration Test	Yes	No
12/6/2021 8:30	Multi-Concentration Test	Yes	Yes
12/14/2021 8:30	Multi-Concentration Test	Yes	No

3.4 SECONDARY PROCESS

Several upgrades were implemented to the Annacis Island WWTP secondary process in 2021:

- five new primary sedimentation tanks (February 24)
- two new solids contact tanks (June 21)
- six new secondary clarifiers (April 19)
- one existing trickling filter refurbished (October 31)

Secondary process operated with an average of three trickling filters (TFs), four aeration tanks in solids contact mode, one aeration tank in re-aeration mode and thirteen secondary clarifiers. Waste secondary solids were withdrawn from the re-aeration tank. The TFs achieved an average soluble $CBOD_5$ ($SCBOD_5$) removal of 66%. The remaining $SCBOD_5$ concentrations of the trickling filter effluent ranged from 7 to 31 mg/L. Average Mean Cell Residence Time (MCRT) for the solids in the aeration tanks was 1.5 days and it was adjusted seasonally from 0.8 to 3.3 days. Mixed Liquor Suspended Solids (MLSS) concentrations were between 914 and 2,170 mg/L with an average of 1,368 mg/L.

3.5 SOLIDS TREATMENT

Sludge from the primary sedimentation tanks was thickened using two gravity thickeners and screened using inline sludge screens. The average Thickened Screened Primary Sludge (TSPS) total solids content was 4.0%.

Waste secondary sludge from the re-aeration tank was thickened using two Dissolved Air Floatation Thickeners (DAFTs). The average Thickened Waste Secondary Sludge (TWSS) total solids content was 5.1% with a Subnatant suspended solids concentration of 27 mg/L and Thickened Bottom Sludge (TBS) suspended solids concentration of 207 mg/L. The average DAFT polymer dosage was 4.5 kg/dry tonne. Mixed sludge from the primary and secondary processes had an average total solids content of 4.3% and a volatile solids content of 88%. The average mixed sludge composition was 55% primary sludge and 45% secondary sludge.

Sludge was digested in four thermophilic primary digesters and one secondary digester or Flow-Through Vessel (FTV). Mixed sludge from the Annacis Island WWTP and 14,573 m^3 of TWSS from the Northwest Langley WWTP were processed in the Annacis Island WWTP digesters.

The digestion operation had an average hydraulic retention time (HRT) of 14 days for the primary digesters and 2 days for the FTV. The average volatile solids reduction was 63% and the average organic loading rate was 2.74 kg/m^3. Bicarbonate alkalinity concentrations ranged between 4,460 and 5,730 mg/L.

Biosolids dewatering achieved an average cake solids content of 26.8% and an average centrate suspended solids concentration of 1,877 mg/L with an average recovery of 91%. The average polymer dosage was 10.6 kg/tonne.

A comprehensive summary of the Annacis Island WWTP performance and monitoring results is presented in Tables 3.10 to 3.13.

TABLE 3.10 ANNACIS ISLAND WWTP – 2021 ROUTINE MONITORING RESULTS AND PERFORMANCE SUMMARY

MONTH	Max. Inst.Flow Rate	Total Daily Effluent Flow (MLD)			Grab pH Average	Grab NH3 Average (mg/L)	96 hr LC50 (%v/v)	Composite Unionized NH3 Maximum (mg/L)
	(m3/sec)	Max.	Min.	Ave.	FINAL EFF	FINAL EFF	FINAL EFF	FINAL EFF
JAN	12.7	900	499	658	7.0	26.8	>100	0.57
FEB	11.7	833	490	580	7.2	30.6	>100	0.60
MAR	9.7	614	465	518	7.2	32.5	>100	0.88
APR	8.2	492	436	462	7.3	38.4	>100	0.87
MAY	7.6	494	420	441	7.3	41.3	>100	0.91
JUN	7.4	498	435	452	7.3	37.0	>100	0.77
JUL	8.8	445	418	432	7.4	40.8	>100	0.96
AUG	7.5	505	415	435	7.4	39.2	>100	0.90
SEP	11.6	760	422	493	7.2	35.7	89.2	0.89
OCT	11.7	861	471	581	7.2	31.7	>100	0.68
NOV	14.0	1062	544	729	7.1	24.8	>100	0.53
DEC	12.2	939	521	674	7.1	29.6	88.3	0.65
# Samples	-	-	-	365	116	59	15	156
Maximum-Yr.	**14.0**	**1062**	-	-	**7.6**	**42.3**	**>100**	**0.96**
Minimum-Yr.	-	-	**415**	-	**6.8**	**12.1**	**88.3**	**0.13**
Average-Yr.	-	-	-	**537**	**7.2**	**33.6**	**>99**	**0.58**

MONTH	Ave Temp. (°C)	SHS Dosage mg/L Cl2	Ave. Residual Cl2 Final Effluent (mg/L)		SBS Dosage mg/L SO2	SO2 mg/L	Geometric Mean Fecal Coliform (MPN/100mL) AT EFFLUENT WEIR	
	FINAL EFF	FINAL EFF	Before SO2	After SO2	FINAL EFF	FINAL EFF	Monthly	Max. 30 d GMean
JAN	14	-	-	-	-	-	-	-
FEB	14	-	-	-	-	-	-	-
MAR	14	-	-	-	-	-	-	-
APR	17	2.3	0.9	<0.02	1.5	0.9	24	28
MAY	19	2.2	0.9	<0.02	1.5	1.2	28	30
JUN	20	2.2	0.9	<0.02	1.5	1.1	39	46
JUL	23	2.4	0.9	<0.02	1.5	1.0	46	56
AUG	23	2.6	0.9	<0.02	1.5	1.0	26	42
SEP	22	2.4	1.0	<0.02	1.6	1.0	56	58
OCT	19	1.9	0.9	<0.02	1.6	1.2	27	48
NOV	16	-	-	-	-	-	-	-
DEC	14	-	-	-	-	-	-	-
# Samples	61	216	217	217	216	224	61	61
Maximum-Yr.	**24**	**2.8**	**1.2**	**<0.02**	**2.0**	**2.0**	**490**	**58**
Minimum-Yr.	**12**	**1.4**	**0.4**	**<0.02**	**1.1**	**0.3**	**<18**	**18**
Average-Yr.	**18**	**2.3**	**<0.9**	**<0.02**	**1.5**	**1.1**	-	**35**
Geometric Mean	-	-	-	-	-	-	**34**	**-**

(1) Dissolved Oxygen, Temperature, Residual Chlorine (taken before dechlorination), 96 hour LC50 and Coliform are determined on grab samples; all other parameters are determined on 24 hr. flow proportioned composite samples.
(2) Effluent is disinfected between April 1 and October 31.
(3) Average values containing one or more results below the detection limit are preceded with a "<" symbol.

TABLE 3.10 CONT'D: ANNACIS ISLAND WWTP – 2021 ROUTINE MONITORING RESULTS AND PERFORMANCE SUMMARY

MONTH	Total Suspended Solids (mg/L)						Total Susp. Solids Ave. % Reduction		Ave. Suspended Solids Loadings (Tonnes/day)		Conductivity (umhos/cm)	
	RAW INF			FINAL EFF					RAW	FINAL	RAW	FINAL
	Max.	Min.	Ave.	Max.	Min.	Ave.	Primary	Final	INF	EFF	INF	EFF
JAN	202	90	147	22	9	15	49	90	92.8	9.5	463	540
FEB	194	108	155	30	11	19	47	88	89.0	10.8	515	594
MAR	194	118	163	28	10	20	50	88	84.1	10.3	516	628
APR	226	149	192	18	9	14	60	93	88.5	6.6	566	701
MAY	258	171	219	14	7	10	67	96	96.9	4.3	555	711
JUN	260	194	221	9	4	7	68	97	99.8	3.2	560	699
JUL	250	188	222	10	4	6	65	97	95.8	2.6	538	655
AUG	244	185	215	10	7	8	66	96	93.6	3.6	526	651
SEP	260	132	202	11	6	9	63	96	97.0	4.3	522	629
OCT	204	104	161	9	5	7	60	96	91.6	4.0	480	576
NOV	204	69	135	11	5	8	53	94	94.5	5.4	426	506
DEC	193	67	136	17	5	10	50	93	89.3	6.5	526	592
# Samples	-	-	350	-	-	364	345	350	350	364	350	364
Maximum-Yr.	**260**	-	-	**30**	-	-	**74**	**98**	**131**	**17.2**	**757**	**791**
Minimum-Yr.	-	**67**	-	-	**4**	-	**19**	**79**	**62.9**	**1.7**	**297**	**343**
Average-Yr.	-	-	**180**	-	-	**11**	**58**	**93**	**92.6**	**5.9**	**515**	**624**
Total to Date - Suspended Solids Loadings (Tonnes):									**33807**	**2151**		

MONTH	BOD_5 (mg/L)			$CBOD_5$ (mg/L)			Average BOD_5 % Reduction		Ave. BOD_5/$CBOD_5$ Loadings (Tonnes/day)		Average COD (mg/L)	
	RAW INF			FINAL EFF					BOD_5	$CBOD_5$	RAW	FINAL
	Max.	Min.	Ave.	Max.	Min.	Ave.	Primary	Final	INF	EFF	INF	EFF
JAN	185	108	152	15	8	12	30	92	96.0	7.4	381	70
FEB	207	114	171	19	9	14	29	92	98.9	7.8	418	80
MAR	214	154	188	21	11	15	30	92	97.4	7.8	453	84
APR	266	198	224	17	9	12	34	94	101.6	5.6	534	84
MAY	257	210	233	11	7	9	37	96	104.8	4.1	552	77
JUN	301	202	239	9	4	7	41	97	107.4	3.2	556	65
JUL	265	198	241	9	<4	<6	37	98	104.8	<2.3	564	61
AUG	268	203	242	8	5	6	38	97	105.6	2.7	567	65
SEP	279	172	229	10	5	8	36	97	105.3	3.8	536	62
OCT	227	161	179	11	4	7	36	96	98.6	3.7	437	58
NOV	190	58	134	9	5	6	37	95	95.7	4.7	335	50
DEC	205	117	155	13	6	9	32	94	98.8	6.1	365	62
# Samples	-	-	96	-	-	157	93	96	96	157	342	261
Maximum-Yr.	**301**	-	-	**21**	-	-	**48**	**98**	**133.1**	**10.4**	**669**	**109**
Minimum-Yr.	-	**58**	-	-	**<4**	-	**19**	**88**	**61.6**	**<1.7**	**155**	**32**
Average-Yr.	-	-	**197**	-	-	**<10**	**35**	**95**	**101.0**	**<4.91**	**473**	**68**
Total to Date - Biochemical Oxygen Demand Loadings (Tonnes):									**36876**	**1790**		

(1) Percent reduction is calculated only for days when both influent and effluent samples are tested.
(2) Half the detection limit is used for less than values when calculating the monthly CBOD and TSS averages reported to WSER.
(3) Average values containing one or more results below the detection limit are preceded with a "<" symbol.

TABLE 3.11 ANNACIS ISLAND WWTP – 2021 COMPREHENSIVE PROGRAM INFLUENT CONCENTRATIONS SUMMARY

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min.	Average
Aluminum Dissolved (µg/L)	40	32	34	29	26	34	36	41	37	34	38	27	41	26	34
Aluminum Total (µg/L)	387	264	277	356	321	343	194	313	365	321	422	350	422	194	326
Arsenic Total (µg/L)	1.1	0.6	0.6	0.7	1.0	0.7	0.6	0.8	0.7	0.7	1.0	0.8	1.1	0.6	0.8
Barium Dissolved (µg/L)	13.1	9.5	9.0	7.6	4.8	5.6	8.8	6.4	6.0	8.1	9.4	14.0	14.0	4.8	8.5
Barium Total (µg/L)	23.8	22.0	21.3	25.0	18.7	19.2	18.5	18.2	17.7	20.3	21.4	27.4	27.4	17.7	21.1
Boron Dissolved (µg/L)	96	124	133	143	97	113	177	154	14	120	88	128	177	14	116
Boron Total (µg/L)	97	119	144	150	96	114	192	168	149	126	91	138	192	91	132
Cadmium Dissolved (µg/L)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cadmium Total (µg/L)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Calcium Total (µg/L)	18700	15300	14600	15000	12700	12200	14200	11700	11200	16700	17200	19900	19900	11200	15000
Chromium Dissolved (µg/L)	0.8	1.1	1.2	0.9	0.8	1.0	0.8	1.1	3.3	0.9	1.4	0.5	3.3	0.5	1.2
Chromium Total (µg/L)	2.6	3.1	2.9	3.5	4.0	4.3	1.5	3.2	8.2	2.6	4.0	2.0	8.2	1.5	3.5
Cobalt Dissolved (µg/L)	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5
Cobalt Total (µg/L)	0.6	0.9	0.7	1.1	0.9	0.8	<0.5	0.8	0.6	0.6	0.6	<0.5	1.1	<0.5	<0.7
Copper Dissolved (µg/L)	9.7	16.6	16.7	16.7	10.8	11.7	11.1	11.8	8.8	8.1	8.0	5.4	16.7	5.4	11.3
Copper Total (µg/L)	32.6	50.7	47.7	57.5	58.7	62.6	32.0	51.3	42.6	39.3	30.1	30.9	62.6	30.1	44.7
Cyanide Total (mg/L)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoride (mg/L)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05	<0.05	<0.05	0.06	<0.05	<0.05
Hardness as CACO3 (mg/L)	61.8	53.3	50.5	51.9	44.2	43.4	50.3	43.5	41.0	55.8	56.3	64.7	64.7	41.0	51.4
Iron Dissolved (µg/L)	737	1170	815	1840	2920	1650	458	1190	941	688	1090	536	2920	458	1170
Iron Total (µg/L)	1990	2900	2090	4880	8430	4390	1150	2870	2570	1950	2800	1670	8430	1150	3140
Lead Dissolved (µg/L)	<0.5	<0.5	<0.5	0.7	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	<0.5	<0.5
Lead Total (µg/L)	1.6	1.8	1.8	4.2	5.8	2.6	1.6	2.2	2.4	2.4	2.3	1.7	5.8	1.6	2.5
Magnesium Total (µg/L)	3650	3660	3430	3520	3050	3160	3600	3500	3130	3450	3250	3670	3670	3050	3420
Manganese Dissolved (µg/L)	63.3	64.2	56.9	67.2	79.0	63.6	49.2	48.7	46.6	56.3	53.7	67.0	79.0	46.6	59.6
Manganese Total (µg/L)	81.4	88.4	82.0	102	116	94.6	71.3	75.9	72.8	79.5	76.9	92.8	116	71.3	86.1
Mercury Total (µg/L)	<0.05	<0.05	0.09	<0.05	<0.05	<0.05	<0.05	0.06	0.10	0.31	<0.05	<0.05	0.31	<0.05	<0.08
Methylene Blue Active Substanc (mg/L)	1.3	2.3	2.8	2.5	2.8	3.5	3.3	3.1	3.5	2.6	1.7	2.2	3.5	1.3	2.6
Molybdenum Dissolved (µg/L)	1.0	1.2	0.8	1.0	1.1	0.9	0.6	1.1	1.1	1.2	1.0	1.3	1.3	0.6	1.0
Molybdenum Total (µg/L)	1.4	1.6	1.3	1.5	1.8	1.6	0.8	1.9	1.9	1.8	1.5	1.9	1.9	0.8	1.6
Nickel Dissolved (µg/L)	1.5	1.8	1.6	1.7	1.7	1.9	1.7	1.9	1.9	1.5	1.8	1.3	1.9	1.3	1.7
Nickel Total (µg/L)	2.5	2.8	2.7	3.2	3.6	3.4	2.4	3.3	3.3	3.1	2.8	2.3	3.6	2.3	3.0
Nitrogen - Ammonia as N (mg/L)	15.6	24.1	23.0	28.2	30.8	29.9	26.5	29.0	30.6	26.5	17.6	21.0	30.8	15.6	25.2
Nitrogen - Nitrate as N (mg/L)	0.02	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.02	<0.01	<0.01	0.04	0.04	<0.01	<0.02
Nitrogen - Nitrite as N (mg/L)	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.04	0.04	<0.01	<0.02
Nitrogen - Total Kjeldahl (mg/L)	25	36	37	41	42	47	42	47	43	41	30	32	47	25	39
Oil & Grease (mg/L)	27	84	52	41	43	47	50	42	84	38	38	31	84	27	48
Phenol (mg/L)	0.02	0.05	0.05	0.07	0.10	0.09	0.07	0.06	0.06	0.05	0.03	0.04	0.10	0.02	0.06
Phosphorus Dissolved (µg/L)	890	1730	1560	1860	1590	2340	2160	2710	2680	2250	1270	1360	2710	890	1870
Phosphorus Total (µg/L)	2670	4150	3790	4880	5360	5560	3820	5640	5290	4860	3400	3690	5640	2670	4430
Selenium Total (µg/L)	<0.5	0.7	<0.5	0.7	0.8	0.7	<0.5	0.6	0.8	0.7	0.5	<0.5	0.8	<0.5	<0.6
Silver Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Silver Total (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sulphate (mg/L)	15.8	13.6	12.4	11.8	11.1	11.3	21.4	8.8	9.1	13.6	14.5	16.0	21.4	8.8	13.3
Zinc Dissolved (µg/L)	15	18	21	17	10	13	22	19	15	14	14	16	22	10	16
Zinc Total (µg/L)	58	81	88	103	104	116	102	118	104	97	73	78	118	58	94

TABLE 3.12 ANNACIS ISLAND WWTP – 2021 COMPREHENSIVE PROGRAM EFFLUENT CONCENTRATIONS SUMMARY

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min.	Average
Aluminum Dissolved (µg/L)	14	10	11	8	11	10	13	12	10	11	11	13	14	8	11
Aluminum Total (µg/L)	44	63	53	32	31	25	27	26	25	30	28	43	63	25	36
Arsenic Total (µg/L)	0.7	0.6	0.5	0.5	0.7	<0.5	0.6	0.6	0.7	0.6	0.6	0.8	0.8	<0.5	<0.6
Barium Dissolved (µg/L)	8.5	3.3	2.2	1.7	2.1	2.3	3.1	1.7	2.1	3.6	4.4	6.0	8.5	1.7	3.4
Barium Total (µg/L)	10.5	7.2	5.3	4.4	3.6	4.0	3.9	2.9	3.7	5.0	6.1	8.5	10.5	2.9	5.4
Boron Dissolved (µg/L)	104	123	145	129	106	122	177	144	14	131	105	154	177	14	121
Boron Total (µg/L)	101	125	151	134	107	120	178	148	154	137	104	159	178	101	135
Cadmium Dissolved (µg/L)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cadmium Total (µg/L)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Calcium Total (µg/L)	18500	15700	13200	12500	10800	11000	12400	10500	10200	14900	15900	18600	18600	10200	13700
Chromium Dissolved (µg/L)	0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	0.6	1.4	0.5	0.5	<0.5	1.4	<0.5	<0.6
Chromium Total (µg/L)	0.8	0.9	0.8	0.7	0.8	0.7	0.5	0.7	2.1	0.6	0.8	0.7	2.1	0.5	0.8
Cobalt Dissolved (µg/L)	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	<0.5	<0.5
Cobalt Total (µg/L)	<0.5	0.5	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	<0.5	<0.5
Copper Dissolved (µg/L)	3.9	5.3	5.3	4.9	6.2	7.3	8.8	6.3	5.0	5.6	1.6	4.4	8.8	1.6	5.4
Copper Total (µg/L)	10.4	19.2	20.0	12.6	14.4	15.6	13.4	10.3	8.8	9.5	6.3	9.4	20.0	6.3	12.5
Cyanide Total (mg/L)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoride (mg/L)	0.06	<0.05	<0.05	<0.05	0.06	<0.05	<0.05	<0.05	0.07	<0.05	<0.05	<0.05	0.07	<0.05	<0.05
Hardness as CaCO3 (mg/L)	60.6	55.0	47.6	45.5	39.1	39.6	45.1	39.6	37.6	50.7	52.8	61.6	61.6	37.6	47.9
Iron Dissolved (µg/L)	122	133	147	92	127	124	101	119	115	94	86	110	147	86	114
Iron Total (µg/L)	333	809	774	852	487	574	245	510	438	421	412	370	852	245	519
Lead Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Lead Total (µg/L)	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5
Magnesium Total (µg/L)	3520	3850	3550	3450	2940	2950	3450	3230	2970	3290	3190	3700	3850	2940	3340
Manganese Dissolved (µg/L)	56.6	52.3	44.0	69.4	48.6	55.6	38.3	46.4	42.3	49.9	54.7	50.0	69.4	38.3	50.7
Manganese Total (µg/L)	67.3	70.3	59.4	76.0	53.8	60.2	46.9	52.9	49.3	56.1	64.3	72.6	76.0	46.9	60.8
Mercury Total (µg/L)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Methylene Blue Active Substanc (mg/L)	0.3	0.3	0.2	0.3	0.4	0.3	0.2	0.3	0.4	0.3	0.2	0.3	0.4	0.2	0.3
Molybdenum Dissolved (µg/L)	0.9	1.0	0.9	0.9	1.0	0.8	0.7	0.9	0.9	0.9	1.0	1.0	1.0	0.7	0.9
Molybdenum Total (µg/L)	1.0	1.1	1.0	0.9	1.1	0.8	0.8	1.0	1.0	0.9	1.0	1.1	1.1	0.8	1.0
Nickel Dissolved (µg/L)	1.8	1.9	1.6	2.4	2.1	3.1	1.9	2.4	3.5	2.0	1.6	1.7	3.5	1.6	2.2
Nickel Total (µg/L)	1.9	2.0	1.8	2.5	2.4	3.1	2.1	2.4	3.9	2.1	1.7	1.8	3.9	1.7	2.3
Nitrogen - Ammonia as N (mg/L)	19.8	34.2	34.1	36.6	43.8	36.7	39.9	41.8	42.2	34.5	26.2	33.5	43.8	19.8	35.3
Nitrogen - Nitrate as N (mg/L)	0.09	0.04	0.05	0.03	0.01	0.04	0.03	0.06	0.03	0.02	0.12	0.09	0.12	0.01	0.05
Nitrogen - Nitrite as N (mg/L)	0.10	0.05	0.03	0.04	0.03	0.14	0.49	0.52	0.28	0.16	0.24	0.05	0.52	0.03	0.18
Nitrogen - Total Kjeldahl (mg/L)	21	36	37	39	42	38	41	46	41	37	30	35	46	21	37
Oil & Grease (mg/L)	<3	<3	<3	<3	<3	<3	<4	<3	<3	<4	<3	<3	<4	<3	<3
Phenol (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus Dissolved (µg/L)	1360	2680	2350	2040	3520	2910	3520	3040	3780	2860	1710	2600	3780	1360	2700
Phosphorus Total (µg/L)	1520	3270	3000	2490	3740	3250	3830	3320	4060	3060	2000	2850	4060	1520	3030
Selenium Total (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Silver Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Silver Total (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sulphate (mg/L)	16.6	15.5	15.3	16.3	16.5	16.5	16.5	15.2	16.0	19.2	16.7	18.6	19.2	15.2	16.6
Zinc Dissolved (µg/L)	16	15	19	24	24	25	27	27	19	19	14	17	27	14	21
Zinc Total (µg/L)	21	27	31	30	29	29	30	31	22	23	19	23	31	19	26

TABLE 3.13 ANNACIS ISLAND WWTP – 2021 COMPREHENSIVE PROGRAM LOADINGS SUMMARY

	INFLUENT				EFFLUENT			
	Max.	Min.	Ave.	Tonnes per	Max.	Min.	Ave.	Tonnes per
Parameters	kg/day			year	kg/day			year
Aluminium Dissolved	35	11	18	6.7	12	3.8	6.1	2.2
Aluminum Total	336	86	178	65	38	11	20	7.2
Arsenic Total	1.0	0.3	0.4	0.2	0.6	<0.2	<0.3	<0.1
Barium Dissolved	11	2.1	4.8	1.8	7.4	0.7	2.1	0.8
Barium Total	21	7.5	11	4.2	9.1	1.3	3.1	1.2
Boron Dissolved	83	5.9	61	22	96	5.9	65	24
Boron Total	86	42	68	25	99	47	70	26
Cadmium Dissolved	<0.18	<0.08	<0.11	<0.04	<0.18	<0.08	<0.11	<0.04
Cadmium Total	<0.18	<0.08	<0.11	<0.04	<0.18	<0.08	<0.11	<0.04
Calcium Total	16236	4757	8243	3017	16063	4332	7611	2786
Chromium Dissolved	1.4	0.3	0.6	0.2	0.6	<0.2	<0.3	<0.1
Chromium Total	3.5	0.7	1.8	0.7	0.9	0.2	0.4	0.2
Cobalt Dissolved	0.4	<0.2	<0.3	<0.1	0.4	<0.2	<0.3	<0.1
Cobalt Total	0.5	<0.2	<0.4	<0.1	0.4	<0.2	<0.3	<0.1
Copper Dissolved	8.9	3.4	5.9	2.2	3.9	1.1	2.7	1.0
Copper Total	28	14	23	8.4	11	3.7	6.5	2.4
Cyanide Total	<17	<8.5	<11	<3.9	<17	<8.5	<11	<3.9
Fluoride	43	<22	<27	<10	52	<22	<28	<10
Hardness as CaCO3	53658	17413	28128	10295	52616	15969	26387	9658
Iron Dissolved	1270	204	593	217	106	43	61	22
Iron Total	3666	512	1591	582	436	109	270	99
Lead Dissolved	0.4	<0.2	<0.3	<0.1	<0.4	<0.2	<0.3	<0.1
Lead Total	2.5	0.7	1.3	0.5	0.4	<0.2	<0.3	<0.1
Magnesium Total	3169	1326	1836	672	3056	1261	1796	657
Manganese Dissolved	55	20	32	12	49	17	27	10
Manganese Total	71	31	46	17	58	21	33	12
Mercury Total	0.15	<0.02	<0.04	<0.02	<0.05	<0.02	<0.03	<0.01
Methylene Blue Active Substance	1540	1129	1327	486	260	89	153	56
Molybdenum Dissolved	0.9	0.3	0.5	0.2	0.8	0.3	0.5	0.2
Molybdenum Total	1.2	0.4	0.8	0.3	0.9	0.4	0.5	0.2
Nickel Dissolved	1.3	0.7	0.9	0.3	1.6	0.8	1.1	0.4
Nickel Total	2.2	1.1	1.5	0.6	1.7	0.9	1.2	0.4
Nitrogen - Ammonia as N	13545	11787	12863	4708	20870	16144	18008	6591
Nitrogen - Nitrate as N	25	<4.3	<8.3	<3.1	83	4.3	30	11
Nitrogen - Nitrite as N	35	<4.2	<9.1	<3.3	228	13	89	32
Nitrogen - Total Kjeldahl	21706	18262	19783	7241	21804	16716	18932	6929
Oil & Grease	45253	18443	24629	9014	<2605	<1274	<1678	<614
Phenol	43	17	28	10	<8.7	<4.2	<5.3	<2.0
Phosphorus Dissolved	1190	691	938	343	1620	957	1363	499
Phosphorus Total	2477	1699	2259	827	1775	1169	1537	563
Selenium Total	0.4	<0.2	<0.3	<0.1	<0.4	<0.2	<0.3	<0.1
Silver Dissolved	<0.4	<0.2	<0.3	<0.1	<0.4	<0.2	<0.3	<0.1
Silver Total	<0.4	<0.2	<0.3	<0.1	<0.4	<0.2	<0.3	<0.1
Sulphate	13718	3864	7244	2651	14413	6674	8867	3245
Zinc Dissolved	13	4.3	8.6	3.1	14	8.1	11	3.9
Zinc Total	52	44	48	17	18	9.3	14	5.0

4.0 IONA ISLAND WWTP

4.0 IONA ISLAND WWTP

4.1 EFFLUENT QUALITY

The quality of effluent from the Iona Island WWTP in 2021, along with the discharge monitoring parameters listed in OC 23, is summarized in Table 4.1.

TABLE 4.1 IONA ISLAND WWTP – 2021 PERFORMANCE SUMMARY

Operational Certificate 23, April 23, 2004

				Number of Times Criteria Not Met											
Parameters	**Testing Frequency**	**OC Limits**	**Max. Value for the Year**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Total Discharge Flow (MLD)	Daily	1,530	1,505	0	0	0	0	0	0	0	0	0	0	0	0
BOD_5 (mg/L)*	3/week	130	116	0	0	0	0	0	0	0	0	0	0	0	0
Suspended Solids (mg/L)	5/week	100	82	0	0	0	0	0	0	0	0	0	0	0	0
BOD_5 (Tonnes/Day)*	3/week	84.0	55.9	0	0	0	0	0	0	0	0	0	0	0	0
Suspended Solids (Tonnes/Day)	5/week	78.0	74.4	0	0	0	0	0	0	0	0	0	0	0	0
Plant Bypass	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0

* BOD_5 reported 1/week when COD are reported 5/week

4.2 PERFORMANCE REVIEW AND OPERATIONAL SUMMARY

The MOECCS, under the provisions of the Environmental Management Act and in accordance with Metro Vancouver's ILWRMP, issued OC 23 on April 23, 2004. The OC included the authorized levels shown in Table 4.2.

TABLE 4.2 IONA ISLAND WWTP – OPERATIONAL CERTIFICATE AUTHORIZED LEVELS

Daily authorized rate of discharge	1,530,000 cubic meters/day, maximum
5-day biochemical oxygen demand (BOD_5)	130 mg/L, maximum
Total suspended solids (non-filterable residue) (TSS)	100 mg/L, maximum

The maximum daily discharge loadings for BOD_5 and TSS are used for the calculation of the annual OC fees. For 2021, the maximum authorized daily loadings were 84.0 tonnes/day for BOD_5 and 78.0 tonnes/day for TSS.

DISCHARGE MONITORING

A total of 24 parameters and two daily loadings results for the final effluent are posted on Metro Vancouver's website on a monthly basis. Specific OC limits apply to five parameters: total daily discharge flow, BOD_5, TSS, and daily loadings for BOD_5 and TSS.

4.2.1 PERFORMANCE REVIEW

PLANT BYPASSES

> Operational Certificate 23 Requirement:
>
> "The discharge of effluent which has bypassed the designated treatment works is prohibited unless the approval of the Regional Waste Manager is obtained and confirmed in writing."

There were no plant bypass events in 2021.

DAILY DISCHARGE LIMITS

There were no exceedances of daily discharge limits in 2021.

There were four instances of unauthorized discharges reported to the MOECCS in 2021. See Table 4.3 for a detailed summary of the events, including probable causes, mitigation measures, and potential environmental effects.

TABLE 4.3 IONA ISLAND WWTP – CATEGORY 1 EVENTS REPORTED TO THE MOECCS

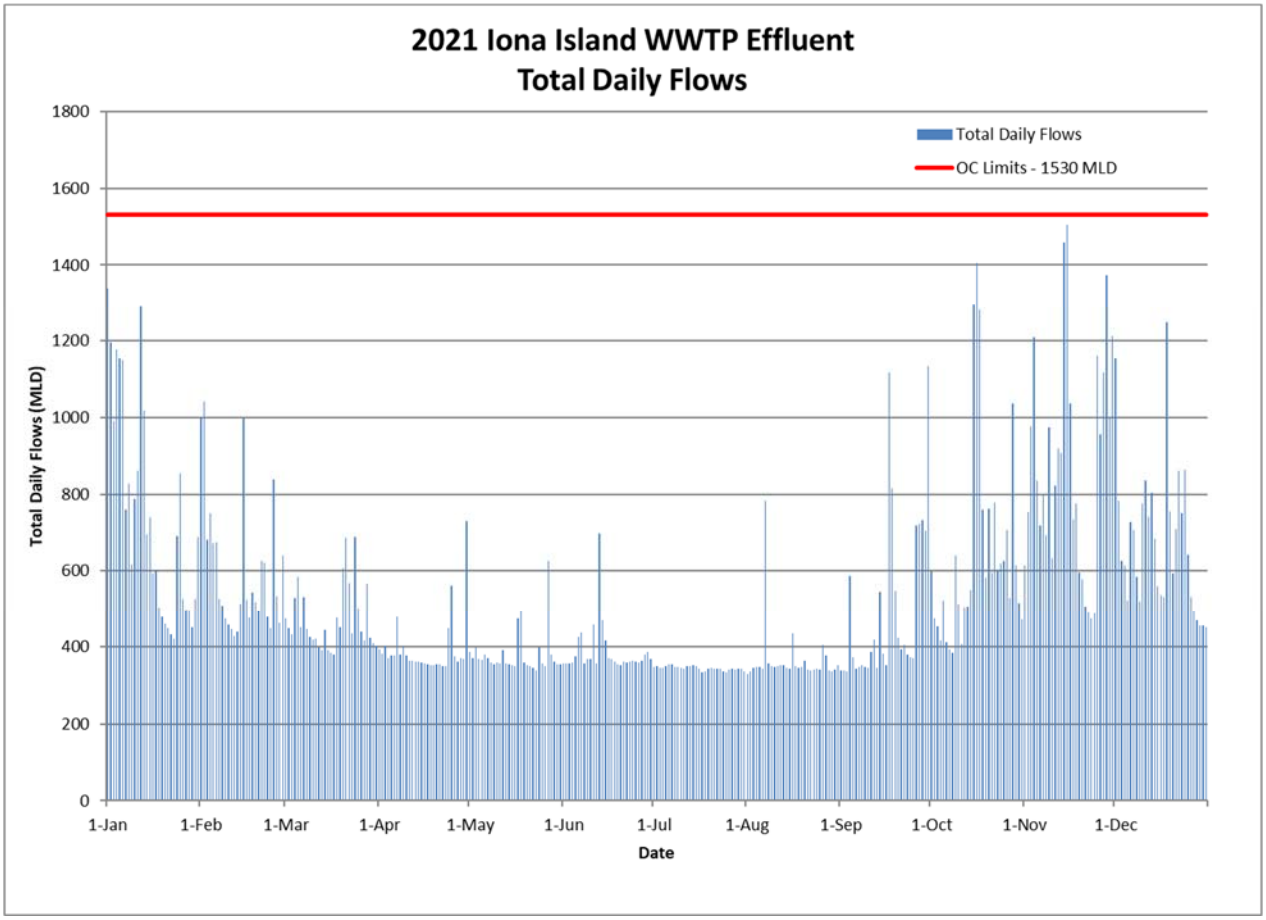
Plant	Date	Description	Quantity Discharged	Duration	Probable Cause	Mitigation Measures	Potential Environmental Effects
Iona Island	Jan 3	Municipal wastewater discharge	Approximately 62,000 litres	1311.8 minutes	Heavy rainfall caused intermittent leaks from the effluent conduit.	Repaired leaks at expansion joints.	The applicable water quality guidelines for the protection of estuarine or marine aquatic life we met. Adverse effects to flora and to aquatic and terrestrial habitats were not observed. Fauna were not observed.
Iona Island	Jan 12	Municipal wastewater discharge	Approximately 2,090,000 litres	106.6 minutes	Reset of a backup communication device unexpectedly affected electrical system, resulting in power interruptions which led to emergency closure of WWTP influent gates.	Restored power. Completed pipeline inspection. Confirmed that no overflows were noted in other areas.	The applicable water quality guidelines for the protection of estuarine or marine aquatic life we met with the exception of pH. It is unclear if observed pH is attributable to the overflow event, or to freshwater inputs to the Fraser River North Arm at sampling site from nearby Musqueam Creek, which are anticipated to be slightly more acidic than

							respective Fraser River conditions. No adverse effects to flora and to aquatic and terrestrial habitats observed. Fauna was not observed.
Iona Island	Sep 20	Process wastewater discharge	The volume of substance that spilled was undetermined as it drained back to the same manhole after the overflowing was stopped.	40.3 minutes	Flow restriction of process wastewater to the plant headworks due to a closed valve located in downstream Process Waste Drainage (PWD) line.	Opened PWD valve located in downstream PWD line.	Adverse effects to flora and to aquatic and terrestrial habitats were not observed. Fauna were not observed.
Iona Island	Dec 31	Primary sludge discharge	Approximately 3,000 litres	129.6 minutes	Sustained below freezing temperature caused trapped sludge to freeze and to expand which resulted in cracking of drain valves.	Replaced damaged drain valves.	Flora and fauna was not observed. Adverse effects to aquatic and terrestrial habitats were not observed.

4.2.2 OPERATIONAL SUMMARY

A total of 194,045 ML of wastewater was treated at the Iona Island WWTP in 2021. The average daily flow of 532 MLD was 2.2% lower than in 2020. The highest daily average flow of 1,505 MLD and the highest peak instantaneous flow of 1,670 MLD both occurred on November 15 (Figure 4.1).

FIGURE 4.1 IONA ISLAND WWTP – 2021 EFFLUENT TOTAL DAILY FLOWS



Influent SS loadings of 24,183 tonnes/day were 7.0% lower than 2020 and influent BOD_5 loadings of 22,769 tonnes/day were 8.1% lower than in 2020. Influent SS concentrations were between 28 and 293 mg/L with an average of 143 mg/L. Influent BOD_5 concentrations were between 33 and 232 mg/L with an average of 139 mg/L (Table 4.4).

TABLE 4.4 IONA ISLAND WWTP – 2012–2021 ANNUAL AVERAGE DATA FOR FLOW, SS, & BOD_5

YEAR	FLOWS MLD	Suspended Solids mg/L		Suspended Solids Tonnes/year		BOD_5 mg/L		BOD_5 Tonnes/year	
		INF	EFF	INF	EFF	INF	EFF	INF	EFF
2012	565	135	54	25135	10875	143	80	25865	15122
2013	500	149	53	25369	9604	151	84	25492	14482
2014	553	138	53	24904	10481	143	81	25523	14960
2015	507	150	54	24659	9758	166	87	26082	14473
2016	538	144	53	25212	10368	153	79	25598	14316
2017	562	148	58	26748	11762	150	83	26858	15919
2018	570	153	52	27303	10482	168	85	28936	15530
2019	493	166	54	27716	9635	179	87	29677	14901
2020	544	150	52	26009	10151	147	75	24768	13402
2021	532	143	47	24183	9077	139	70	22769	12212

Effluent SS concentrations were between 25 to 82 mg/L with an average of 47 mg/L (Figure 4.2). Effluent BOD_5 concentrations were between 26 to 116 mg/L with an average of 70 mg/L (Figure 4.3).

FIGURE 4.2 IONA ISLAND WWTP – 2021 EFFLUENT TSS CONCENTRATIONS

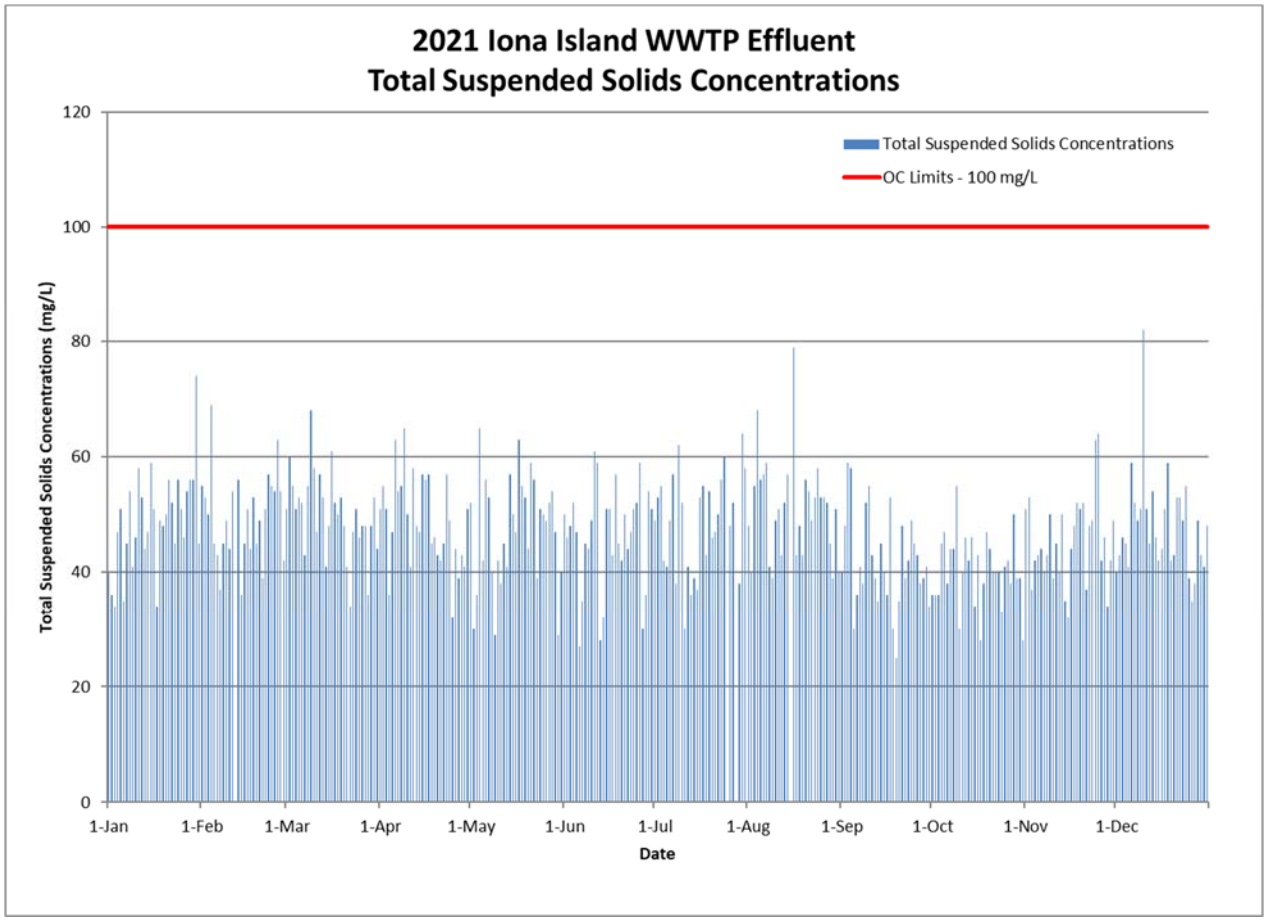
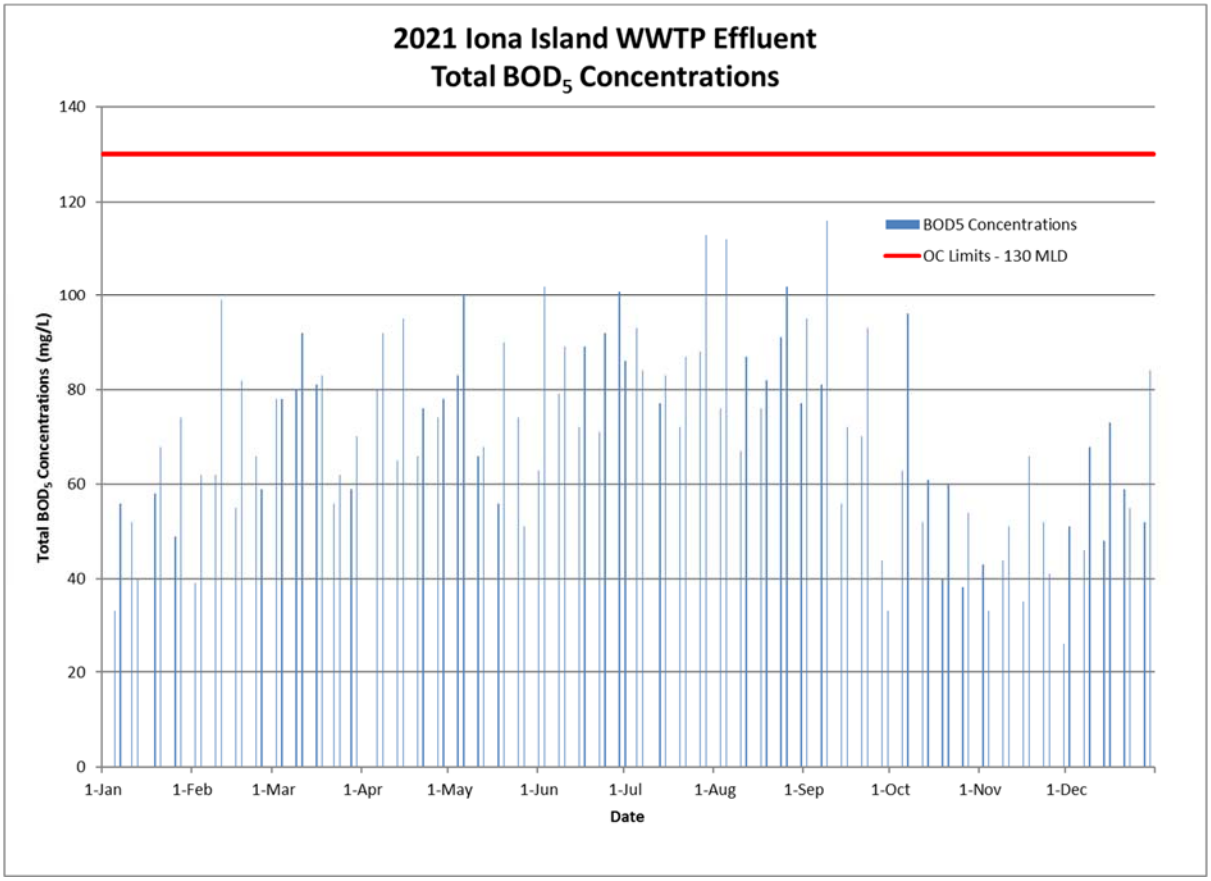


FIGURE 4.3 IONA ISLAND WWTP – 2021 EFFLUENT TOTAL BOD_5 CONCENTRATIONS



Influent at the Iona Island WWTP comes from a combined sanitary/storm water collection system. Variations in annual rainfall influence average flow, SS and BOD_5 loadings, and plant removal efficiencies. During high flow events, BOD_5 and SS removal efficiencies are reduced. In 2021, the average reduction of SS was 62% and the average reduction of BOD_5 was 46%.

4.3 WASTEWATER SYSTEMS EFFLUENT REGULATIONS (WSER)

A transitional authorization under WSER was issued to the GVS&DD for the Iona Island WWTP on September 5, 2014. The GVS&DD is authorized as of January 1, 2015 until December 31, 2030 to deposit effluent from the Iona Island WWTP that has characteristics shown in Table 4.5.

TABLE 4.5 IONA ISLAND WWTP – WSER TRANSITIONAL AUTHORIZATION LEVELS

Monthly average carbonaceous biochemical oxygen demand (CBOD)	105 mg/L
Monthly average concentration of suspended solids (SS)	71 mg/L

Quarterly monitoring reports were submitted through ECCC's Effluent Regulatory Reporting Information System (ERRIS). The effluent monitoring data reported were number of days that effluent was deposited, total volume of effluent deposited in cubic meters, average concentration of CBOD in mg/L, and average concentration of SS in mg/L.

In 2021, all transitional authorization limits for CBOD and SS were met at the Iona Island WWTP, as summarized in Table 4.6.

TABLE 4.6 IONA ISLAND WWTP – 2021 WSER MONITORING REPORT

	Number of days that effluent was deposited	Total volume of effluent deposited (m^3)	Average CBOD (mg/L)	Average concentration of suspended solids (mg/L)
January	31	23,278,211	48	49
February	28	16,810,776	55	50
March	31	14,616,863	62	50
April	30	11,780,368	66	49
May	31	11,748,028	65	47
June	30	11,623,167	69	46
July	31	10,656,663	77	48
August	31	11,303,295	78	51
September	30	14,965,421	59	42
October	31	19,955,328	51	40
November	30	26,319,554	38	46
December	31	20,987,111	51	48

4.4 CHEMICALLY ENHANCED PRIMARY TREATMENT

Chemically Enhanced Primary Treatment (CEPT) was operated at the Iona Island WWTP. On average, the CEPT system used 69 mg/L of alum and 0.67 mg/L of polymer with run times between 1 and 8 hours. In 2021, there were a total of 68 daily CEPT treatment runs which occurred mostly from April to October.

4.5 SLUDGE TREATMENT/DIGESTER OPERATIONS

Sludge from the primary sedimentation tanks was screened and degritted in the Solids Handling Facility before thickening using three gravity thickeners. The average Thickened Primary Sludge (TPS) total solids content was 5.9%.

Sludge was digested in four mesophilic digesters. The digestion operation had an average system HRT of 27 days. The average volatile solids reduction was 70% and the average organic loading rate was 2.09 kg/m^3. Bicarbonate alkalinity concentrations ranged between 2,600 and 5,130 mg/L.

A comprehensive summary of the Iona Island WWTP performance and monitoring results is presented in Tables 4.7 to 4.10.

TABLE 4.7 IONA ISLAND WWTP – 2021 ROUTINE MONITORING RESULTS AND PERFORMANCE SUMMARY

MONTH	Max Instant Flow Rate	Total Daily Effluent Flow (MLD)			Composite - Max Un-ionzed NH3 (mg/L)	Average DO (mg/L)	Grab NH3 Average (mg/L)	Average Grab pH	96 hr LC50 (%v/v)
	m3/sec	Max.	Min.	Ave.	EFF	EFF	EFF	EFF	EFF
JAN	18.1	1340	420	751	0.14	9.1	6.1	6.9	>100
FEB	17.5	1040	428	600	0.15	7.9	8.5	7.3	>100
MAR	15.6	687	379	472	0.17	7.1	12.6	7.3	>100
APR	17.5	731	348	393	0.22	4.9	18.7	7.2	>100
MAY	16.0	626	337	379	0.28	4.2	22.0	7.2	>100
JUN	14.7	698	352	387	0.21	6.3	13.4	7.1	>100
JUL	5.1	354	333	344	0.22	4.7	19.4	7.1	94.9
AUG	15.5	784	328	365	0.19	5.6	18.4	7.1	>100
SEP	17.8	1134	335	499	0.19	1.3	15.4	7.2	>100
OCT	18.5	1405	383	644	0.17	5.1	11.5	7.3	>100
NOV	19.3	1505	473	877	0.17	9.0	8.0	7.3	>100
DEC	17.6	1250	451	677	0.18	8.2	10.9	7.4	>100
# Samples		-	-	365	155	13	56	56	12
Maximum-Yr.	**19.3**	**1505**	-	-	0.28	**9.1**	**25.5**	**7.4**	**>100**
Minimum-Yr.		-	**328**	-	0.02	**1.3**	**3.0**	**6.7**	**94.9**
Average-Yr.		-	-	**532**	0.12	**6.3**	**13.5**	**7.2**	**>100**

MONTH	Average Conductivity (umhos/cm)		Average COD (mg/L)		Average Soluble BOD_5 (mg/L)		$CBOD_5$ (mg/L) EFFLUENT		
	INF	EFF	INF	EFF	INF	EFF	Max.	Min.	Ave.
JAN	508	509	224	137	22	21	65	31	48
FEB	520	532	257	159	29	28	82	32	55
MAR	574	588	322	180	38	34	76	48	62
APR	639	643	389	195	48	38	78	46	66
MAY	644	652	404	203	45	40	78	44	65
JUN	637	637	400	198	58	49	82	50	69
JUL	706	696	448	211	63	51	114	58	77
AUG	697	704	420	218	56	49	94	60	78
SEP	588	586	337	179	41	41	98	30	59
OCT	541	548	252	145	29	29	79	28	51
NOV	417	430	182	125	15	16	53	20	38
DEC	609	632	226	151	24	26	70	40	51
# Samples	244	245	360	360	100	100	-	-	157
Maximum-Yr.	**891**	**920**	**600**	**270**	**89**	**75**	**114**	-	-
Minimum-Yr.	**192**	**208**	**64**	**68**	**7**	**7**	-	**20**	-
Average-Yr.	**590**	**596**	**322**	**175**	**39**	**36**	-	-	**60**
Geometric Mean	-	-	-	-	-	-	-	-	-

(1) Dissolved Oxygen, 96 hour LC50, pH and NH3 are determined on grab samples; all other parameters are determined on 24 hr. flow proportioned composite samples.
(2) Average values containing one or more results below the detection limit are preceded with a "<" symbol.

TABLE 4.7 CONT'D: IONA ISLAND WWTP – 2021 ROUTINE MONITORING RESULTS AND PERFORMANCE SUMMARY

MONTH	Total Suspended Solids (mg/L)						Susp. Solids % Average Reduction	Suspended Solids Average Loadings (Tonnes/day)	
	INFLUENT			EFFLUENT					
	Max.	Min.	Ave.	Max.	Min.	Ave.		INF	EFF
JAN	180	41	105	74	34	49	46	67.9	35.8
FEB	163	66	115	69	36	50	55	65.6	30.2
MAR	222	93	143	68	34	50	64	65.4	23.4
APR	206	105	171	65	32	49	71	66.2	19.2
MAY	238	136	181	65	29	47	74	68.1	18.0
JUN	224	93	178	61	27	46	74	67.8	17.6
JUL	293	142	201	64	30	48	76	69.1	16.7
AUG	274	152	186	79	39	51	72	67.7	18.9
SEP	216	59	149	59	25	42	70	67.0	20.7
OCT	162	28	109	55	28	40	59	63.4	25.8
NOV	180	31	82	64	32	46	36	62.8	39.0
DEC	148	48	99	82	35	48	49	63.9	33.1
# Samples	-	-	361	-	-	361	358	361	361
Maximum-Yr.	**293**	-	-	**82**	-	-	**85**	**121**	**74.4**
Minimum-Yr.	-	**28**	-	-	**25**	-	**-10**	**35.9**	**10.2**
Average-Yr.	-	-	**143**	-	-	**47**	**62**	**66.3**	**24.9**
Total to Date - Suspended Solids Loadings (Tonnes):								**24183**	**9077**

MONTH	Biochemical Oxygen Demand (mg/L)						BOD_5 % Average Reduction	BOD_5 Average Loadings (Tonnes/day)	
	INFLUENT			EFFLUENT					
	Max.	Min.	Ave.	Max.	Min.	Ave.		INF	EFF
JAN	138	41	95	74	33	54	38	59.1	35.9
FEB	179	50	109	99	39	66	37	63.2	39.4
MAR	184	92	142	92	56	74	46	66.5	35.6
APR	199	161	172	95	65	78	55	62.6	28.5
MAY	199	107	166	100	51	74	55	65.4	29.2
JUN	232	139	178	102	63	84	52	65.7	31.1
JUL	213	179	198	113	72	87	56	68.7	30.1
AUG	222	147	176	112	67	86	51	62.4	30.4
SEP	203	43	141	116	33	73	45	59.4	32.1
OCT	179	68	111	96	38	58	47	63.1	34.0
NOV	107	33	62	66	26	43	27	53.1	38.7
DEC	149	76	99	84	46	60	39	58.7	36.2
# Samples	-	-	101	-	-	104	101	101	104
Maximum-Yr.	**232**	-	-	**116**	-	-	**65**	**89.3**	**55.9**
Minimum-Yr.	-	**33**	-	-	**26**	-	**9**	**40.0**	**22.4**
Average-Yr.	-	-	**139**	-	-	**70**	**46**	**62.4**	**33.5**
Total to Date - Biochemical Oxygen Demand Loadings (Tonnes):								**22769**	**12212**

(1) Percent reduction is calculated only for days when both influent and effluent samples are tested.
(2) Half the detection limit is used for less than values when calculating the monthly CBOD and TSS averages reported to WSER.
(3) Average values containing one or more results below the detection limit are preceded with a "<" symbol.

TABLE 4.8 IONA ISLAND WWTP – 2021 COMPREHENSIVE PROGRAM INFLUENT CONCENTRATIONS SUMMARY

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min.	Average
Aluminum Dissolved (µg/L)	18	19	21	19	18	22	24	26	30	20	16	19	30	16	21
Aluminum Total (µg/L)	633	703	492	748	331	805	353	1200	988	502	336	470	1200	331	630
Arsenic Total (µg/L)	1.5	0.8	0.7	0.9	0.8	0.9	0.8	0.9	0.9	1.3	1.0	1.4	1.5	0.7	1.0
Barium Dissolved (µg/L)	10.6	11.3	10.2	10.0	8.5	8.1	8.1	7.4	8.0	9.9	13.5	11.0	13.5	7.4	9.7
Barium Total (µg/L)	17.7	20.5	19.9	21.4	17.1	22.3	17.3	19.7	18.6	18.2	20.4	18.2	22.3	17.1	19.3
Boron Dissolved (µg/L)	27	60	63	64	76	81	83	80	92	64	60	48	92	27	67
Boron Total (µg/L)	28	60	71	75	72	78	88	88	91	65	60	49	91	28	69
Cadmium Dissolved (µg/L)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cadmium Total (µg/L)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Calcium Total (µg/L)	14300	19000	18200	17300	16100	15400	18400	16900	17200	17900	20700	18300	20700	14300	17500
Chromium Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	0.5	<0.5	<0.5
Chromium Total (µg/L)	1.5	1.4	1.3	1.4	1.0	1.5	1.2	2.1	1.5	1.5	1.0	1.3	2.1	1.0	1.4
Cobalt Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cobalt Total (µg/L)	<0.5	0.6	<0.5	0.6	<0.5	0.6	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5
Copper Dissolved (µg/L)	5.0	6.4	7.9	10.3	6.8	7.5	7.5	6.0	6.2	6.3	4.0	4.4	10.3	4.0	6.5
Copper Total (µg/L)	17.2	34.6	35.6	42.5	37.5	43.4	45.3	48.1	40.5	31.7	20.7	21.6	48.1	17.2	34.9
Cyanide Total (mg/L)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoride (mg/L)	<0.05	0.12	0.08	0.06	0.12	<0.05	<0.05	0.08	0.08	<0.05	0.10	0.12	0.12	<0.05	<0.08
Hardness as CACO3 (mg/L)	53.2	82.4	73.7	70.5	69.7	63.5	72.5	75.9	75.7	69.9	82.2	67.0	82.4	53.2	71.4
Iron Dissolved (µg/L)	70	151	149	166	179	196	241	222	191	160	98	93	241	70	160
Iron Total (µg/L)	806	1130	1050	1240	953	1280	1200	1660	1350	985	657	850	1660	657	1100
Lead Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Lead Total (µg/L)	2.2	2.7	2.1	2.7	1.8	2.7	2.5	3.7	2.7	2.2	1.4	1.9	3.7	1.4	2.4
Magnesium Total (µg/L)	4240	8450	6860	6630	7170	6090	6450	8210	7970	6100	7400	5160	8450	4240	6730
Manganese Dissolved (µg/L)	18.0	35.7	31.8	35.4	34.0	33.7	32.3	31.2	33.9	31.1	29.3	25.9	35.7	18.0	31.0
Manganese Total (µg/L)	32.3	54.3	49.7	58.5	49.3	54.5	51.5	55.0	54.5	46.0	39.3	39.8	58.5	32.3	48.7
Mercury Total (µg/L)	<0.05	<0.05	<0.05	0.05	<0.05	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05	<0.05
Methylene Blue Active Substanc (mg/L)	0.2	0.4	0.4	0.6	0.8	0.9	0.7	1.1	1.0	0.6	0.2	0.3	1.1	0.2	0.6
Molybdenum Dissolved (µg/L)	0.6	0.9	1.0	1.1	1.1	1.1	1.0	1.8	2.4	1.2	1.1	0.8	2.4	0.6	1.2
Molybdenum Total (µg/L)	0.8	1.2	1.3	1.5	1.5	1.6	1.6	2.6	2.9	1.7	1.3	1.1	2.9	0.8	1.6
Nickel Dissolved (µg/L)	0.7	1.7	1.2	1.3	1.2	1.2	1.5	1.8	1.5	1.3	1.1	0.9	1.8	0.7	1.3
Nickel Total (µg/L)	1.3	2.8	1.8	2.3	2.0	2.3	2.4	3.2	2.5	2.2	1.6	1.5	3.2	1.3	2.2
Nitrogen - Ammonia as N (mg/L)	4.9	15.4	15.9	19.8	22.7	22.7	19.8	23.9	22.2	14.6	10.3	9.2	23.9	4.9	16.8
Nitrogen - Nitrate as N (mg/L)	1.02	0.46	0.41	0.09	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	1.00	0.38	1.02	<0.01	<0.29
Nitrogen - Nitrite as N (mg/L)	0.05	0.05	0.05	0.07	0.04	<0.01	<0.01	<0.01	<0.01	0.01	0.05	0.03	0.07	<0.01	<0.03
Nitrogen - Total Kjeldahl (mg/L)	9	27	26	33	37	36	33	41	36	26	17	15	41	9	28
Oil & Grease (mg/L)	5	5	8	16	16	22	15	12	9	9	3	5	22	3	10
Phenol (mg/L)	<0.01	<0.01	<0.01	0.01	0.02	0.04	0.02	0.02	0.01	0.02	<0.01	<0.01	0.04	<0.01	<0.02
Phosphorus Dissolved (µg/L)	455	1200	1260	1750	2200	2050	1640	1790	1980	1240	787	615	2200	455	1410
Phosphorus Total (µg/L)	1160	2960	3010	3940	4200	4230	4070	4450	4510	3180	1900	1910	4510	1160	3290
Selenium Total (µg/L)	<0.5	0.7	<0.5	0.5	0.7	0.6	0.6	0.8	0.7	0.6	<0.5	<0.5	0.8	<0.5	<0.6
Silver Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Silver Total (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sulphate (mg/L)	14.3	26.2	22.8	23.6	24.7	23.7	19.5	27.3	25.5	21.3	22.8	16.9	27.3	14.3	22.4
Zinc Dissolved (µg/L)	18	25	28	33	28	28	24	22	24	25	21	22	33	18	25
Zinc Total (µg/L)	42	70	72	93	78	95	110	112	98	78	46	54	112	42	79

TABLE 4.9 IONA ISLAND WWTP – 2021 COMPREHENSIVE PROGRAM EFFLUENT CONCENTRATIONS SUMMARY

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min.	Average
Aluminum Dissolved (µg/L)	18	18	14	19	17	19	23	41	45	21	19	19	45	14	23
Aluminum Total (µg/L)	569	297	180	282	140	236	108	897	1020	192	196	307	1020	108	369
Arsenic Total (µg/L)	1.4	0.7	0.7	0.8	0.8	0.7	0.6	0.6	0.6	1.2	1.0	1.3	1.4	0.6	0.9
Barium Dissolved (µg/L)	10.7	11.3	9.7	9.0	8.5	6.6	7.9	6.2	6.0	9.6	13.1	11.1	13.1	6.0	9.1
Barium Total (µg/L)	17.0	16.5	15.8	14.8	11.6	13.0	11.5	11.2	11.2	13.8	16.4	16.4	17.0	11.2	14.1
Boron Dissolved (µg/L)	30	59	63	59	73	70	82	80	92	62	58	49	92	30	65
Boron Total (µg/L)	29	60	63	58	69	80	88	87	93	63	51	51	93	29	66
Cadmium Dissolved (µg/L)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cadmium Total (µg/L)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Calcium Total (µg/L)	14900	18400	16900	15900	14900	13800	16900	15300	15700	16500	20200	18100	20200	13800	16500
Chromium Dissolved (µg/L)	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	0.6	<0.5	<0.5
Chromium Total (µg/L)	1.5	1.0	0.8	0.8	0.8	0.7	0.8	0.6	0.5	0.9	1.0	1.4	1.5	0.5	0.9
Cobalt Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cobalt Total (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Copper Dissolved (µg/L)	4.7	6.8	7.3	8.4	7.5	5.0	7.3	4.2	3.2	7.2	5.1	4.8	8.4	3.2	6.0
Copper Total (µg/L)	16.8	26.1	27.6	30.7	27.7	29.0	27.3	24.5	21.8	22.7	16.6	18.9	30.7	16.6	24.1
Cyanide Total (mg/L)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoride (mg/L)	<0.05	<0.05	0.15	0.06	0.06	<0.05	<0.05	0.08	0.08	<0.05	0.10	0.09	0.15	<0.05	<0.07
Hardness as CaCO3 (mg/L)	55.1	80.7	70.7	65.3	65.9	60.0	66.5	71.7	71.8	64.9	79.4	66.8	80.7	55.1	68.2
Iron Dissolved (µg/L)	72	146	146	145	178	178	216	142	110	149	104	97	216	72	140
Iron Total (µg/L)	736	630	616	621	536	579	533	621	486	500	450	584	736	450	574
Lead Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Lead Total (µg/L)	2.0	1.2	1.0	1.2	0.9	1.1	0.9	1.0	0.8	1.0	0.9	1.3	2.0	0.8	1.1
Magnesium Total (µg/L)	4330	8420	6940	6250	6970	6220	5910	8140	7910	5760	7050	5230	8420	4330	6590
Manganese Dissolved (µg/L)	18.5	36.3	30.4	35.7	33.2	33.1	31.5	31.7	30.4	30.6	29.8	26.0	36.3	18.5	30.6
Manganese Total (µg/L)	31.0	47.1	42.8	46.4	41.0	42.3	39.4	40.8	40.4	38.9	37.9	35.9	47.1	31.0	40.3
Mercury Total (µg/L)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Methylene Blue Active Substanc (mg/L)	0.2	0.6	0.5	1.1	1.1	1.7	1.7	1.9	1.6	1.1	0.4	0.4	1.9	0.2	1.0
Molybdenum Dissolved (µg/L)	0.7	0.9	1.0	1.1	1.1	1.0	1.0	1.6	2.2	1.2	1.1	0.9	2.2	0.7	1.2
Molybdenum Total (µg/L)	0.8	1.1	1.2	1.3	1.5	1.4	1.3	2.1	2.6	1.4	1.2	1.0	2.6	0.8	1.4
Nickel Dissolved (µg/L)	0.8	1.6	1.1	1.2	1.4	1.7	1.9	1.5	1.2	1.1	1.1	0.8	1.9	0.8	1.3
Nickel Total (µg/L)	1.4	2.2	1.6	1.7	1.8	1.8	2.3	1.7	1.6	1.6	1.5	1.3	2.3	1.3	1.7
Nitrogen - Ammonia as N (mg/L)	5.3	15.7	17.0	19.3	22.0	21.9	18.7	23.2	22.0	14.2	10.0	10.3	23.2	5.3	16.6
Nitrogen - Nitrate as N (mg/L)	0.96	0.25	0.18	0.02	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	0.88	0.40	0.96	<0.01	<0.23
Nitrogen - Nitrite as N (mg/L)	0.05	0.06	0.03	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.04	0.04	0.06	<0.01	<0.03
Nitrogen - Total Kjeldahl (mg/L)	9	23	25	27	32	30	26	35	27	21	16	15	35	9	24
Oil & Grease (mg/L)	<4	7	9	15	11	11	14	15	10	6	4	<3	15	<3	<9
Phenol (mg/L)	<0.01	<0.01	<0.01	0.01	0.01	0.02	0.02	0.03	0.01	0.02	<0.01	0.01	0.03	<0.01	<0.01
Phosphorus Dissolved (µg/L)	511	1230	1290	1620	1970	1900	1490	1010	1150	1140	874	740	1970	511	1240
Phosphorus Total (µg/L)	1070	2450	2690	3100	3410	3290	2820	2630	2620	2340	1660	1660	3410	1070	2480
Selenium Total (µg/L)	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5
Silver Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Silver Total (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sulphate (mg/L)	14.8	26.1	22.9	23.1	24.3	24.3	19.3	36.3	38.2	20.6	22.0	17.2	38.2	14.8	24.1
Zinc Dissolved (µg/L)	18	23	28	31	27	32	29	28	24	27	20	21	32	18	26
Zinc Total (µg/L)	39	44	54	61	50	60	61	59	51	52	37	43	61	37	51

TABLE 4.10 IONA ISLAND WWTP – 2021 COMPREHENSIVE PROGRAM LOADINGS SUMMARY

	INFLUENT				EFFLUENT			
	Max.	Min.	Ave.	Tonnes per	Max.	Min.	Ave.	Tonnes per
Parameters	kg/day			year	kg/day			year
Aluminium Dissolved	21	6.6	10	3.8	21	6.2	11	4.0
Aluminum Total	731	121	310	113	657	38	191	70
Arsenic Total	1.7	0.3	0.6	0.2	1.6	0.2	0.5	0.2
Barium Dissolved	12	2.6	5.3	1.9	12	2.0	5.1	1.9
Barium Total	20	6.0	9.9	3.6	20	3.8	7.7	2.8
Boron Dissolved	42	24	31	11	40	22	30	11
Boron Total	42	26	32	12	41	22	31	11
Cadmium Dissolved	<0.24	<0.07	<0.10	<0.04	<0.24	<0.07	<0.10	<0.04
Cadmium Total	<0.24	<0.07	<0.10	<0.04	<0.24	<0.07	<0.10	<0.04
Calcium Total	16517	5488	9005	3296	17210	4918	8627	3158
Chromium Dissolved	0.6	<0.2	<0.3	<0.1	0.7	<0.2	<0.3	<0.1
Chromium Total	1.7	0.4	0.7	0.3	1.7	0.2	0.5	0.2
Cobalt Dissolved	<0.6	<0.2	<0.3	<0.1	<0.6	<0.2	<0.3	<0.1
Cobalt Total	0.6	<0.2	<0.3	<0.1	<0.6	<0.2	<0.3	<0.1
Copper Dissolved	5.8	2.1	3.1	1.2	5.4	1.1	3.0	1.1
Copper Total	20	14	16	5.9	19	7.4	12	4.3
Cyanide Total	<23	<6.8	<10	<3.8	<23	<6.8	<10	<3.8
Fluoride	96	<17	<42	<15	72	<17	<38	<14
Hardness as CaCO3	61449	22628	36059	13198	63644	21381	34881	12766
Iron Dissolved	84	63	72	27	83	37	66	24
Iron Total	931	347	526	193	850	164	306	112
Lead Dissolved	<0.6	<0.2	<0.3	<0.1	<0.6	<0.2	<0.3	<0.1
Lead Total	2.5	0.7	1.2	0.4	2.3	0.3	0.6	0.2
Magnesium Total	5122	2170	3293	1205	5001	2063	3239	1186
Manganese Dissolved	21	11	15	5.5	21	10	15	5.5
Manganese Total	37	18	24	8.6	36	14	20	7.4
Mercury Total	0.06	<0.02	<0.03	<0.01	<0.06	<0.02	<0.03	<0.01
Methylene Blue Active Substance	381	138	258	94	657	223	427	156
Molybdenum Dissolved	0.8	0.3	0.5	0.2	0.8	0.3	0.6	0.2
Molybdenum Total	1.0	0.5	0.7	0.3	0.9	0.5	0.7	0.2
Nickel Dissolved	0.8	0.4	0.6	0.2	0.9	0.4	0.6	0.2
Nickel Total	1.5	0.7	1.0	0.4	1.6	0.5	0.8	0.3
Nitrogen - Ammonia as N	8273	5660	7399	2708	8277	6122	7410	2712
Nitrogen - Nitrate as N	1178	<3.5	<220	<80	1109	<3.4	<189	<69
Nitrogen - Nitrite as N	58	<3.4	<19	<6.8	58	<3.4	<16	<5.8
Nitrogen - Total Kjeldahl	14183	10396	12412	4543	12108	9075	10791	3950
Oil & Grease	7840	2076	4558	1668	5691	<2411	<3946	<1444
Phenol	14	<3.4	<7.4	<2.7	12	<3.4	<6.8	<2.5
Phosphorus Dissolved	802	494	617	226	718	349	568	208
Phosphorus Total	1664	1315	1468	537	1334	885	1140	417
Selenium Total	0.6	<0.2	<0.3	<0.1	0.6	<0.2	<0.3	<0.1
Silver Dissolved	<0.6	<0.2	<0.3	<0.1	<0.6	<0.2	<0.3	<0.1
Silver Total	<0.6	<0.2	<0.3	<0.1	<0.6	<0.2	<0.3	<0.1
Sulphate	16517	6806	10909	3993	17095	6736	11502	4210
Zinc Dissolved	21	7.6	12	4.5	21	8.1	12	4.6
Zinc Total	49	28	36	13	45	17	25	9.1

5.0 LIONS GATE WWTP

5.0 LIONS GATE WWTP

5.1 EFFLUENT QUALITY

The quality of effluent from the Lions Gate WWTP in 2021, along with the discharge monitoring parameters listed in OC 30, is summarized in Table 5.1.

TABLE 5.1 LIONS GATE WWTP – 2021 PERFORMANCE SUMMARY

Operational Certificate 30, April 23, 2004

				Number of Times Criteria Not Met											
Parameters	**Testing Frequency**	**OC Limits**	**Max. Value for the Year**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Total Discharge Flow (MLD)	Daily	318	278	0	0	0	0	0	0	0	0	0	0	0	0
BOD_5 (mg/L)*	3/week	130	111	0	0	0	0	0	0	0	0	0	0	0	0
Suspended Solids (mg/L)	5/week	130	89	0	0	0	0	0	0	0	0	0	0	0	0
BOD_5 (Tonnes/Day)	3/week	13.5	9.4	0	0	0	0	0	0	0	0	0	0	0	0
Suspended Solids (Tonnes/Day)	5/week	14.5	10.6	0	0	0	0	0	0	0	0	0	0	0	0
Chlorine Residual (mg/L)**	Daily	<0.1	<0.02	0	0	0	0	0	0	0	0	0	0	0	0
Disinfection	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0

* BOD_5 reported 1/week when COD are reported 5/week

* Effluent disinfected between May 1 and September 30

5.2 PERFORMANCE REVIEW AND OPERATIONAL SUMMARY

The MOECCS, under the provisions of the Environmental Management Act and in accordance with Metro Vancouver's ILWRMP, issued OC 30 on April 23, 2004. The OC included the following authorized levels shown in Table 5.2.

TABLE 5.2 LIONS GATE WWTP – OPERATIONAL CERTIFICATE AUTHORIZED LEVELS

Daily authorized rate of discharge	318,000 cubic meters/day, maximum
5-day biochemical oxygen demand (BOD_5)	130 mg/L, maximum
Total suspended solids (non-filterable residue) (TSS)	130 mg/L, maximum

The maximum daily discharge loadings for BOD_5 and TSS are used for the calculation of the annual OC fees. For 2021, the maximum daily loadings were 13.5 tonnes/day for BOD_5 and 14.5 tonnes/day for TSS.

DISCHARGE MONITORING

A total of 25 parameters and two daily loadings results for the final effluent are posted on Metro Vancouver's website on a monthly basis. Specific operational discharge monitoring levels apply to six parameters: total daily discharge flow, BOD_5, TSS, chlorine residual, and maximum authorized daily loadings for BOD_5 and TSS.

5.2.1 PERFORMANCE REVIEW

PLANT BYPASSES

> Operational Certificate 30 Requirement:
>
> "The discharge of effluent which has bypassed the designated treatment works is prohibited unless the approval of the Regional Waste Manager is obtained and confirmed in writing."

There were no plant bypass events in 2021.

DISINFECTION

> Operational Certificate 30 Requirement:
>
> "The effluent shall be disinfected between May 1 and September 30 so that the Burrard Inlet fecal coliform water quality objective is not exceeded at the edge of the initial dilution zone as described in the Municipal Sewage Regulation. If chlorine is used, the effluent shall be dechlorinated prior to discharge to reduce the chlorine residual below the detection limit."

The effluent from the Lions Gate WWTP was disinfected between May 1 and September 30 using SHS and dechlorinated using SBS prior to discharge to Burrard Inlet. The average SHS dosage as chlorine was 9.1 mg/L and the average SBS dosage as SO2 was 3.7 mg/L.

There were no disinfection interruption events in 2021.

The Burrard Inlet fecal coliform WQO of 200 MPN/100/ml for the edge of the IDZ was predicted to have been met from May through September in 2021 as shown in Table 5.3.

TABLE 5.3 LIONS GATE WWTP – PREDICTED 30-DAY FECAL COLIFORM GEOMETRIC MEAN AT THE IDZ

Final Effluent	May	June	July	August	September
Max 30 day Geometric Mean*	494	279	160	146	50
Dilution Factor**	250	250	250	250	250
IDZ Result ***	2.0	1.1	0.6	0.6	0.2
WQO (Met or Not Met)	Met	Met	Met	Met	Met

* Geometric Mean (MPN/100mL) over a 30-day period (effluent).

** Lowest seasonal average dilution factor: 25-h average dilution factor based on peak plant flow conditions.

*** IDZ Result (MPN/100mL) – determined by calculation of geometric mean of fecal coliforms levels in the receiving water due to discharges of final effluent, for 30-day periods at the edge of the IDZ.

There were two instances unauthorized discharges reported to the MOECCS in 2021. See Table 5.4 for a detailed summary of the events, including probable causes, mitigation measures, and potential environmental effects.

TABLE 5.4 LIONS GATE WWTP – CATEGORY 1 EVENTS REPORTED TO THE MOECCS

Plant	Date	Description	Quantity Discharged	Duration	Probable Cause	Mitigation Measures	Potential Environmental Effects
Lions Gate	Sep 17	Disinfected and dechlorinated final effluent discharge	Undetermined	9.9 minutes	Insufficient wet weather capacity of the temporary outfall bypass pumping system.	Slowed the incoming flow to the Plant by raising the influent wet well level and partially closing the North Vancouver Interceptor gate.	Adverse effects to flora and to aquatic and terrestrial habitats were not observed. Fauna were not observed.
Lions Gate	Nov 15	Treated final effluent discharge*	Approximately 22,000 litres	150.0 minutes	High flow conditions caused leaks from abandoned conduit holes in the chlorine contact tank to the ground surface.	Plugged the abandoned conduit holes.	Adverse effects to flora and to aquatic and terrestrial habitats were not observed. Fauna were not observed.

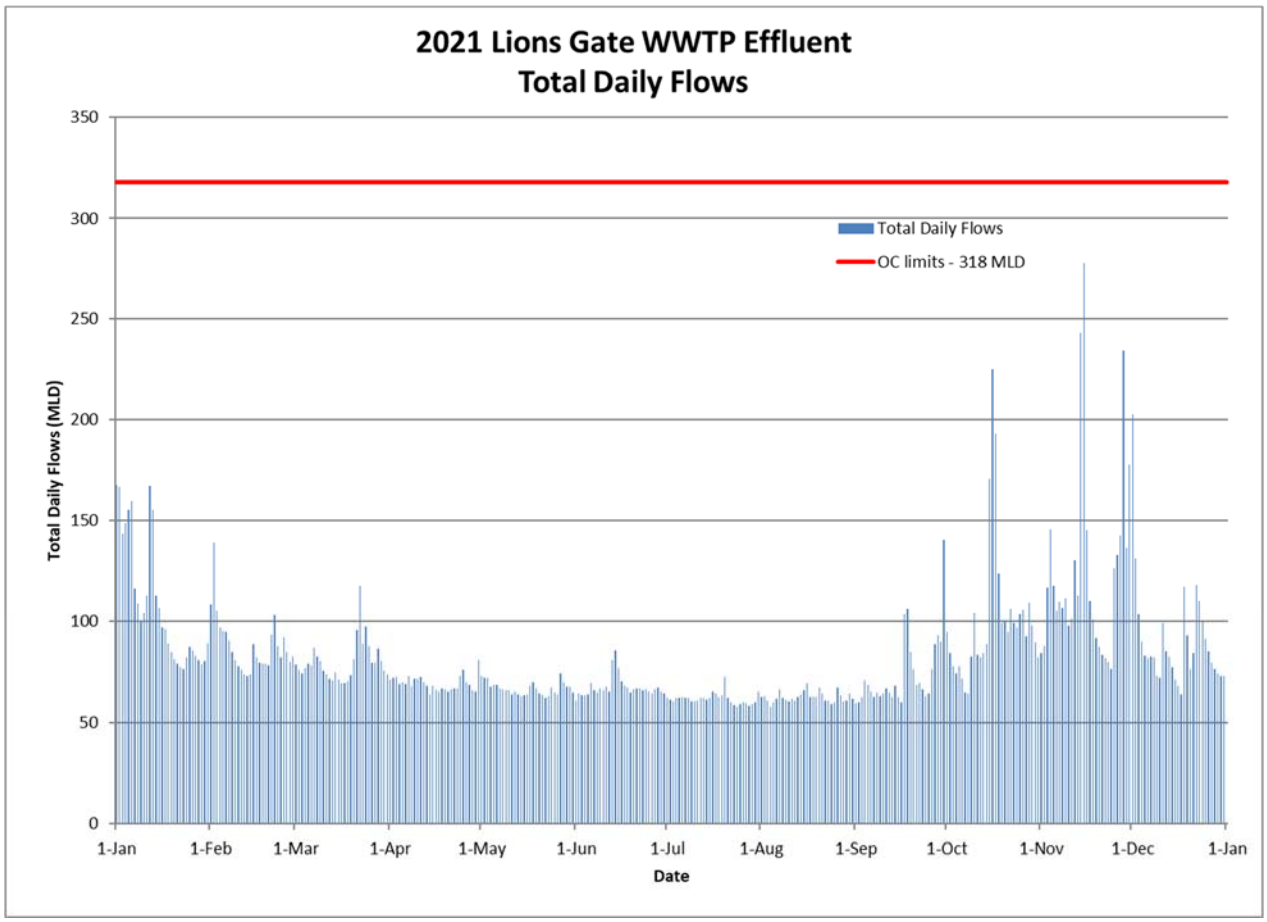
* The event was managed by the WWTP according to the Emergency Procedures clause of the OC.

5.2.2 OPERATIONAL SUMMARY

A total of 30,204 ML of wastewater was treated at the Lions Gate WWTP in 2021. The 2021 average daily flow of 83 MLD was 2.4% lower than the 2020 average daily flow. The highest daily flow of 278 MLD and a peak instantaneous flow of 426 MLD were recorded on November 15 (Figure 5.1).

As part of the North Shore Wastewater Treatment Plant Conveyance project, a pump bypass system was installed to divert final effluent flow from the chlorine contact tank to the existing marine outfall chamber. The bypass system was operated between July 1 and October 8, 2021. During this period, reported plant flow was the sum of the measured flows from each of the primary sedimentation tanks in service.

FIGURE 5.1 LIONS GATE WWTP – 2021 EFFLUENT TOTAL DAILY FLOWS



Influent SS and BOD_5 loadings were 2.6% and 4.6% lower, respectively, than in 2020 (Table 5.5). Influent SS concentrations ranged from 64 to 358 mg/L with an average of 193 mg/L. Influent BOD_5 concentrations ranged from 59 to 215 mg/L with an average of 141 mg/L.

The effluent SS concentrations were between 24 mg/L and 89 mg/L with an average value of 49 mg/L (Figure 5.2). Effluent total BOD_5 concentrations were between 29 mg/L to 111 mg/L with an average value of 73 mg/L (Figure 5.3). Effluent SS loadings of 1,477 tonnes/year were 9.7% lower and effluent BOD_5 loadings of 2,090 tonnes/year were 2.4% lower than the previous year (Table 5.5). The average SS reduction was 73% and the average BOD_5 reduction was 47%.

TABLE 5.5 LIONS GATE WWTP – 2012–2021 ANNUAL AVERAGE DATA FOR FLOW, SS, AND BOD_5

YEAR	FLOWS MLD	Suspended Solids mg/L		Suspended Solids Tonnes/year		BOD_5 mg/L		BOD_5 Tonnes/year	
		INF	EFF	INF	EFF	INF	EFF	INF	EFF
2012	88	167	54	5237	1731	146	90	4553	2818
2013	78	176	55	4857	1558	140	91	3825	2515
2014	83	169	52	4889	1561	133	81	3854	2358
2015	80	183	54	4974	1557	150	78	3956	2121
2016	83	170	53	4852	1587	134	71	3796	2066
2017	83	165	54	4725	1645	132	72	3791	2128
2018	85	167	51	4770	1580	133	77	3781	2228
2019	76	193	54	5101	1488	151	77	4038	2105
2020	85	192	53	5586	1636	143	72	4134	2142
2021	83	193	49	5438	1477	141	73	3942	2090

FIGURE 5.2 LIONS GATE WWTP – 2021 EFFLUENT TSS CONCENTRATIONS

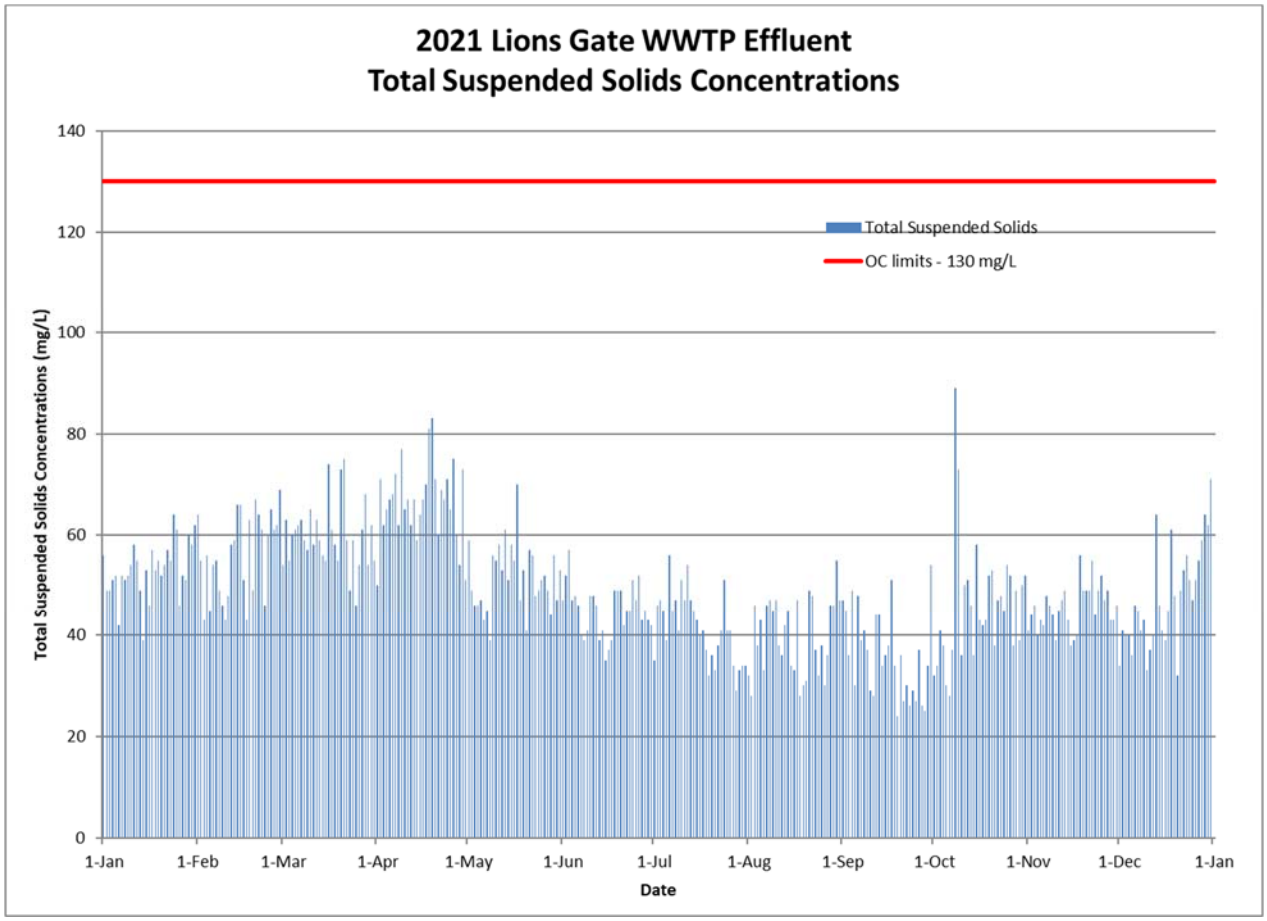
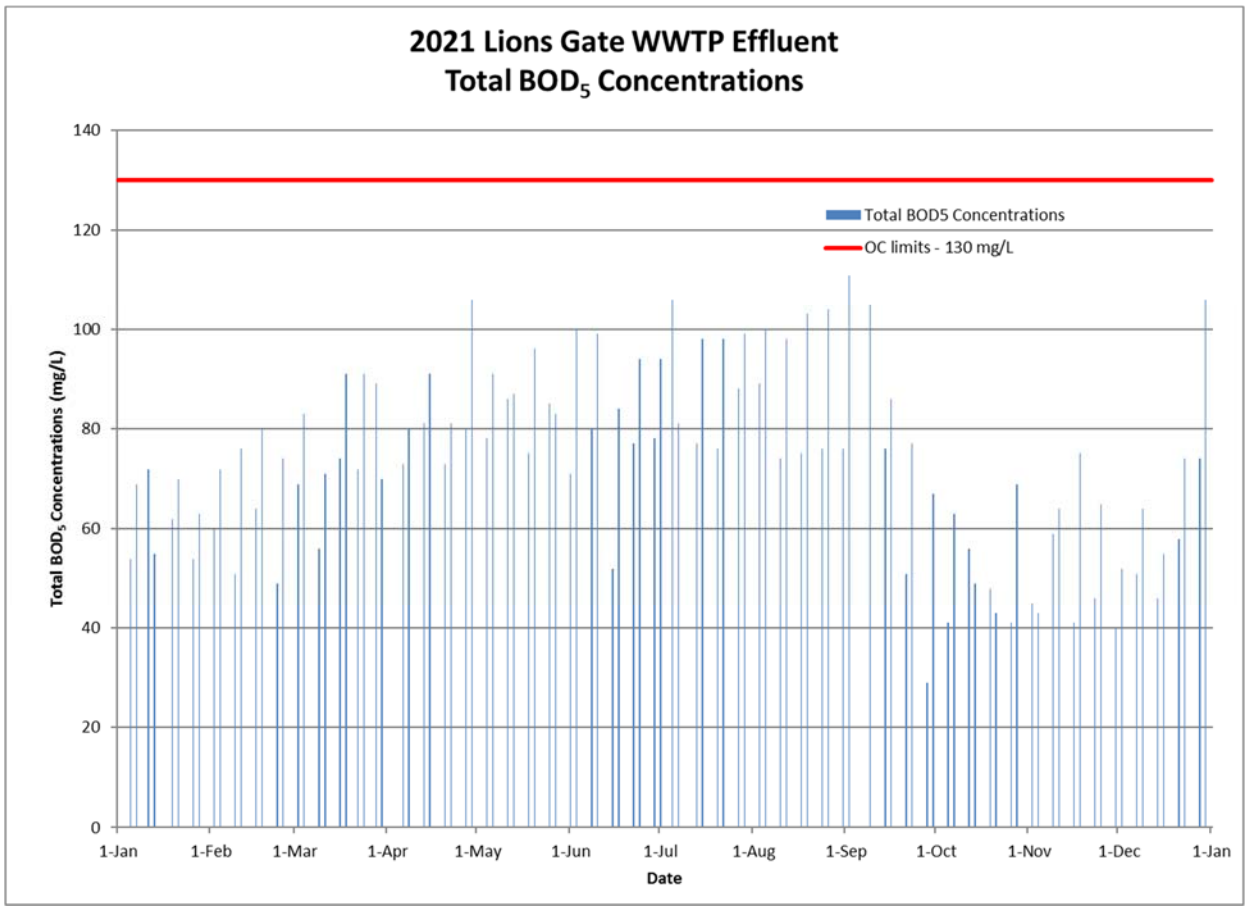


FIGURE 5.3 LIONS GATE WWTP – 2021 EFFLUENT TOTAL BOD_5 CONCENTRATIONS



5.3 WASTEWATER SYSTEMS EFFLUENT REGULATIONS (WSER)

The WSER specifies the limits for substances that are authorized to be deposited by any wastewater system. The effluent quality standards and limits for the Lions Gate WWTP are shown in Table 5.6.

TABLE 5.6 LIONS GATE WWTP – WSER AUTHORIZED LEVELS

Monthly average carbonaceous biochemical oxygen demand (CBOD)	25 mg/L
Monthly average concentration of suspended solids (SS)	25 mg/L
Monthly average concentration of total residual chlorine	0.02 mg/L

Quarterly monitoring reports were submitted through ECCC's Effluent Regulatory Reporting Information System (ERRIS). The effluent monitoring data reported were number of days that effluent was deposited, total volume of effluent deposited in cubic meters, average concentration of CBOD in mg/L, average concentration SS in mg/L, and acute lethality.

The Lions Gate Transitional Authorization (TA) expired on December 30, 2020. The monthly average limits of 115 mg/L CBOD and 76 mg/L TSS as specified in the TA were only applicable up to the end of 2020.

Starting January 2021, the applicable monthly average limits as specified in WSER Section 6.1 are 25 mg/L CBOD and 25 mg/L TSS. Due to a delay constructing the North Shore Secondary project, the Lions Gate WWTP did not meet the CBOD and TSS limits although it met the limits for total residual chlorine (WSER Section 6.1.c) and un-ionized ammonia (WSER section 6.1.d), even without the secondary treatment (Table 5.7). The requirement to report acute lethality results was met by the Lions Gate WWTP.

TABLE 5.7 LIONS GATE WWTP – 2021 WSER MONITORING REPORT

	Number of days that effluent was deposited	Total volume of effluent deposited (m^3)	Average CBOD (mg/L)	Average concentration of suspended solids (mg/L)	Average concentration of total residual chlorine (mg/L)
January	31	3,370,443	60	53	
February	28	2,457,871	61	56	
March	31	2,470,746	67	60	
April	30	2,075,315	73	67	
May	31	2,065,151	81	51	<0.02
June	30	2,018,081	71	45	<0.02
July	31	1,914,754	75	41	<0.02
August	31	1,940,074	77	40	<0.02
September	30	2,216,896	71	36	<0.02
October	31	3,122,113	48	46	
November	30	3,756,438	47	46	
December	31	2,796,574	57	47	

Acute Lethality Test Results

Sample Collection Date/Time	EPS 1 / RM / 13	EPS 1 / RM / 50	Was sample acutely lethal?
1/5/2021 8:00	Multi-Concentration Test	Yes	No
2/9/2021 8:00	Multi-Concentration Test	Yes	No
3/8/2021 8:00	Multi-Concentration Test	Yes	No
4/8/2021 8:00	Multi-Concentration Test	Yes	No
5/5/2021 8:00	Multi-Concentration Test	Yes	No
6/3/2021 8:00	Multi-Concentration Test	Yes	No
7/5/2021 8:00	Multi-Concentration Test	Yes	Yes
8/4/2021 8:00	Multi-Concentration Test	Yes	No
8/18/2021 8:10	Multi-Concentration Test	Yes	Yes
9/2/2021 8:00	Multi-Concentration Test	Yes	Yes
9/14/2021 8:00	Multi-Concentration Test	Yes	No
10/5/2021 8:00	Multi-Concentration Test	Yes	No
10/13/2021 8:00	Multi-Concentration Test	Yes	No
11/3/2021 8:00	Multi-Concentration Test	Yes	No
12/6/2021 8:00	Multi-Concentration Test	Yes	No

5.4 CHEMICALLY ENHANCED PRIMARY TREATMENT

Chemically Enhanced Primary Treatment (CEPT) occurred from March to December with a total of 327 treatment runs. The chemical dosing system was set at 65 mg/L of alum and 0.50 mg/L of polymer with run times between 6 and 13 hours.

5.5 SLUDGE TREATMENT/DEWATERING

Sludge from the primary sedimentation tanks was thickened using two gravity thickeners. The average Thickened Primary Sludge (TPS) total solids content was 5.8%.

Sludge was digested in two thermophilic digesters. The average HRT was 28 days with an average volatile solids reduction of 70% and the average organic loading rate of 1.95 kg/m^3. Bicarbonate alkalinity concentrations ranged between 3,000 and 5,430 mg/L.

Sludge dewatering is provided by two centrifuges that were operated throughout the year for an average of 7 hours per day.

The average total solids content in dewatered digested sludge (biosolids) was 29% and centrate suspended solids concentration was 1,593 mg/L with an average recovery of 92%. The average polymer dosage was 7.6 kg/tonne.

A comprehensive summary of the Lions Gate WWTP performance and monitoring results is presented in Tables 5.8 to 5.11.

TABLE 5.8 LIONS GATE WWTP – 2021 ROUTINE MONITORING RESULTS AND PERFORMANCE SUMMARY

MONTH	Max. Instant. Flow Rates (m3/sec)	Total Daily Effluent Flow (MLD)			Average Temp. (°C)	Average DO (mg/L)	Comp.- Max. Un-ionized NH3 (mg/L)	Average Grab pH	Grab NH3 Average (mg/L)	96 hr LC50 (%v/v)
		Max.	Min.	Ave.	EFF	EFF	EFF	EFF	EFF	EFF
JAN	2.9	168	76	109	12	8.8	0.15	7.1	15.0	>100
FEB	2.1	139	73	88	12	3.3	0.18	7.1	17.8	>100
MAR	1.8	118	69	80	12	3.1	0.16	7.1	18.9	>100
APR	1.3	80	64	69	14	2.6	0.21	7.2	24.4	>100
MAY	1.2	74	62	67	16	3.8	0.22	7.1	25.9	>100
JUN	1.4	85	61	67	18	3.4	0.22	7.1	24.2	>100
JUL	1.0	72	58	62	20	3.0	0.27	7.1	29.4	95.6
AUG	NA	69	58	63	21	3.5	0.30	7.1	27.0	>100
SEP	NA	141	60	74	20	3.5	0.31	7.1	25.1	92.6
OCT	3.9	225	64	101	17	4.3	0.16	7.0	17.7	>100
NOV	4.9	278	76	125	14	5.9	0.16	7.1	11.2	>100
DEC	4.0	203	64	90	12	6.9	0.22	7.1	16.5	>100
# Samples	-	-	-	365	60	16	156	60	58	15
Maximum-Yr.	**4.9**	**278**	-	-	**22**	**8.8**	**0.31**	**7.3**	**30.7**	**>100**
Minimum-Yr.	-	-	**58**	-	**10**	**2.6**	**0.03**	**6.8**	**2.1**	**78.7**
Average-Yr.	-	-	-	**83**	**16**	**4.3**	**0.15**	**7.1**	**21.0**	**>98**

MONTH	SHS Dose (mg/L Cl_2)	Residual Chlorine (mg/L) Final Effluent		SBS Dose (mg/L SO_2)	Res. SO2 (mg/L)	Geometric Mean Fecal Coliform (MPN/100mL) AT EFFLUENT WEIR		$CBOD_5$ (mg/L) EFFLUENT		
	EFF	Before SO2	After SO2	EFF	EFF	Monthly	Max. 30 d GMean	Max.	Min.	Ave.
JAN	-	-	-	-	-	-	-	90	46	60
FEB	-	-	-	-	-	-	-	82	44	61
MAR	-	-	-	-	-	-	-	83	50	67
APR	-	-	-	-	-	-	-	95	59	73
MAY	7.2	0.9	<0.02	3.4	2.1	315	494	102	60	81
JUN	7.9	1.3	<0.02	3.1	1.7	75	279	95	40	71
JUL	10.5	1.6	<0.02	3.4	1.3	160	160	95	58	75
AUG	11.2	1.5	<0.02	4.5	2.4	39	146	105	56	77
SEP	8.8	1.7	<0.02	4.2	2.7	29	50	104	24	71
OCT	-	-	-	-	-	-	-	66	34	48
NOV	-	-	-	-	-	-	-	69	35	47
DEC	-	-	-	-	-	-	-	93	38	57
# Samples	155	155	155	155	157	44	44	-	-	157
Maximum-Yr.	**13.3**	**3.5**	**<0.02**	**4.8**	**4.7**	**33000**	**494**	**105**	-	-
Minimum-Yr.	**2.9**	**0.1**	**<0.02**	**3.0**	**0.5**	**<18**	**28**	-	**24**	-
Average-Yr.	**9.1**	**1.4**	**<0.02**	**3.7**	**2.1**	-	**131**	-	-	**66**
Geometric Mean	-	-	-	-	-	**80**	-	-	-	-

(1) pH, Dissolved Oxygen, Temperature,Residual Chlorine, 96 hour LC50 and Coliform are determined on grab samples; all other parameters are determined on 24 hr. flow proportioned composite samples.
(2) Effluent is disinfected between May 1 and September 30.
(3) Average values containing one or more results below the detection limit are preceded with a "<" symbol.
(4) Max Instantaneous Flow not available from July 15 to October 8 due to ongoing tie-in work for piping to the North Shore WWTP

TABLE 5.8 CONT'D: LIONS GATE WWTP – 2021 ROUTINE MONITORING RESULTS AND PERFORMANCE SUMMARY

MONTH	Total Suspended Solids (mg/L)						Susp. Solids % Average Reduction	Suspended Solids Average Loadings (Tonnes/day)		Average Conductivity (umhos/cm)	
	INFLUENT			EFFLUENT							
	Max.	Min.	Ave.	Max.	Min.	Ave.		INF	EFF	INF	EFF
JAN	202	89	148	64	39	53	63	15.2	5.7	1388	1419
FEB	218	108	171	69	43	56	67	14.8	4.9	1718	1772
MAR	244	145	197	75	46	60	69	15.6	4.8	1938	1969
APR	313	178	223	83	50	67	70	15.4	4.6	1934	1977
MAY	271	202	237	70	39	51	78	15.8	3.4	1705	1779
JUN	289	171	225	57	35	45	80	15.1	3.0	1728	1797
JUL	269	192	229	56	29	41	82	14.2	2.6	1857	1895
AUG	358	198	239	55	28	40	83	15.0	2.5	2077	2125
SEP	258	127	203	54	24	36	82	14.6	2.7	1725	1783
OCT	282	72	162	89	28	46	69	15.1	4.6	1524	1562
NOV	211	65	132	56	38	46	63	15.1	5.6	733	773
DEC	212	64	152	71	32	47	68	13.1	4.2	854	891
# Samples	-	-	364	-	-	365	364	364	365	247	248
Maximum-Yr.	**358**	-	-	**89**	-	-	**89**	**23.6**	**10.6**	**3630**	**4420**
Minimum-Yr.	-	**64**	-	-	**24**	-	**39**	**10.5**	**1.7**	**320**	**330**
Average-Yr.	-	-	**193**	-	-	**49**	**73**	**14.9**	**4.0**	**1601**	**1649**
Total to Date - Suspended Solids Loadings (Tonnes):								**5438**	**1477**		

MONTH	Biochemical Oxygen Demand (mg/L)						BOD_5 % Average Reduction	BOD_5 Average Loadings (Tonnes/day)		Average COD (mg/L)	
	INFLUENT			EFFLUENT							
	Max.	Min.	Ave.	Max.	Min.	Ave.		INF	EFF	INF	EFF
JAN	140	72	112	72	54	62	42	11.4	6.7	286	169
FEB	172	88	130	80	49	66	48	11.5	6.0	332	187
MAR	185	102	149	91	56	77	48	11.9	6.3	373	201
APR	215	156	179	106	73	83	53	12.0	5.6	430	225
MAY	176	152	160	96	75	85	47	10.7	5.7	436	241
JUN	215	133	164	100	52	82	50	10.8	5.4	421	222
JUL	181	135	161	106	76	91	44	10.1	5.7	421	233
AUG	180	126	154	104	74	88	43	9.6	5.5	430	241
SEP	174	82	138	111	29	75	45	9.8	5.5	368	213
OCT	172	92	123	69	41	51	57	10.8	4.6	297	153
NOV	129	59	98	75	40	53	44	11.0	6.2	244	148
DEC	170	85	123	106	46	64	49	10.0	5.5	285	165
# Samples	-	-	100	-	-	103	99	100	103	363	364
Maximum-Yr.	**215**	-	-	**111**	-	-	**68**	**15.1**	**9.4**	**587**	**289**
Minimum-Yr.	-	**59**	-	-	**29**	-	**18**	**7.8**	**2.7**	**122**	**95**
Average-Yr.	-	-	**141**	-	-	**73**	**47**	**10.8**	**5.7**	**361**	**200**
Total to Date - Biochemical Oxygen Demand Loadings (Tonnes):								**3942**	**2090**		

(1) Percent reduction is calculated only for days when both influent and effluent samples are tested.
(2) Half the detection limit is used for less than values when calculating the monthly CBOD and TSS averages reported to WSER.
(3) Average values containing one or more results below the detection limit are preceded with a "<" symbol.

TABLE 5.9 LIONS GATE WWTP – 2021 COMPREHENSIVE PROGRAM INFLUENT CONCENTRATIONS SUMMARY

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min.	Average
Aluminum Dissolved (µg/L)	17	20	28	18	64	53	22	56	24	36	30	29	64	17	33
Aluminum Total (µg/L)	269	337	818	617	4280	4700	492	9220	985	1050	1170	700	9220	269	2050
Arsenic Total (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.0	0.6	0.7	0.7	<0.5	1.0	<0.5	<0.6
Barium Dissolved (µg/L)	11.0	13.0	11.0	11.0	9.8	9.1	11.2	8.7	9.5	13.0	8.3	9.2	13.0	8.3	10.4
Barium Total (µg/L)	16.8	22.2	20.7	23.9	23.7	22.1	20.7	27.2	16.8	25.8	18.0	20.0	27.2	16.8	21.5
Boron Dissolved (µg/L)	82	140	162	173	142	191	185	183	23	169	80	105	191	23	136
Boron Total (µg/L)	80	137	174	165	145	182	216	189	231	162	85	112	231	80	157
Cadmium Dissolved (µg/L)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cadmium Total (µg/L)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.3	<0.2	<0.2	0.2	<0.2	0.3	<0.2	<0.2
Calcium Total (µg/L)	17800	24600	24600	25500	20300	18700	24100	25000	23400	24500	19600	21700	25500	17800	22500
Chromium Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium Total (µg/L)	0.6	0.9	0.9	1.0	1.0	1.1	0.9	3.0	1.3	1.1	1.2	1.0	3.0	0.6	1.2
Cobalt Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cobalt Total (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5
Copper Dissolved (µg/L)	8.6	9.7	7.7	7.0	4.6	3.9	5.9	3.3	4.9	5.8	5.2	4.8	9.7	3.3	6.0
Copper Total (µg/L)	26.1	40.7	39.8	45.5	41.8	48.0	41.3	97.2	43.9	35.0	29.0	29.2	97.2	26.1	43.1
Cyanide Total (mg/L)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoride (mg/L)	0.08	0.10	0.16	0.06	0.12	0.09	0.06	0.11	0.18	0.09	<0.05	0.11	0.18	<0.05	<0.10
Hardness as CACO3 (mg/L)	97.0	187	195	200	141	126	175	181	165	165	79.4	97.6	200	79.4	151
Iron Dissolved (µg/L)	107	156	103	137	67	71	140	94	100	97	98	107	156	67	106
Iron Total (µg/L)	628	935	963	1120	1020	1290	761	1760	817	2680	1090	976	2680	628	1170
Lead Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	0.6	<0.5	<0.5
Lead Total (µg/L)	1.1	2.2	2.7	2.5	2.4	4.0	3.4	4.4	8.7	2.1	1.7	1.7	8.7	1.1	3.1
Magnesium Total (µg/L)	12700	30400	32400	33100	22000	19300	27900	28800	25900	25100	7410	10500	33100	7410	23000
Manganese Dissolved (µg/L)	33.5	54.9	47.3	53.1	46.1	38.4	35.6	39.9	37.4	41.4	34.3	56.3	56.3	33.5	43.2
Manganese Total (µg/L)	40.6	66.4	59.1	66.9	60.8	50.9	47.2	59.2	49.7	54.1	48.2	74.6	74.6	40.6	56.5
Mercury Total (µg/L)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.09	<0.05	<0.05	<0.05	<0.05	0.09	<0.05	<0.05
Methylene Blue Active Substanc (mg/L)	0.3	0.6	0.4	0.7	1.0	0.9	0.8	3.1	1.0	0.8	0.3	0.5	3.1	0.3	0.9
Molybdenum Dissolved (µg/L)	0.8	0.8	0.8	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.7	0.8	0.7	0.8
Molybdenum Total (µg/L)	0.9	1.1	1.2	1.1	1.3	1.2	1.0	2.0	1.3	1.2	1.1	1.0	2.0	0.9	1.2
Nickel Dissolved (µg/L)	0.7	0.9	0.9	1.0	0.9	1.1	1.1	2.8	1.1	1.0	1.0	0.9	2.8	0.7	1.1
Nickel Total (µg/L)	1.0	1.5	1.5	1.8	1.8	1.9	1.9	5.3	1.9	1.7	1.9	1.5	5.3	1.0	2.0
Nitrogen - Ammonia as N (mg/L)	7.6	16.0	15.4	17.9	19.4	19.1	17.4	18.8	19.4	16.1	9.6	13.8	19.4	7.6	15.9
Nitrogen - Nitrate as N (mg/L)	0.76	0.37	0.44	0.27	0.14	<0.01	0.04	<0.01	0.02	0.21	0.70	0.43	0.76	<0.01	<0.28
Nitrogen - Nitrite as N (mg/L)	0.04	0.04	0.05	0.06	0.04	0.02	0.06	<0.01	0.03	0.05	0.06	0.07	0.07	<0.01	<0.04
Nitrogen - Total Kjeldahl (mg/L)	14	26	25	32	32	32	30	42	30	27	20	24	42	14	28
Oil & Grease (mg/L)	5	7	11	17	10	9	10	10	9	6	4	13	17	4	9
Phenol (mg/L)	<0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01	<0.01	0.01	0.02	<0.01	<0.01
Phosphorus Dissolved (µg/L)	867	1590	1120	1940	279	187	2140	210	1660	1220	727	892	2140	187	1070
Phosphorus Total (µg/L)	1870	3480	3430	4610	4040	4280	3800	7240	4570	3690	2610	2970	7240	1870	3880
Selenium Total (µg/L)	<0.5	0.6	<0.5	0.7	0.7	<0.5	<0.5	0.7	0.6	<0.5	<0.5	<0.5	0.7	<0.5	<0.6
Silver Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Silver Total (µg/L)	<0.5	<0.5	<0.5	<0.5	0.8	1.9	0.6	1.4	0.7	0.5	0.5	<0.5	1.9	<0.5	<0.7
Sulphate (mg/L)	33.4	69.3	76.5	75.7	84.0	78.5	61.9	96.3	63.7	65.3	25.3	32.5	96.3	25.3	63.5
Zinc Dissolved (µg/L)	24	34	30	34	27	27	36	22	35	26	22	22	36	22	28
Zinc Total (µg/L)	46	75	73	88	93	101	103	173	93	78	65	61	173	46	87

TABLE 5.10 LIONS GATE WWTP – 2021 COMPREHENSIVE PROGRAM EFFLUENT CONCENTRATIONS SUMMARY

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min.	Average
Aluminum Dissolved (µg/L)	20	33	29	45	52	121	46	43	64	77	28	49	121	20	51
Aluminum Total (µg/L)	329	1010	1140	1200	1580	1690	1900	1640	2030	1750	586	1300	2030	329	1350
Arsenic Total (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	0.5	<0.5	0.6	<0.5	0.7	<0.5	<0.5
Barium Dissolved (µg/L)	9.9	9.3	8.9	7.5	5.6	5.9	5.6	5.1	6.1	10.1	8.4	7.1	10.1	5.1	7.5
Barium Total (µg/L)	15.8	16.1	16.0	15.3	15.0	14.0	14.4	12.7	13.9	15.1	15.8	15.5	16.1	12.7	15.0
Boron Dissolved (µg/L)	82	132	160	161	139	169	194	173	21	164	80	105	194	21	132
Boron Total (µg/L)	84	138	167	160	143	177	207	182	211	172	85	116	211	84	154
Cadmium Dissolved (µg/L)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cadmium Total (µg/L)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Calcium Total (µg/L)	17800	23500	23100	23800	18500	17700	23000	22500	21800	23500	20800	21100	23800	17700	21400
Chromium Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium Total (µg/L)	0.6	0.7	0.6	0.6	0.6	0.6	0.7	0.8	0.8	<0.5	0.8	0.7	0.8	<0.5	<0.7
Cobalt Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cobalt Total (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Copper Dissolved (µg/L)	5.2	4.2	3.4	4.2	7.4	7.4	4.1	4.2	5.3	2.1	4.3	3.0	7.4	2.1	4.6
Copper Total (µg/L)	22.0	23.5	24.7	28.7	29.6	30.6	27.4	29.9	26.6	14.0	21.7	17.2	30.6	14.0	24.7
Cyanide Total (mg/L)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoride (mg/L)	0.13	0.20	0.20	0.08	0.16	0.07	0.07	0.19	0.20	0.09	<0.05	0.11	0.20	<0.05	<0.13
Hardness as CaCO3 (mg/L)	99.4	183	186	194	135	122	168	168	155	162	82.3	93.3	194	82.3	146
Iron Dissolved (µg/L)	168	104	102	103	99	113	91	86	81	85	149	93	168	81	106
Iron Total (µg/L)	682	655	704	673	633	607	582	522	521	425	739	659	739	425	617
Lead Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Lead Total (µg/L)	1.0	1.1	1.2	1.2	1.4	1.2	1.2	1.1	2.3	0.6	0.9	0.8	2.3	0.6	1.2
Magnesium Total (µg/L)	13300	30100	31200	32800	21400	19000	26800	27100	24300	25100	7390	9870	32800	7390	22400
Manganese Dissolved (µg/L)	37.6	52.2	43.0	48.7	39.1	35.4	33.8	30.2	34.9	42.5	35.8	58.3	58.3	30.2	41.0
Manganese Total (µg/L)	44.7	61.3	51.0	57.8	49.0	44.3	43.4	40.4	44.7	46.4	47.0	72.9	72.9	40.4	50.2
Mercury Total (µg/L)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Methylene Blue Active Substanc (mg/L)	0.3	1.3	1.1	1.4	1.7	2.2	2.4	3.3	2.6	1.4	0.4	0.8	3.3	0.3	1.6
Molybdenum Dissolved (µg/L)	0.8	0.8	0.8	0.8	0.9	0.7	1.0	1.3	1.0	0.9	0.9	0.8	1.3	0.7	0.9
Molybdenum Total (µg/L)	1.0	1.0	1.2	1.0	1.1	1.0	1.2	1.1	1.3	1.0	1.1	0.9	1.3	0.9	1.1
Nickel Dissolved (µg/L)	1.4	1.0	0.9	1.0	1.1	1.3	1.4	2.2	1.6	2.2	1.1	1.0	2.2	0.9	1.4
Nickel Total (µg/L)	1.8	1.3	1.4	1.4	1.5	1.7	1.8	2.8	2.0	2.6	1.6	1.4	2.8	1.3	1.8
Nitrogen - Ammonia as N (mg/L)	12.5	21.6	21.8	24.1	27.8	27.0	29.2	29.0	30.7	27.7	15.1	21.5	30.7	12.5	24.0
Nitrogen - Nitrate as N (mg/L)	0.68	0.19	0.09	0.07	0.04	0.02	0.05	<0.01	0.02	0.06	0.61	0.26	0.68	<0.01	<0.18
Nitrogen - Nitrite as N (mg/L)	0.04	0.05	0.09	0.03	0.03	<0.01	<0.01	0.01	<0.01	0.03	0.05	0.08	0.09	<0.01	<0.04
Nitrogen - Total Kjeldahl (mg/L)	18	28	29	35	32	33	40	40	36	31	22	28	40	18	31
Oil & Grease (mg/L)	5	11	13	15	15	19	22	25	24	3	<3	5	25	<3	<13
Phenol (mg/L)	<0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.02	<0.01	0.02	0.03	<0.01	<0.02
Phosphorus Dissolved (µg/L)	1010	839	783	1180	1630	1630	1660	1750	1670	89	833	420	1750	89	1130
Phosphorus Total (µg/L)	2000	2440	2530	3120	3570	3460	3330	3580	3810	1420	2260	1930	3810	1420	2790
Selenium Total (µg/L)	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	0.5	0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5
Silver Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Silver Total (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5
Sulphate (mg/L)	37.1	77.3	81.2	82.7	66.8	63.4	77.0	69.0	68.4	93.7	23.4	45.5	93.7	23.4	65.5
Zinc Dissolved (µg/L)	20	23	20	23	29	28	31	30	27	15	20	17	31	15	24
Zinc Total (µg/L)	42	46	45	51	60	58	62	57	56	32	46	38	62	32	49

TABLE 5.11 LIONS GATE WWTP – 2021 COMPREHENSIVE PROGRAM LOADINGS SUMMARY

	INFLUENT				EFFLUENT			
	Max.	Min.	Ave.	Tonnes per	Max.	Min.	Ave.	Tonnes per
Parameters	kg/day			year	kg/day			year
Aluminium Dissolved	4.4	1.2	2.5	0.9	7.7	2.4	3.7	1.4
Aluminum Total	532	27	139	51	136	51	97	36
Arsenic Total	0.08	<0.03	<0.05	<0.02	0.08	<0.03	<0.04	<0.02
Barium Dissolved	1.7	0.5	0.8	0.3	1.5	0.3	0.6	0.2
Barium Total	2.6	1.0	1.7	0.6	2.5	0.7	1.2	0.5
Boron Dissolved	13	1.4	10	3.8	13	1.3	10	3.7
Boron Total	14	9.1	12	4.3	14	9.4	12	4.2
Cadmium Dissolved	<0.04	<0.01	<0.02	<0.01	<0.04	<0.01	<0.02	<0.01
Cadmium Total	0.03	<0.01	<0.02	<0.01	<0.04	<0.01	<0.02	<0.01
Calcium Total	2767	1190	1783	653	2767	1126	1716	628
Chromium Dissolved	<0.08	<0.03	<0.04	<0.01	<0.08	<0.03	<0.04	<0.01
Chromium Total	0.17	0.06	0.09	0.03	0.09	<0.04	<0.05	<0.02
Cobalt Dissolved	<0.08	<0.03	<0.04	<0.01	<0.08	<0.03	<0.04	<0.01
Cobalt Total	0.08	<0.03	<0.04	<0.01	<0.08	<0.03	<0.04	<0.01
Copper Dissolved	1.3	0.2	0.5	0.2	0.8	0.2	0.4	0.1
Copper Total	5.6	2.4	3.2	1.2	3.4	1.1	1.9	0.7
Cyanide Total	<3.1	<1.2	<1.6	<0.6	<3.1	<1.2	<1.6	<0.6
Fluoride	13	<3.7	<7.9	<2.9	20	<4.4	<10	<3.7
Hardness as CaCO3	16033	7951	11562	4232	15452	7600	11246	4116
Iron Dissolved	17	4.5	8.7	3.2	26	4.9	9.2	3.4
Iron Total	208	47	91	33	106	30	51	19
Lead Dissolved	0.08	<0.03	<0.04	<0.02	<0.08	<0.03	<0.04	<0.01
Lead Total	0.52	0.14	0.22	0.08	0.16	0.05	0.09	0.03
Magnesium Total	2664	855	1725	631	2565	804	1689	618
Manganese Dissolved	5.2	2.2	3.4	1.3	5.8	1.7	3.3	1.2
Manganese Total	6.3	2.9	4.5	1.6	6.9	2.3	4.1	1.5
Mercury Total	0.008	<0.003	<0.004	<0.002	<0.010	<0.003	<0.004	<0.001
Methylene Blue Active Substance	179	33	61	22	190	47	109	40
Molybdenum Dissolved	0.12	0.04	0.06	0.02	0.12	0.04	0.07	0.03
Molybdenum Total	0.14	0.06	0.09	0.03	0.16	0.06	0.09	0.03
Nickel Dissolved	0.16	0.06	0.08	0.03	0.22	0.07	0.11	0.04
Nickel Total	0.31	0.11	0.15	0.05	0.28	0.10	0.14	0.05
Nitrogen - Ammonia as N	1326	1085	1194	437	2151	1642	1812	663
Nitrogen - Nitrate as N	118	<0.6	<29	<11	106	<0.6	<20	<7.3
Nitrogen - Nitrite as N	7.0	<0.6	<3.7	<1.4	7.4	<0.6	<3.2	<1.2
Nitrogen - Total Kjeldahl	2424	1799	2101	769	2798	2099	2361	864
Oil & Grease	1158	466	699	256	1443	<233	<936	<343
Phenol	1.6	<0.5	<0.9	<0.3	1.9	<0.7	<1.4	<0.5
Phosphorus Dissolved	135	12	85	31	157	6.9	86	31
Phosphorus Total	418	237	290	106	311	110	214	78
Selenium Total	0.08	<0.03	<0.04	<0.02	0.08	<0.03	<0.04	<0.02
Silver Dissolved	<0.08	<0.03	<0.04	<0.01	<0.08	<0.03	<0.04	<0.01
Silver Total	0.12	<0.03	<0.06	<0.02	0.08	<0.03	<0.04	<0.02
Sulphate	6290	2648	4739	1734	7275	2739	4959	1815
Zinc Dissolved	3.7	1.3	2.2	0.8	3.1	1.2	1.8	0.7
Zinc Total	10	5.0	6.5	2.4	6.5	2.5	3.9	1.4

6.0 LULU ISLAND WWTP

6.0 LULU ISLAND WWTP

6.1 EFFLUENT QUALITY

The quality of effluent from the Lulu Island WWTP in 2021, along with the discharge monitoring parameters listed in OC 23, is summarized in Table 6.1.

TABLE 6.1 LULU ISLAND WWTP – 2021 PERFORMANCE SUMMARY

Operational Certificate 233, April 23, 2004

				Number of Times Criteria Not Met											
Parameters	**Testing Frequency**	**OC Limits**	**Max. Value for the Year**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Total Discharge Flow (MLD)	Daily	233	130	0	0	0	0	0	0	0	0	0	0	0	0
$CBOD_5$ (mg/L)*	3/week	45	14	0	0	0	0	0	0	0	0	0	0	0	0
Suspended Solids (mg/L)	5/week	45	12	0	0	0	0	0	0	0	0	0	0	0	0
$CBOD_5$ (Tonnes/Day)*	3/week	3.6	1.0	0	0	0	0	0	0	0	0	0	0	0	0
Susp. Solids (Tonnes/Day)	5/week	4.5	1.6	0	0	0	0	0	0	0	0	0	0	0	0
Chlorine Residual (mg/L)**	Daily	<0.1	<0.02	0	0	0	0	0	0	0	0	0	0	0	0
Disinfection	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0
Plant Bypass	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0
Secondary Bypass	2ADW	-	-	0	0	0	0	0	0	0	0	0	0	0	0

* $CBOD_5$ reported 1/week when COD are reported 5/week

** Effluent disinfected between April 1 and October 31

6.2 PERFORMANCE REVIEW AND OPERATIONAL SUMMARY

The MOECCS, under the provisions of the Environmental Management Act and in accordance with Metro Vancouver's ILWRMP, issued OC 23 on April 23, 2004. The OC included the authorized levels shown in Table 6.2.

TABLE 6.2 LULU ISLAND WWTP – OPERATIONAL CERTIFICATE AUTHORIZED LEVELS

Daily authorized rate of discharge	233,000 cubic meters/day, maximum
5-day carbonaceous biochemical oxygen demand ($CBOD_5$)	45 mg/L, maximum
Total suspended solids (non-filterable residue) (TSS)	45 mg/L, maximum

The maximum daily discharge loadings for $CBOD_5$ and TSS are used for the calculation of the annual OC fees. For 2021, the maximum authorized daily loadings were 3.6 tonnes/day for $CBOD_5$ and 4.5 tonnes/day for TSS.

DISCHARGE MONITORING

A total of 27 parameters and two daily loading results for the final effluent are posted on Metro Vancouver's website on a monthly basis. Specific discharge monitoring levels apply to six parameters: total daily discharge flow, $CBOD_5$, TSS, chlorine residual, and maximum authorized daily loadings for $CBOD_5$ and TSS.

6.2.1 PERFORMANCE REVIEW

EFFLUENT BYPASSES

> Operational Certificate 23 Requirement:
>
> "For flows less than two times dry weather flow, wastewater bypassing the designated treatment works is prohibited unless the approval of the Regional Waste Manager is obtained and confirmed in writing. Wastewater flows exceeding the capacity of the secondary treatment works may bypass those works when flows are greater than two times measured dry weather flow, provided that primary effluent standards are maintained for the effluent not receiving secondary treatment."

There was no bypassing of the secondary treatment process in 2021.

PLANT BYPASSES

There were no plant bypasses in 2021.

DISINFECTION

> Operational Certificate 23 Requirement:
>
> "The effluent shall be disinfected between April 1 and October 31 so that the Fraser River fecal coliform water quality objective is not exceeded at the edge of the initial dilution zone as described in the Municipal Sewage Regulation. If chlorine is used, the effluent shall be dechlorinated prior to discharge to reduce the chlorine residual below the detection limit."

The effluent from the Lulu Island WWTP was disinfected between April 1 and October 31 using SHS and dechlorinated using SBS. The average SHS dosage as chlorine was 2.0 mg/L and the average SBS dosage as SO_2 was 2.3 mg/L.

There were no disinfection interruption events in 2021.

The 30-day Geometric Means calculated for fecal coliforms levels in final effluent and at the edge of the IDZ are summarized in Table 6.3. In 2021, the calculated results for fecal coliform levels at the edge of the IDZ met the Fraser River fecal coliforms WQO of 200 MPN/100 mL from April through October.

TABLE 6.3 LULU ISLAND WWTP – PREDICTED 30-DAY FECAL COLIFORM GEOMETRIC MEAN AT THE IDZ

Final Effluent	April	May	June	July	August	September	October
Max 30-day Geometric Mean*	32	34	34	35	28	45	46
Dilution Factor**	30	30	30	30	30	30	30
IDZ Result ***	1.1	1.1	1.1	1.2	0.9	1.5	1.5
WQO (Met or Not Met)	Met	Met	Met	Met	Met	Met	Met

* Geometric Mean (MPN/100mL) over a 30-day period (effluent).

** Lowest seasonal average dilution factor: 25-h average dilution factor based on peak plant flow and low river flow conditions.

*** IDZ Result (MPN/100mL) – determined by calculation of geometric mean of fecal coliforms levels in the receiving water due to discharges of final effluent, for 30-day periods at the edge of the IDZ.

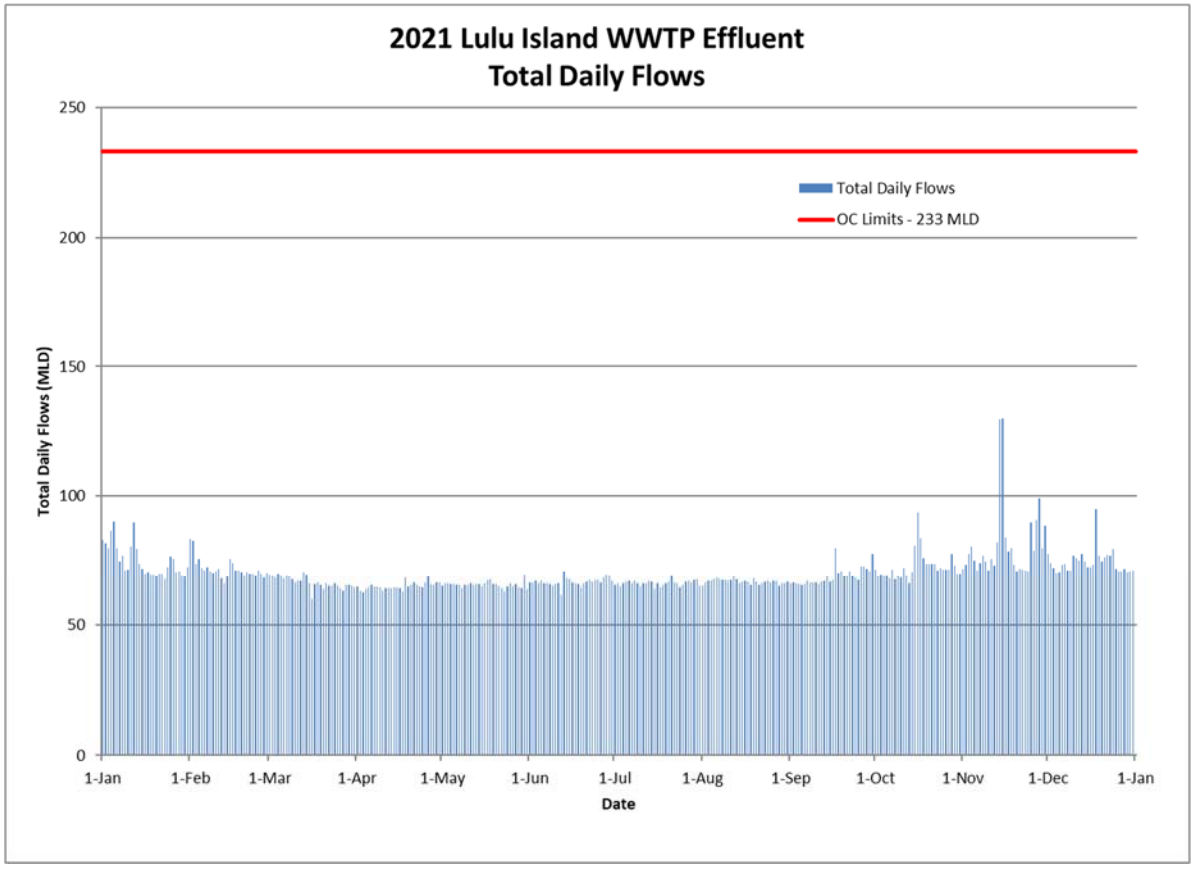
DAILY DISCHARGE LIMITS

There were no exceedances of daily discharge limits specified by the OC in 2021.

6.2.2 OPERATIONAL SUMMARY

A total of 25,526 ML of wastewater was treated at the Lulu Island WWTP in 2021. The average daily flow of 69.9 MLD was 0.9% lower than 2020. The highest average daily flow of 130 MLD (Figure 6.1) and a peak instantaneous flow of 194 MLD were recorded on November 15.

FIGURE 6.1 LULU ISLAND WWTP – 2021 EFFLUENT TOTAL DAILY FLOWS



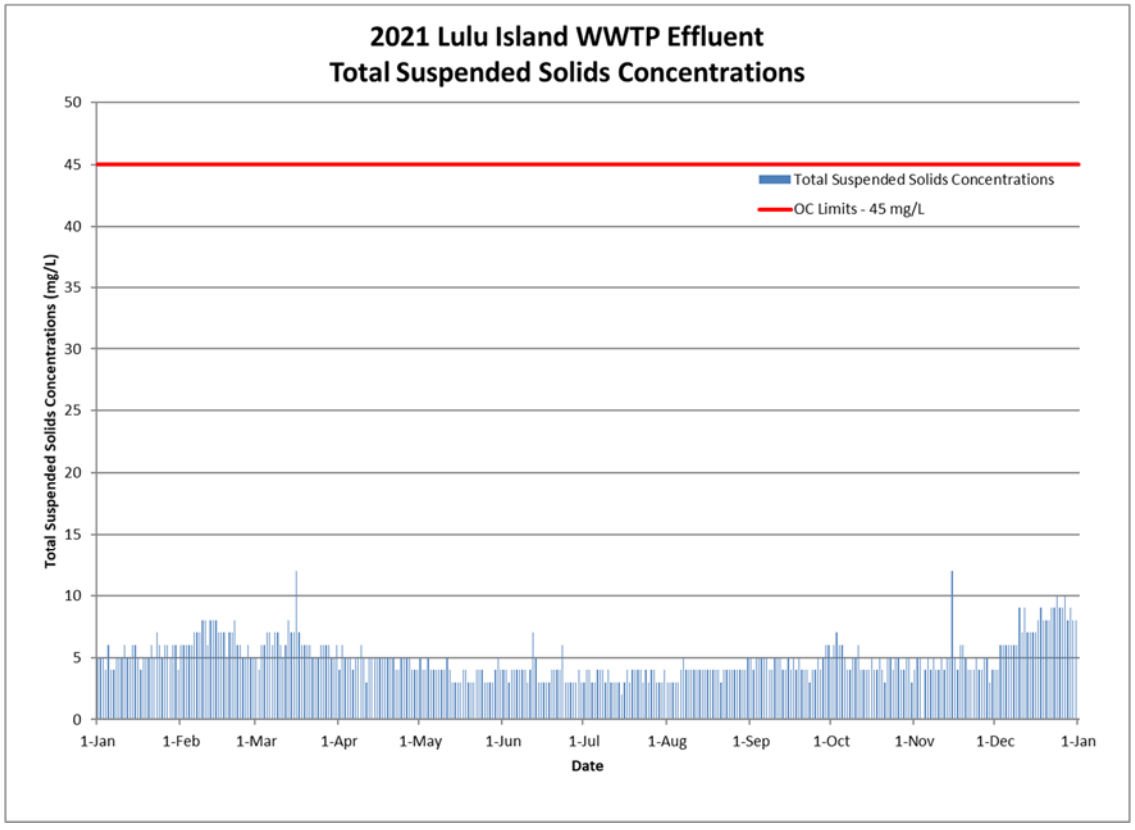
The influent BOD_5 concentrations were between 189 and 321 mg/L with an average of 260 mg/L. The influent SS concentrations were between 154 and 290 mg/L with an average of 216 mg/L. Influent SS loadings of 5,482 tonnes/year and influent BOD_5 loadings of 6,616 tonnes/year were 4.2% and 5.5% lower, respectively, than in 2020 (Table 6.4).

TABLE 6.4 LULU ISLAND WWTP – 2012–2021 ANNUAL AVERAGE DATA FOR FLOW, SS, AND BOD_5

YEAR	FLOWS MLD	Suspended Solids mg/L		Suspended Solids Tonnes/year		BOD_5	$CBOD_5$	BOD_5	$CBOD_5$
						mg/L		Tonnes/year	
		INF	EFF	INF	EFF	INF	EFF	INF	EFF
2012	71.0	201	5	5210	142	263	<5	6856	126
2013	69.4	206	5	5205	134	263	5	6722	130
2014	70.7	205	5	5276	128	263	5	6813	139
2015	69.2	216	5	5431	133	273	6	6903	134
2016	70.0	217	5	5541	132	266	6	6853	149
2017	70.6	213	6	5478	150	266	6	6946	169
2018	69.8	214	7	5439	188	279	8	7146	208
2019	68.9	233	6	5851	139	286	5	7216	148
2020	70.5	222	5	5720	133	270	6	7004	155
2021	69.9	216	5	5482	127	260	6	6616	154

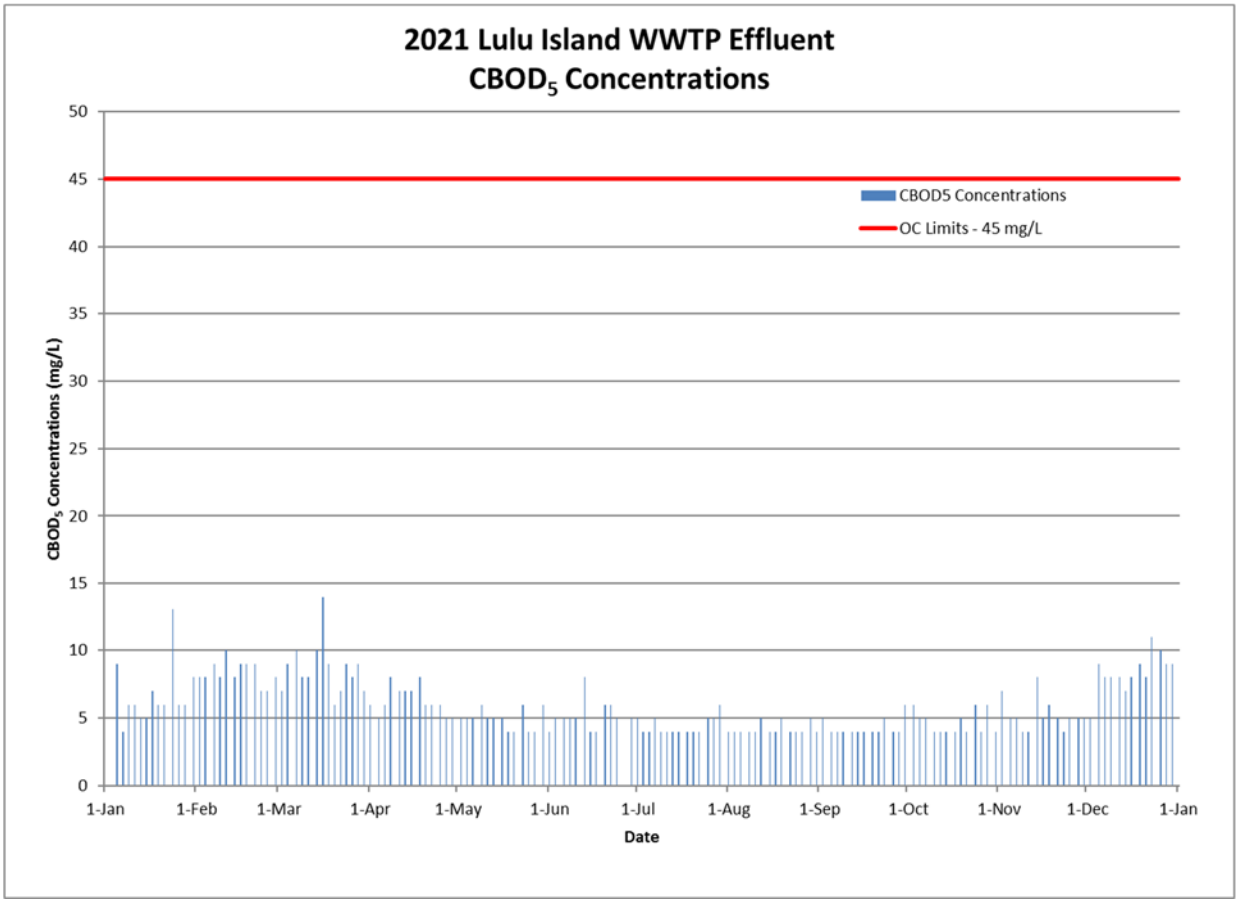
The effluent SS concentrations were between 2 and 12 mg/L with an average of 5 mg/L (Figure 6.2).

FIGURE 6.2 LULU ISLAND WWTP – 2021 EFFLUENT TSS CONCENTRATIONS



The effluent $CBOD_5$ levels were between <4 and 14 mg/L with an average of 6 mg/L (Figure 6.3). The effluent SS loadings of 127 tonnes/year were 4.5% lower than in 2020. The effluent $CBOD_5$ loadings of 154 tonnes/year were 0.6% lower than in 2020.

FIGURE 6.3 LULU ISLAND WWTP – 2021 EFFLUENT TOTAL $CBOD_5$ CONCENTRATIONS



In 2021, the average percent reduction of SS was 98% and the percent reduction for BOD_5 was 98%.

6.3 WASTEWATER SYSTEMS EFFLUENT REGULATIONS (WSER)

The WSER specifies the limits for the substances that are authorized to be deposited by any wastewater system. The effluent quality standards and limits for the Lulu Island WWTP are shown in Table 6.6.

TABLE 6.6 LULU ISLAND WWTP – WSER AUTHORIZED LEVELS

Monthly average carbonaceous biochemical oxygen demand (CBOD)	25 mg/L
Monthly average concentration of suspended solids (SS)	25 mg/L
Monthly average concentration of total residual chlorine	0.02 mg/L

Quarterly monitoring reports were submitted through ECCC's Effluent Regulatory Reporting Information System (ERRIS). The effluent monitoring data reported were number of days that effluent was deposited,

total volume of effluent deposited in cubic meters, average concentration of CBOD in mg/L, average concentration of SS in mg/L, and acute lethality.

In 2021, WSER effluent quality standards and limits on CBOD and SS were met at the Lulu Island WWTP as summarized in Table 6.7.

TABLE 6.7 LULU ISLAND WWTP – 2021 WSER MONITORING REPORT

	Number of days that effluent was deposited	Total volume of effluent deposited (m^3)	Average CBOD (mg/L)	Average concentration of suspended solids (mg/L)	Average concentration of total residual chlorine (mg/L)
January	31	2,322,412	7	5	
February	28	2,007,556	8	7	
March	31	2,060,579	9	6	
April	30	1,946,092	6	5	<0.02
May	31	2,027,790	5	4	<0.02
June	30	1,997,715	5	4	<0.02
July	31	2,048,237	4	3	<0.02
August	31	2,067,782	3	4	<0.02
September	30	2,060,911	4	5	<0.02
October	31	2,246,740	4	5	<0.02
November	30	2,434,369	5	5	
December	31	2,305,794	8	8	

Acute Lethality Test Results

Sample Collection Date/Time	EPS 1 / RM / 13	EPS 1 / RM / 50	Was sample acutely lethal?
2/9/2021 8:32	Multi-Concentration Test	Yes	No
5/5/2021 8:28	Multi-Concentration Test	Yes	No
8/4/2021 7:50	Multi-Concentration Test	Yes	No
11/3/2021 8:00	Multi-Concentration Test	Yes	No
12/6/2021 8:30	Multi-Concentration Test	Yes	Yes
12/14/2021 8:11	Multi-Concentration Test	Yes	No

6.4 SECONDARY PROCESS

The secondary process operated using an average of three TFs, three aeration tanks in solids contact mode, and three secondary clarifiers in service in 2021.

The average soluble $CBOD_5$ ($SCBOD_5$) removal across the TFs was 76%. The trickling filter effluent $SCBOD_5$ concentrations were in the range of 12 to 33 mg/L with an average of 20 mg/L.

The mixed liquor suspended solids (MLSS) were between 1,150 to 2,220 mg/L with an average of 1,611 mg/L. The average mean cell residence time (MCRT) was 1.56 days and it varied from 0.97 days to 2.63 days.

Power interruptions on June 12 and November 15, resulted in a bypass of the TF unit where the primary effluent received partial secondary treatment through the solids contact tanks. In both instances, the plant maintained compliance with the Authorized Discharge section of its OC and the 24-hour final effluent sample TSS concentrations met the final effluent standards. In addition, the MOECCS WQOs for TSS and dissolved oxygen were expected to have been met in the Fraser River. All events were managed by the WWTP according to the Emergency Procedures clause of the OC.

6.5 SOLIDS TREATMENT

Primary sludge from the primary sedimentation tanks was thickened in one gravity thickener and screened through one sludge screen. The average Thickened Screened Primary Sludge (TSPS) total solids content was 4.8%.

One Dissolved Air Flotation Thickener (DAFT) unit was used to thicken waste secondary sludge from the mixed liquor channel. The average Thickened Waste Secondary Sludge (TWSS) total solids content was 4.5% with a subnatant suspended solids concentration of 50 mg/L and Thickened Bottom Sludge (TBS) suspended solids concentration of 76 mg/L. The average polymer dosage was 4.9 kg/tonne.

Primary sludge and secondary sludge were mixed in a sludge blending tank. Treated mixed sludge averaged approximately 64% primary sludge and 36% secondary sludge over the year with seasonal variation to accommodate the changing biomass requirements for secondary treatment. The average total and volatile solids content of the mixed sludge were 4.5% and 88%, respectively.

Sludge was digested in two mesophilic digesters. The average HRT was 29 days with a volatile solids reduction of 64% and an organic loading rate of 1.43 kg/m^3. Bicarbonate alkalinity concentrations ranged between 4,310 and 5,610 mg/L.

6.6 DEWATERED SLUDGE

Digested sludge dewatering was completed via two centrifuges. The centrifuges were normally operated six days per week on an alternating basis. The average dewatered digested sludge (biosolids) total solids content was 23.0%. The average solids recovery was 95.8% and the average centrate suspended solids concentration was 892 mg/L. The average polymer dosage was 12.4 kg/tonne.

A comprehensive summary of the Lulu Island WWTP performance and monitoring results is presented in Tables 6.8 to 6.11.

TABLE 6.8 LULU ISLAND WWTP – 2021 ROUTINE MONITORING RESULTS AND PERFORMANCE SUMMARY

MONTH	Max. Inst.Flow Rate (m3/sec)	Total Daily Effluent Flow (MLD)			Grab pH Average FINAL EFF	Max. Comp. Un-ionized NH3 mg/L FIN EFF	Grab NH3 Ave. mg/L FINAL EFF	96 hr LC50 (%v/v) FINAL EFFLUENT Regular
		Max.	Min.	Ave.				
JAN	1.73	90.0	67.5	74.9	7.0	0.53	25.4	>100
FEB	1.34	83.3	66.1	71.7	7.1	0.50	26.8	>100
MAR	1.34	70.5	59.8	66.5	7.2	0.61	33.8	>100
APR	1.19	68.6	62.6	64.9	7.2	0.62	35.5	>100
MAY	1.24	69.4	62.9	65.4	7.1	0.56	32.2	>100
JUN	1.19	70.7	61.4	66.6	7.1	0.53	27.8	>100
JUL	1.04	69.3	63.9	66.1	7.2	0.60	30.9	>100
AUG	1.06	68.4	64.9	66.7	7.2	0.69	30.4	>100
SEP	1.23	79.8	65.3	68.7	7.1	0.68	28.8	>100
OCT	1.41	93.7	66.1	72.5	7.2	0.60	27.8	>100
NOV	2.24	130.0	70.8	81.1	7.1	0.53	26.6	>100
DEC	1.75	94.8	70.3	74.4	7.2	0.40	33.0	81.7
# Samples	-	-	-	365	72	156	59	13
Maximum-Yr.	**2.24**	**130**	**-**	**-**	**7.3**	**0.69**	**44.1**	**>100**
Minimum-Yr.	**-**	**-**	**59.8**	**-**	**6.9**	**0.20**	**13.4**	**81.7**
Average-Yr.	**-**	**-**	**-**	**69.9**	**7.2**	**0.45**	**29.9**	**>99**

MONTH	Ave. Temp. (°C) FINAL EFF	Average DO (mg/L) FINAL EFF	SHS Dose (mg/L Cl2) EFF	Ave. Residual Chlorine FINAL EFFLUENT (mg/L)		SBS Dose (mg/L SO2) EFF	SO_2 Outfall (mg/L) EFF	Geometric Mean Fecal Coliform (MPN/100mL) AT EFFLUENT WEIR	
				Before SBS	After SBS			Monthly	Max. 30 d GMean
JAN	15	2.9	-	-	-	-	-	-	-
FEB	15	2.5	-	-	-	-	-	-	-
MAR	16	2.5	-	-	-	-	-	-	-
APR	18	2.5	1.9	0.66	<0.02	2.6	1.4	31	32
MAY	19	2.8	1.8	0.60	<0.02	2.3	1.6	29	34
JUN	21	2.6	1.9	0.53	<0.02	2.2	1.2	32	34
JUL	22	2.4	2.3	0.51	<0.02	2.3	1.2	28	35
AUG	23	2.4	2.4	0.53	<0.02	2.3	1.1	28	28
SEP	22	2.4	2.1	0.51	<0.02	2.3	1.3	38	45
OCT	20	2.4	2.0	0.55	<0.02	2.3	1.4	28	46
NOV	18	3.2	-	-	-	-	-	-	-
DEC	15	2.5	-	-	-	-	-	-	-
# Samples	59	15	216	219	219	226	232	61	61
Maximum-Yr.	**23**	**3.2**	**3.3**	**0.9**	**<0.02**	**3.7**	**8.12**	**130**	**46**
Minimum-Yr.	**13**	**2.2**	**0.4**	**0.3**	**<0.02**	**0.3**	**0.18**	**<18**	**18**
Average-Yr.	**19**	**2.6**	**2.0**	**0.6**	**<0.02**	**2.3**	**1.35**	**-**	**31**
Geometric Mean	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**31**	**-**

(1) pH, Dissolved Oxygen, Temperature,Residual Chlorine, 96 hour LC50 and Coliform are determined on grab samples; all other parameters are determined on 24 hr. flow proportioned composite samples.
(2) Effluent is disinfected between April 1 and October 31.
(3) Average values containing one or more results below the detection limit are preceded with a "<" symbol.

TABLE 6.8 CONT'D: LULU ISLAND WWTP – 2021 ROUTINE MONITORING RESULTS AND PERFORMANCE SUMMARY

MONTH	Total Suspended Solids (mg/L)						Suspended Solids Ave. % Reduction		Ave. Susp. Solids Loadings (Tonnes/day)		Ave Conductivity (umhos/cm)	
	RAW INFLUENT			FINAL EFFLUENT								
	Max.	Min.	Ave.	Max.	Min.	Ave.	Primary	Final	Influent	Effluent	INF	EFF
JAN	261	158	209	7	4	5	77	97	15.6	0.4	581	634
FEB	252	191	215	8	5	7	76	97	15.4	0.5	600	657
MAR	290	202	238	12	4	6	78	97	15.9	0.4	676	748
APR	285	211	236	6	3	5	80	98	15.3	0.3	624	712
MAY	269	180	232	5	3	4	77	98	15.2	0.2	617	690
JUN	272	215	239	7	3	4	78	98	15.9	0.3	596	672
JUL	271	204	229	4	2	3	77	98	15.1	0.2	592	664
AUG	276	166	211	5	3	4	73	98	14.1	0.3	596	670
SEP	238	161	198	6	3	5	73	98	13.6	0.3	617	690
OCT	254	161	194	7	3	5	74	98	14.0	0.3	619	684
NOV	252	159	197	12	3	5	74	98	16.0	0.4	580	637
DEC	238	154	193	10	4	8	75	96	14.3	0.6	628	686
# Samples	-	-	362	-	-	364	356	361	362	364	362	364
Maximum-Yr.	**290**	**-**	**-**	**12**	**-**	**-**	**83**	**99**	**30.3**	**1.6**	**967**	**1050**
Minimum-Yr.	**-**	**154**	**-**	**-**	**2**	**-**	**62**	**93**	**10.9**	**0.1**	**417**	**413**
Average-Yr.	**-**	**-**	**216**	**-**	**-**	**5**	**76**	**98**	**15.0**	**0.3**	**610**	**679**
Total to Date - Suspended Solids Loadings (Tonnes):									**5482**	**127**		

MONTH	BOD_5 (mg/L)			$CBOD_5$ (mg/L)			Average BOD_5 % Reduction		Average BOD_5/$CBOD_5$ Loadings (Tonnes/day)		Average COD (mg/L)	
	RAW INFLUENT			FINAL EFFLUENT					Influent	Effluent		
	Max.	Min.	Ave.	Max.	Min.	Ave.	Primary	Final	BOD_5	$CBOD_5$	Inf	Eff
JAN	270	214	241	13	4	7	48	97	18.3	0.5	556	53
FEB	321	220	262	10	7	8	47	97	19.2	0.6	596	58
MAR	320	257	285	14	6	9	46	97	18.9	0.6	650	59
APR	301	257	272	8	5	6	44	98	17.7	0.4	633	57
MAY	295	252	272	6	<4	<5	49	98	17.9	<0.4	612	53
JUN	319	255	283	8	<4	<5	49	98	19.0	<0.4	630	53
JUL	275	249	267	6	<4	<4	46	98	17.7	<0.4	616	53
AUG	298	213	257	5	<4	<4	44	98	17.3	<0.4	601	53
SEP	284	222	249	6	<4	<4	42	98	17.1	<0.4	602	54
OCT	276	192	244	6	<4	<5	47	98	17.6	<0.4	567	54
NOV	274	189	236	8	4	5	51	98	18.8	0.4	522	51
DEC	280	216	249	11	5	8	51	97	18.3	0.6	568	61
# Samples	-	-	99	-	-	157	98	98	99	157	362	260
Maximum-Yr.	**321**	**-**	**-**	**14**	**-**	**-**	**60**	**99**	**23.0**	**1.0**	**780**	**81**
Minimum-Yr.	**-**	**189**	**-**	**-**	**<4**	**-**	**30**	**95**	**14.2**	**<0.3**	**331**	**39**
Average-Yr.	**-**	**-**	**260**	**-**	**-**	**<6**	**47**	**98**	**18.1**	**<0.5**	**596**	**55**
Total to Date - Biochemical Oxygen Demand Loadings (Tonnes):									**6616**	**154**		

(1) Percent reduction is calculated only for days when both influent and effluent samples are tested.
(2) Half the detection limit is used for less than values when calculating the monthly CBOD and TSS averages reported to WSER.
(3) Average values containing one or more results below the detection limit are preceded with a "<" symbol.

TABLE 6.9 LULU ISLAND WWTP – 2021 COMPREHENSIVE PROGRAM INFLUENT CONCENTRATIONS SUMMARY

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min.	Average
Aluminum Dissolved (µg/L)	40	45	29	28	23	22	24	31	32	37	48	42	48	22	33
Aluminum Total (µg/L)	253	491	245	371	244	338	260	276	293	291	387	539	539	244	332
Arsenic Total (µg/L)	0.7	1.0	0.8	0.8	1.0	0.8	0.7	0.9	0.8	0.8	0.9	0.9	1.0	0.7	0.8
Barium Dissolved (µg/L)	6.0	6.6	5.4	5.3	5.0	24.6	5.2	5.0	5.4	5.4	6.4	5.8	24.6	5.0	7.2
Barium Total (µg/L)	14.1	18.6	15.2	16.7	14.2	43.1	14.2	12.5	15.0	14.2	16.1	16.3	43.1	12.5	17.5
Boron Dissolved (µg/L)	73	100	80	75	75	87	112	88	90	89	130	83	130	73	90
Boron Total (µg/L)	75	101	82	96	74	84	117	92	92	89	142	87	142	74	94
Cadmium Dissolved (µg/L)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cadmium Total (µg/L)	<0.2	0.3	0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	0.4	<0.2	<0.2
Calcium Total (µg/L)	14300	13300	12200	13300	11900	11800	15300	13300	14100	16300	19000	17800	19000	11800	14400
Chromium Dissolved (µg/L)	0.9	0.8	0.7	0.6	0.6	<0.5	0.5	0.7	0.5	0.7	0.8	0.7	0.9	<0.5	<0.7
Chromium Total (µg/L)	2.1	2.5	1.8	2.9	2.1	1.5	1.4	1.6	1.5	1.6	2.1	2.1	2.9	1.4	1.9
Cobalt Dissolved (µg/L)	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	0.9	0.6	0.9	<0.5	<0.6
Cobalt Total (µg/L)	1.0	0.8	0.7	0.7	0.8	0.8	0.5	0.7	0.6	0.9	1.3	1.0	1.3	0.5	0.8
Copper Dissolved (µg/L)	8.4	12.8	11.6	11.1	11.4	6.3	7.1	8.9	7.3	8.6	6.6	5.8	12.8	5.8	8.8
Copper Total (µg/L)	39.3	53.1	40.3	37.9	40.6	41.8	31.8	32.4	33.1	33.2	30.1	29.1	53.1	29.1	36.9
Cyanide Total (mg/L)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoride (mg/L)	<0.05	0.36	<0.05	0.07	0.14	<0.05	<0.05	<0.05	0.07	<0.05	<0.05	0.06	0.36	<0.05	<0.09
Hardness as CACO3 (mg/L)	58.7	57.5	52.9	55.2	50.4	50.4	58.4	52.6	53.2	62.8	72.2	69.7	72.2	50.4	57.8
Iron Dissolved (µg/L)	794	937	806	771	763	581	547	530	532	665	646	664	937	530	686
Iron Total (µg/L)	1990	2410	2280	2280	2160	2190	1800	1530	1580	1850	2120	2290	2410	1530	2040
Lead Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Lead Total (µg/L)	1.6	4.4	1.9	1.7	1.8	2.0	1.6	1.7	2.1	2.0	2.1	1.7	4.4	1.6	2.1
Magnesium Total (µg/L)	5610	5910	5440	5370	5020	5080	4910	4720	4350	5360	6010	6120	6120	4350	5330
Manganese Dissolved (µg/L)	60.2	57.8	55.6	55.4	52.0	56.7	46.5	40.9	44.0	61.0	60.0	61.0	61	40.9	54.3
Manganese Total (µg/L)	84.6	85.7	84.5	84.9	77.4	76.6	72.3	59.9	67.4	84.4	87.5	92.1	92.1	59.9	79.8
Mercury Total (µg/L)	<0.05	0.09	<0.05	<0.05	0.08	0.06	0.13	<0.05	<0.05	0.08	0.07	0.06	0.13	<0.05	<0.07
Methylene Blue Active Substanc (mg/L)	1.7	2.5	2.8	2.1	3.2	3.1	2.1	2.8	2.7	2.6	2.5	1.9	3.2	1.7	2.5
Molybdenum Dissolved (µg/L)	0.9	1.8	0.9	1.0	0.9	0.9	1.1	0.9	0.9	1.4	1.7	0.9	1.8	0.9	1.1
Molybdenum Total (µg/L)	1.3	2.6	1.5	1.6	1.3	1.5	1.7	1.3	1.5	2.0	2.4	1.4	2.6	1.3	1.7
Nickel Dissolved (µg/L)	2.8	2.4	1.7	1.8	1.4	1.5	1.4	1.7	1.3	1.8	3.4	2.3	3.4	1.3	2.0
Nickel Total (µg/L)	4.5	3.5	3.1	3.4	2.7	2.8	2.5	2.9	2.5	3.0	5.2	4.0	5.2	2.5	3.3
Nitrogen - Ammonia as N (mg/L)	26.9	28.3	30.2	31.5	30.1	30.4	28.8	30.2	30.9	30.3	24.8	28.5	31.5	24.8	29.2
Nitrogen - Nitrate as N (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.04	0.04	<0.01	<0.01
Nitrogen - Nitrite as N (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrogen - Total Kjeldahl (mg/L)	39	48	46	48	45	43	43	46	41	42	35	42	48	35	43
Oil & Grease (mg/L)	39	28	29	34	35	31	26	24	36	29	19	20	39	19	29
Phenol (mg/L)	0.03	0.05	0.05	0.04	0.05	0.05	0.05	0.04	0.05	0.06	0.03	0.04	0.06	0.03	0.05
Phosphorus Dissolved (µg/L)	2380	2770	2700	2930	2880	3000	2570	2770	2960	2780	2120	2310	3000	2120	2680
Phosphorus Total (µg/L)	4180	4690	4660	5030	5020	4820	4240	4640	5020	4650	4270	4420	5030	4180	4640
Selenium Total (µg/L)	0.7	0.6	0.6	0.9	0.9	0.6	0.7	0.8	0.6	0.6	0.6	0.7	0.9	0.6	0.7
Silver Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Silver Total (µg/L)	0.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	<0.5	<0.5
Sulphate (mg/L)	17.5	13.9	12.6	11.2	10.7	9.9	10.8	9.8	9.0	11.9	17.0	17.8	17.8	9.0	12.7
Zinc Dissolved (µg/L)	20	21	20	20	19	24	21	22	19	19	14	18	24	14	20
Zinc Total (µg/L)	92	114	107	106	112	114	129	99	105	103	94	94	129	92	106

TABLE 6.10 LULU ISLAND WWTP – 2021 COMPREHENSIVE PROGRAM EFFLUENT CONCENTRATIONS SUMMARY

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min.	Average
Aluminum Dissolved (µg/L)	13	23	10	8	7	7	7	9	9	11	11	13	23	7	11
Aluminum Total (µg/L)	29	37	21	16	15	17	17	26	20	26	25	30	37	15	23
Arsenic Total (µg/L)	0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	0.5	<0.5	0.6	0.6	0.5	0.6	<0.5	<0.5
Barium Dissolved (µg/L)	2.6	6.4	3.2	2.6	2.4	3.0	2.0	2.4	2.7	3.3	2.6	3.0	6.4	2.0	3.0
Barium Total (µg/L)	3.3	7.9	4.2	3.2	2.8	3.7	2.6	3.0	3.4	4.3	3.3	4.1	7.9	2.6	3.8
Boron Dissolved (µg/L)	73	84	86	75	77	87	98	87	93	87	103	94	103	73	87
Boron Total (µg/L)	73	85	94	74	76	88	100	89	93	89	103	99	103	73	89
Cadmium Dissolved (µg/L)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cadmium Total (µg/L)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Calcium Total (µg/L)	13200	12400	10500	11000	10200	10500	13200	13400	12500	14500	16800	15900	16800	10200	12800
Chromium Dissolved (µg/L)	0.6	0.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	0.5	0.7	<0.5	<0.5
Chromium Total (µg/L)	0.7	0.8	0.6	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	0.5	0.6	0.6	0.8	<0.5	<0.6
Cobalt Dissolved (µg/L)	0.7	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	0.8	0.5	0.8	<0.5	<0.5
Cobalt Total (µg/L)	0.8	0.6	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	0.5	0.8	0.6	0.8	<0.5	<0.6
Copper Dissolved (µg/L)	3.8	5.6	3.6	5.3	4.9	5.7	5.8	6.3	5.1	5.4	2.1	2.6	6.3	2.1	4.7
Copper Total (µg/L)	8.4	11.4	12.4	8.2	7.3	8.8	8.5	8.1	7.9	8.2	6.0	7.3	12.4	6.0	8.5
Cyanide Total (mg/L)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoride (mg/L)	0.07	<0.05	<0.05	<0.05	0.10	<0.05	<0.05	<0.05	0.06	<0.05	<0.05	0.06	0.1	<0.05	<0.06
Hardness as CaCO3 (mg/L)	54.9	54.5	47.2	48.4	44.5	45.9	51.8	52.8	50.0	56.6	65.4	63.5	65.4	44.5	53.0
Iron Dissolved (µg/L)	108	201	140	121	104	107	113	111	107	131	111	127	201	104	123
Iron Total (µg/L)	212	392	317	227	195	201	213	214	219	274	219	289	392	195	248
Lead Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Lead Total (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Magnesium Total (µg/L)	5310	5710	5070	5100	4620	4760	4550	4710	4550	4930	5710	5790	5790	4550	5070
Manganese Dissolved (µg/L)	18.5	52.1	47.8	51.9	42.7	35.2	11.0	25.3	27.1	49.7	40.5	41.6	52.1	11.0	37.0
Manganese Total (µg/L)	34.5	63.0	59.1	55.6	46.4	42.2	16.1	30.3	34.8	56.1	46.7	58.9	63.0	16.1	45.3
Mercury Total (µg/L)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Methylene Blue Active Substanc (mg/L)	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.3	0.3	0.3	0.2	0.3	0.3	0.2	0.2
Molybdenum Dissolved (µg/L)	0.8	1.0	0.7	0.9	0.8	0.8	0.8	0.9	2.1	0.6	1.0	0.7	2.1	0.6	0.9
Molybdenum Total (µg/L)	0.8	1.2	0.8	1.0	0.8	0.9	0.8	1.1	0.8	0.7	1.1	0.8	1.2	0.7	0.9
Nickel Dissolved (µg/L)	3.5	2.3	1.6	1.6	1.4	1.4	1.3	1.6	1.3	1.7	2.9	2.1	3.5	1.3	1.9
Nickel Total (µg/L)	3.6	2.4	1.8	1.7	1.5	1.6	1.3	1.7	1.4	1.9	3.0	2.3	3.6	1.3	2.0
Nitrogen - Ammonia as N (mg/L)	30.7	31.8	40.5	36.7	37.6	34.8	38.5	36.1	36.8	36.5	32.4	38.8	40.5	30.7	35.9
Nitrogen - Nitrate as N (mg/L)	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	0.02	<0.01	0.03	0.03	0.03	<0.01	<0.01
Nitrogen - Nitrite as N (mg/L)	0.01	<0.01	<0.01	<0.01	0.01	0.02	0.05	0.04	0.03	0.02	0.01	<0.01	0.05	<0.01	<0.02
Nitrogen - Total Kjeldahl (mg/L)	32	33	44	37	38	36	42	41	36	39	35	42	44	32	38
Oil & Grease (mg/L)	5	<3	4	<3	<3	<4	5	<3	<4	<3	<3	<3	5	<3	<4
Phenol (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.01	<0.01	<0.01
Phosphorus Dissolved (µg/L)	2260	2380	3210	2620	2950	2670	3330	3320	3310	3060	2710	2840	3330	2260	2890
Phosphorus Total (µg/L)	2410	2680	3520	2810	3060	2880	3610	3510	3460	3260	2790	3270	3610	2410	3110
Selenium Total (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Silver Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Silver Total (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sulphate (mg/L)	19.9	18.9	19.2	20.9	18.4	19.4	18.1	18.9	17.9	20.7	24.2	19.7	24.2	17.9	19.7
Zinc Dissolved (µg/L)	18	20	17	21	25	25	24	22	17	19	14	13	25	13	20
Zinc Total (µg/L)	21	25	24	23	27	28	26	26	20	19	18	19	28	18	23

TABLE 6.11 LULU ISLAND WWTP – 2021 COMPREHENSIVE PROGRAM LOADINGS SUMMARY

	INFLUENT				EFFLUENT			
	Max.	Min.	Ave.	Tonnes per	Max.	Min.	Ave.	Tonnes per
Parameters	kg/day			year	kg/day			year
Aluminium Dissolved	3.7	1.5	2.3	0.9	1.6	0.5	0.7	0.3
Aluminum Total	40	16	23	8.5	2.6	1.0	1.6	0.6
Arsenic Total	0.07	0.05	0.06	0.02	0.05	<0.03	<0.04	<0.01
Barium Dissolved	1.6	0.3	0.5	0.2	0.4	0.1	0.2	0.1
Barium Total	2.9	0.8	1.2	0.4	0.6	0.2	0.3	0.1
Boron Dissolved	10	4.8	6.3	2.3	8.0	4.8	6.0	2.2
Boron Total	11	4.9	6.6	2.4	8.0	4.8	6.1	2.2
Cadmium Dissolved	<0.02	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
Cadmium Total	0.03	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.01
Calcium Total	1473	780	1002	367	1303	669	895	328
Chromium Dissolved	0.07	<0.03	<0.05	<0.02	0.05	<0.03	<0.04	<0.01
Chromium Total	0.19	0.09	0.13	0.05	0.06	<0.03	<0.04	<0.01
Cobalt Dissolved	0.07	<0.03	<0.04	<0.01	0.06	<0.03	<0.04	<0.01
Cobalt Total	0.10	0.03	0.06	0.02	0.06	<0.03	<0.04	<0.01
Copper Dissolved	0.9	0.4	0.6	0.2	0.4	0.2	0.3	0.1
Copper Total	3.7	2.1	2.5	0.9	0.9	0.5	0.6	0.2
Cyanide Total	<1.6	<1.3	<1.4	<0.5	<1.6	<1.3	<1.4	<0.5
Fluoride	25	<3.3	<6.0	<2.2	6.6	<3.2	<4.0	<1.5
Hardness as CaCO3	5598	3304	4025	1473	5071	2918	3687	1349
Iron Dissolved	66	35	48	17	14	6.8	8.6	3.1
Iron Total	169	102	141	52	28	13	17	6.3
Lead Dissolved	<0.04	<0.03	<0.04	<0.01	<0.04	<0.03	<0.04	<0.01
Lead Total	0.31	0.11	0.14	0.05	<0.04	<0.03	<0.04	<0.01
Magnesium Total	466	289	370	135	443	302	352	129
Manganese Dissolved	4.7	2.7	3.8	1.4	3.7	0.7	2.6	0.9
Manganese Total	6.8	4.0	5.5	2.0	4.4	1.1	3.1	1.2
Mercury Total	0.009	<0.003	<0.005	<0.002	<0.010	<0.003	<0.003	<0.001
Methylene Blue Active Substance	210	127	172	63	22	13	17	6
Molybdenum Dissolved	0.13	0.06	0.08	0.03	0.14	0.04	0.06	0.02
Molybdenum Total	0.19	0.09	0.12	0.04	0.09	0.05	0.06	0.02
Nickel Dissolved	0.26	0.09	0.14	0.05	0.26	0.09	0.13	0.05
Nickel Total	0.40	0.17	0.23	0.09	0.27	0.09	0.14	0.05
Nitrogen - Ammonia as N	2096	1918	2018	739	2850	2234	2482	908
Nitrogen - Nitrate as N	2.9	<0.6	<0.9	<0.3	2.3	<0.6	<1.0	<0.4
Nitrogen - Nitrite as N	<0.8	<0.6	<0.7	<0.3	3.3	<0.6	<1.3	<0.5
Nitrogen - Total Kjeldahl	3373	2714	2978	1090	3085	2319	2621	959
Oil & Grease	2913	1469	2009	735	373	<194	<248	<91
Phenol	4.2	2.2	3.1	1.1	0.8	<0.6	<0.7	<0.3
Phosphorus Dissolved	201	164	185	68	222	167	199	73
Phosphorus Total	334	282	320	117	242	180	214	78
Selenium Total	0.06	0.04	0.05	0.02	<0.04	<0.03	<0.04	<0.01
Silver Dissolved	<0.04	<0.03	<0.04	<0.01	<0.04	<0.03	<0.04	<0.01
Silver Total	0.05	<0.03	<0.04	<0.01	<0.04	<0.03	<0.04	<0.01
Sulphate	1318	598	888	325	1876	1190	1367	500
Zinc Dissolved	1.6	1.1	1.4	0.5	1.7	1.0	1.3	0.5
Zinc Total	8.6	6.6	7.3	2.7	1.9	1.3	1.6	0.6

7.0 NORTHWEST LANGLEY WWTP

7.0 NORTHWEST LANGLEY WWTP

7.1 EFFLUENT QUALITY

The quality of effluent from the Northwest Langley WWTP in 2021, along with the discharge monitoring parameters listed in OC 4339, is summarized in Table 7.1.

TABLE 7.1 NORTHWEST LANGLEY WWTP – 2021 PERFORMANCE SUMMARY

Operational Certificate 4339, December 21, 2017

				Number of Times Criteria Not Met											
Parameters	**Testing Frequency**	**OC Limits**	**Max. Value for the Year**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Total Discharge Flow (MLD)	Daily	42	38.8	0	0	0	0	0	0	0	0	0	0	0	0
$CBOD_5$ (mg/L)	1/week	45	25	0	0	0	0	0	0	0	0	0	0	0	0
Suspended Solids (mg/L)	1/week	45	29	0	0	0	0	0	0	0	0	0	0	0	0
COD_5 (Tonnes/Day)	1/week	0.50	0.45	0	0	0	0	0	0	0	0	0	0	0	0
Susp. Solids (Tonnes/Day)	1/week	0.55	0.78	0	0	0	0	0	0	0	0	0	0	1**	0
Chlorine Residual (mg/L)*	Daily	<0.1	N/A	0	0	0	0	0	0	0	0	0	0	0	0
Disinfection	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0

* Effluent disinfected between April 1 and October 31. Peracetic Acid is used as the primary disinfectant

** The event was managed by the WWTP according to the Emergency Procedures clause of the OC.

7.2 PERFORMANCE REVIEW AND OPERATIONAL SUMMARY

The MOECCS, under the provisions of the Environmental Management Act and in accordance with Metro Vancouver's ILWRMP, issued OC 4339 on December 21, 2017. The OC included authorized levels shown in Table 7.2.

TABLE 7.2 NORTHWEST LANGLEY WWTP – OPERATIONAL CERTIFICATE AUTHORIZED LEVELS

Daily authorized rate of discharge	42,000 cubic meters/day, maximum
5-day carbonaceous biochemical oxygen demand ($CBOD_5$)	45 mg/L, maximum
Total suspended solids (non-filterable residue) (TSS)	45 mg/L, maximum

The maximum daily discharge loadings for $CBOD_5$ and TSS are used for the calculation of the annual OC fees. For 2021, the maximum authorized daily loadings were 0.50 tonnes/day for $CBOD_5$ and 0.55 tonnes/day for TSS.

DISCHARGE MONITORING

A total of 26 parameters and two daily loading results for the final effluent are posted on Metro Vancouver's website on a monthly basis. Specific discharge monitoring levels apply to six parameters: total daily discharge flow, $CBOD_5$, SS, chlorine residual, and maximum daily loadings for $CBOD_5$ and SS.

7.2.1 PERFORMANCE REVIEW

PLANT BYPASSES

> Operational Certificate 4339 Requirement:
>
> "The discharge of effluent which has bypassed the designated treatment works is prohibited unless the approval of the Director is obtained and confirmed in writing."

There were no plant bypass events in 2021.

DISINFECTION

> Operational Certificate 4339 Requirement:
>
> "The effluent must be disinfected from April 1 to October 31, If chlorine is used, the effluent must be dechlorinated below 0.1 mg/L total residual chlorine before discharge."

From April 1 to October 31 inclusive, the Northwest Langley WWTP final effluent was disinfected using Peracetic Acid (PAA). The PAA dosage ranged from 0.67 to 1.66 mg/L with an average of 1.42 mg/L.

There were no disinfection interruption events in 2021.

The Fraser River fecal coliform WQO of 200 MPN/100 ml for the edge of the IDZ was predicted to have been met from April to October in 2021 as shown in Table 7.3.

TABLE 7.3 NORTHWEST LANGLEY WWTP – PREDICTED 30-DAY FECAL COLIFORM GEOMETRIC MEAN AT THE IDZ

Final Effluent	April	May	June	July	August	September	October
Max 30-day Geometric Mean*	67	589	694	834	1823	1067	1435
Dilution Factor**	51	51	51	51	51	51	51
IDZ Result ***	1.3	11.5	13.6	16.4	35.7	20.9	28.1
WQO (Met or Not Met)	Met	Met	Met	Met	Met	Met	Met

* Geometric Mean (MPN/100mL) over a 30-day period (effluent).

** Lowest seasonal average dilution factor: 48-h average dilution factor based on peak plant flow and low river flow conditions.

*** IDZ Result – determined by calculation of geometric mean of fecal coliform levels in the receiving water due to discharges of final effluent, for 30-day periods at the edge of the IDZ.

DAILY DISCHARGE LIMITS

There was one instance of suspended solids discharge loading reported to the MOECCS in 2021. The event was managed by the WWTP according to the Emergency Procedures clause of the OC. See Table 7.4 for a detailed summary of the event, including probable causes, mitigation measures, and potential environmental effects.

TABLE 7.4 NORTHWEST LANGLEY WWTP – CATEGORY 1 EVENTS REPORTED TO THE MOECCS

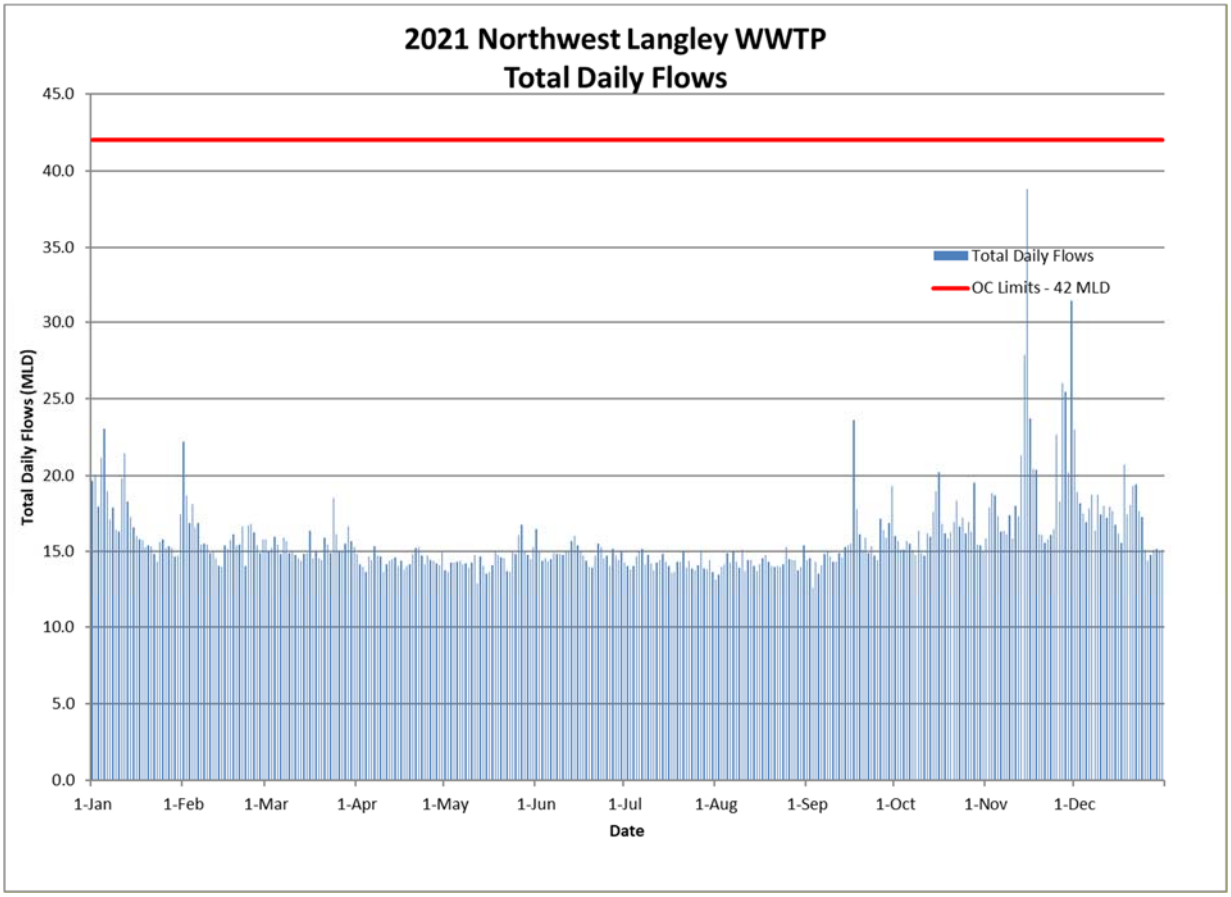
Plant	Date	Description	Quantity Discharged	Duration	Probable Cause	Mitigation Measures	Potential Environmental Effects (estimated based on dilution dispersion modelling of the receiving environment)
Northwest Langley	Nov 11	Suspended solids discharge loading*	0.23 tonnes/day	Not Applicable	Severe rain event caused high influent flow conditions.	No remedial action required.	The applicable BC Ministry of Environment and Climate Change Strategy (MOECCS) Water Quality Objectives for TSS and dissolved oxygen were expected to have been met in the Fraser River

*The event was managed by the WWTP according to the Emergency Procedures clause of the OC.

7.2.2 OPERATIONAL SUMMARY

A total of 5,777 ML of wastewater was treated at the Northwest Langley WWTP in 2021. The average daily flow of 15.8 MLD was 2.6% higher than in 2020. The highest average daily flow of 38.8 MLD and a peak instantaneous flow of 52.4 MLD occurred on November 15 (Figure 7.1).

FIGURE 7.1 NORTHWEST LANGLEY WWTP – 2021 EFFLUENT TOTAL DAILY FLOWS



The influent SS concentrations ranged from 135 to 386 mg/L with an average of 256 mg/L. The influent BOD_5 concentrations varied from 155 to 482 mg/L with an average of 277 mg/L. The influent SS loadings of 1,460 tonnes/year was 4.1% higher than in 2020 and the BOD_5 loadings of 1,612 tonnes/year was 3.4% higher than in 2020 (Table 7.5).

TABLE 7.5 NORTHWEST LANGLEY WWTP – 2012–2021 ANNUAL DATA FOR FLOW, SS AND BOD_5

YEAR	FLOWS MLD	Suspended Solids mg/L		Suspended Solids Tonnes/year		BOD_5 mg/L	$CBOD_5$ mg/L	BOD_5 Tonnes/year	$CBOD_5$ Tonnes/year
		INF	EFF	INF	EFF	INF	EFF	INF	EFF
2012	12.2	236	21	1049	96	289	12	1290	55
2013	12.2	258	20	1142	88	319	15	1431	66
2014	12.8	260	17	1213	82	299	14	1397	66
2015	12.9	279	19	1301	91	310	15	1431	68
2016	12.4	280	18	1258	83	292	15	1330	69
2017	12.8	292	18	1360	85	295	15	1399	68
2018	13.3	272	19	1309	91	329	17	1592	83
2019	14.4	261	19	1366	99	298	16	1575	84
2020	15.4	251	18	1403	102	276	15	1559	81
2021	15.8	256	17	1460	100	277	14	1612	77

The effluent SS concentrations were between 9 and 29 mg/L with an average of 17 mg/L (Figure 7.2). The effluent $CBOD_5$ concentrations were between <4 and 25 mg/L with an average of 14 mg/L (Figure 7.3). The average effluent SS loadings of 100 tonnes/year was 1.9% lower than in 2020 and the $CBOD_5$ loadings of 77 tonnes/year was 5.3% lower than in 2020. Average reductions of 93% and 95% for SS and BOD_5, respectively, were attained at the plant.

FIGURE 7.2 NORTHWEST LANGLEY WWTP – 2021 EFFLUENT TSS CONCENTRATIONS

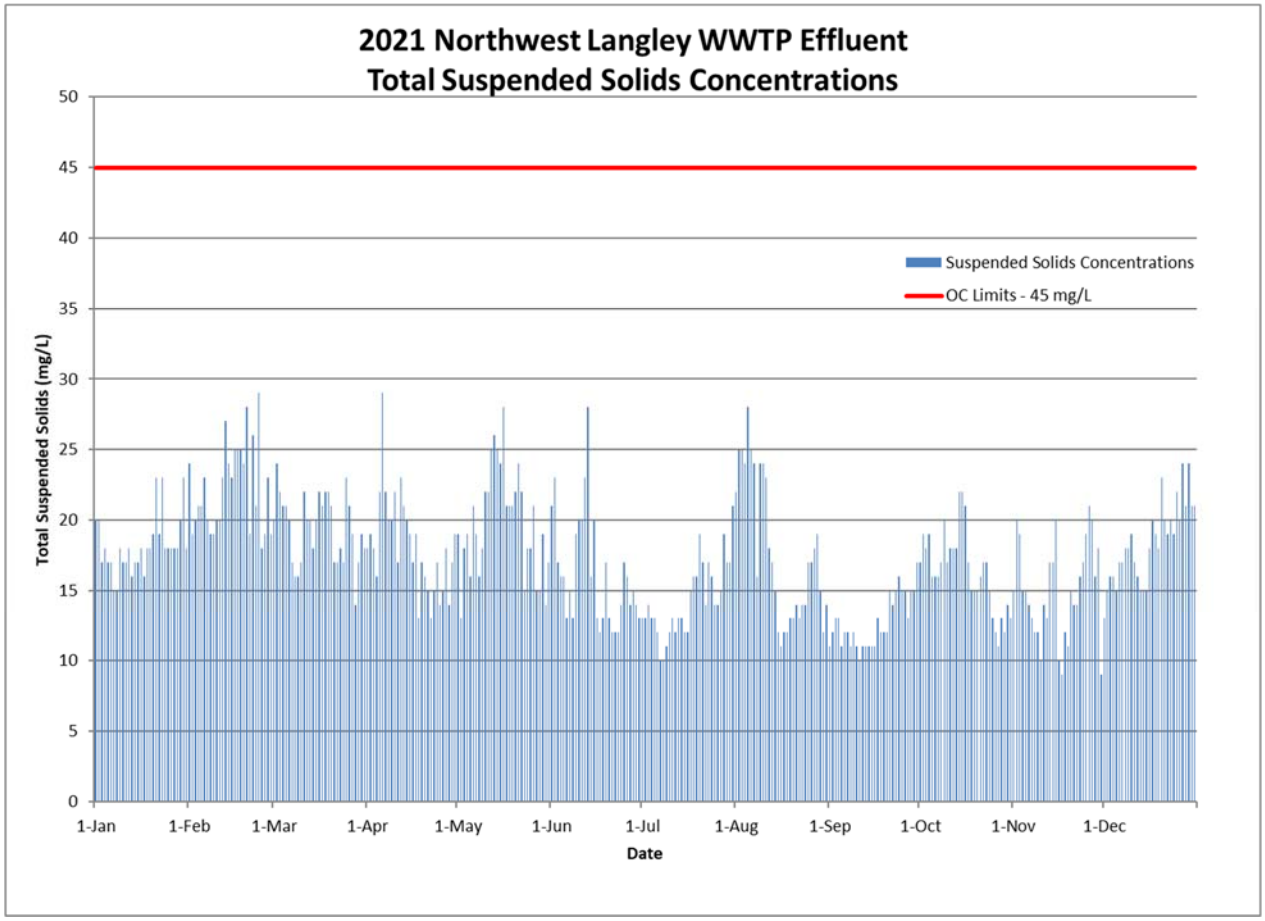
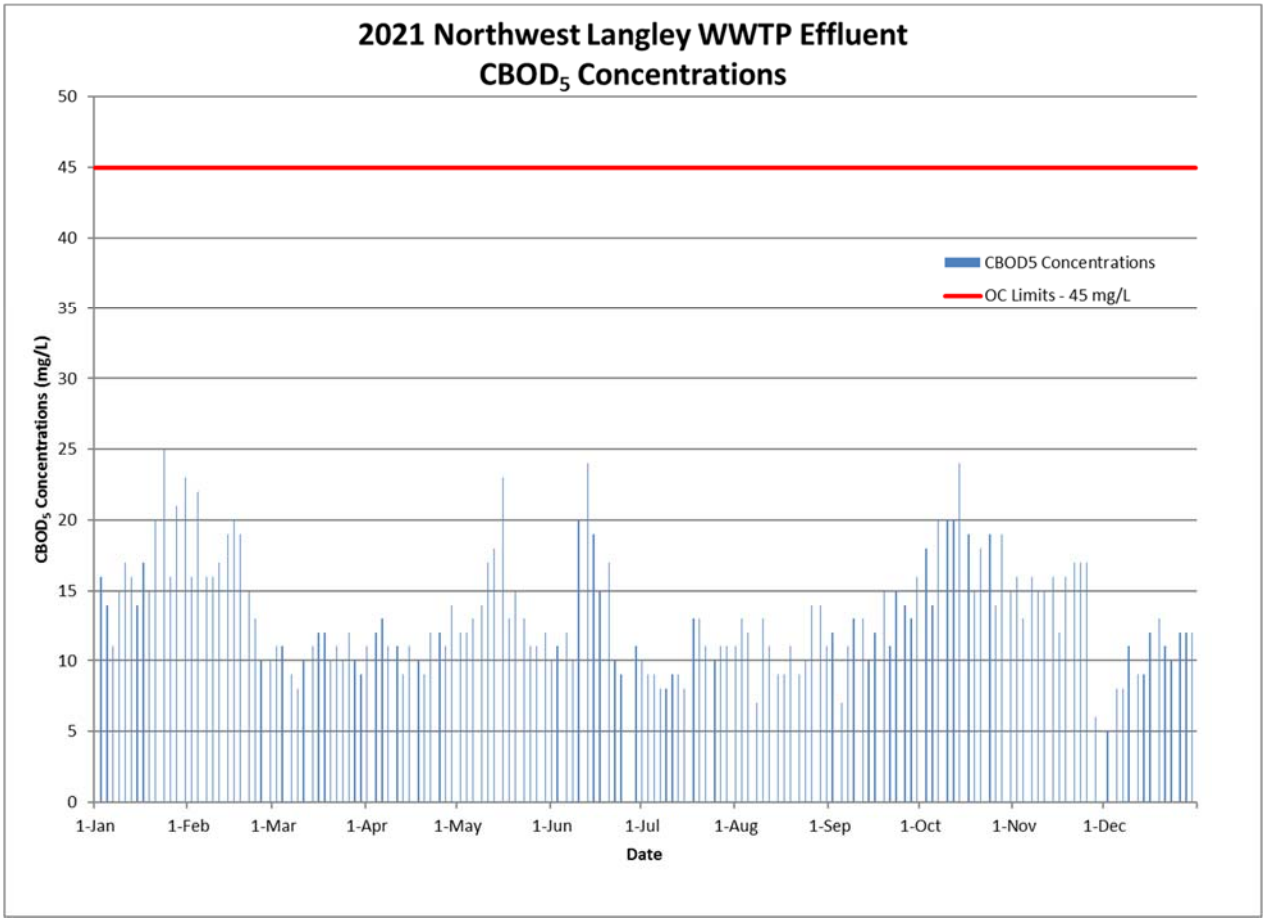


FIGURE 7.3 NORTHWEST LANGLEY WWTP – 2021 EFFLUENT TOTAL $CBOD_5$ CONCENTRATIONS



7.3 WASTEWATER SYSTEMS EFFLUENT REGULATIONS (WSER)

The WSER specifies the limits for the substances that are authorized to be deposited by any wastewater system. The effluent quality standards and limits for the Northwest Langley WWTP are shown in Table 7.7.

TABLE 7.7 NORTHWEST LANGLEY WWTP – WSER AUTHORIZED LEVELS

Quarterly average carbonaceous biochemical oxygen demand (CBOD)	25 mg/L
Quarterly average concentration of suspended solids (SS)	25 mg/L
Quarterly average concentration of total residual chlorine	0.02 mg/L

Quarterly monitoring reports were submitted through Environment and Climate Change Canada's Effluent Regulatory Reporting Information System (ERRIS). The effluent monitoring data reported were number of days that effluent was deposited, total volume of effluent deposited in cubic meters, average concentration of CBOD in mg/L, average concentration of SS in mg/L, and acute lethality.

In 2021, WSER effluent quality standards and limits on CBOD and SS were met at the Northwest Langley WWTP, as summarized in Table 7.8.

TABLE 7.8 NORTHWEST LANGLEY WWTP – 2021 WSER MONITORING REPORT

	Number of days that effluent was deposited	Total volume of effluent deposited (m^3)	Average CBOD (mg/L)	Average concentration of suspended solids (mg/L)
January-March	90	1,454,218	14	20
April-June	91	1,327,883	13	18
July-September	92	1,351,727	11	15
October-December	92	1,643,438	14	17

Acute Lethality Test Results

Sample Collection Date/Time	EPS 1 / RM / 13	EPS 1 / RM / 50	Was sample acutely lethal?
5/5/2021 7:15	Multi-Concentration Test	Yes	No

7.4 SECONDARY PROCESS

The secondary process operated with an average of one TF, two activated sludge tanks (AST) and two secondary clarifiers in service in 2021.

Approximately 54% of plant flow passed through the plant equalization pond where it was mixed and aerated before discharge into the TF. The remaining 46% of the raw influent flowed directly to the TF.

The average soluble $CBOD_5$ ($SCBOD_5$) removal across the TF was 79%. The trickling filter effluent $SCBOD_5$ concentrations were in the range of 5 to 32 mg/L with an average of 10 mg/L.

A high precipitation event on November 15, resulted in a MOECCS authorized bypassing of secondary treatment works for flows in excess of 400 litres per second. The applicable MOECCS Water Quality Objectives for TSS and dissolved oxygen were expected to have been met in the Fraser River.

7.5 SLUDGE TREATMENT

In 2021, 14,573 m^3 of undigested thickened waste secondary sludge was trucked to the Annacis Island WWTP for processing.

A comprehensive summary of the Northwest Langley WWTP performance and monitoring results is presented in Tables 7.9 to 7.12.

TABLE 7.9 NORTHWEST LANGLEY WWTP – 2021 ROUTINE MONITORING RESULTS AND PERFORMANCE SUMMARY

MONTH	Max. Inst.Flow Rate (m3/sec)	Total Daily Effluent Flow (MLD)				Ave. Temp (°C) FINAL EFF	Ave. DO (mg/L) FINAL EFF	Un-ionized NH3 Comp - Max (mg/L) EFF	Ave NH3 Grab (mg/L) EFF
		Max.	Min.	Ave.	***Q Ave***				
JAN	0.4	23.0	14.4	17.1		12	5.6	0.36	22.6
FEB	0.4	22.2	14.0	16.0		11	5.7	0.45	25.8
MAR	0.4	18.5	14.4	15.4	***16.2***	13	7.5	0.21	28.5
APR	0.3	15.4	13.7	14.5		15	7.2	0.31	30.9
MAY	0.5	16.8	12.9	14.5		17	6.7	0.48	27.6
JUN	0.3	16.5	13.9	14.9	***14.6***	20	5.5	0.16	14.3
JUL	0.3	15.2	13.6	14.3		22	4.7	0.18	12.6
AUG	0.3	15.4	13.2	14.3		22	4.9	0.25	14.8
SEP	0.4	23.6	12.7	15.5	***14.7***	20	5.5	0.28	18.2
OCT	0.4	20.2	14.8	16.4		17	5.4	0.23	16.7
NOV	0.6	38.8	15.6	20.0		14	5.3	0.36	18.8
DEC	0.4	22.9	14.4	17.3	***17.9***	12	8.3	0.16	27.3
# Samples	-	-	-	365	-	79	61	52	52
Maximum-Yr.	**0.6**	**38.8**	**-**	**-**	***17.9***	**24**	**9.1**	**0.48**	**32.6**
Minimum-Yr.	**-**	**-**	**12.7**	**-**	-	**8**	**3.4**	**0.02**	**8.5**
Average-Yr.	**-**	**-**	**-**	**15.8**	-	**16**	**6.0**	**0.20**	**21.1**

MONTH	Average COD (mg/L)		PAA Dose mg/L	Residual PAA (mg/L)			Geometric Mean Fecal Coliform (MPN/100mL) AT EFFLUENT WEIR		96 hr LC50 (%v/v)
				Morning	Morning Final Effluent				
	INF	EFF	EFF	At Injection	Monthly	***Q Ave***	Monthly	Max 30 d GMean	EFF
JAN	592	115	-	-	-		-	-	-
FEB	621	113	-	-	-		-	-	>100
MAR	653	83	-	-	-		-	-	-
APR	671	88	1.4	<0.9	<0.5		65	67	-
MAY	659	104	1.3	<0.6	<0.4		1,039	589	>100
JUN	643	105	1.5	<0.5	<0.4	***<0.4***	694	694	-
JUL	659	95	1.4	<0.5	<0.4		565	834	-
AUG	642	98	1.5	<0.5	<0.4		1,124	1,823	>100
SEP	651	99	1.5	<0.5	<0.4	***<0.4***	1,165	1,067	-
OCT	614	109	1.4	<0.5	<0.4		1,259	1,435	-
NOV	538	94	-	-	-		-	-	>100
DEC	570	77	-	-	-	***<0.4***	-	-	-
# Samples	363	363	216	219	219	-	31	31	4
Maximum-Yr.	**857**	**141**	**1.7**	**1.3**	**1.1**	***<0.4***	**3,300**	**1,823**	**>100**
Minimum-Yr.	**314**	**42**	**0.4**	**<0.4**	**<0.4**	**-**	**40**	**40**	**>100**
Average-Yr.	**626**	**98**	**1.4**	**<0.7**	**<0.6**	**-**	**-**	**720**	**>100**
Geometric Mean	**-**	**-**	**-**	**-**	**-**	**-**	**607**	**-**	**-**

(1) pH, Dissolved Oxygen, Temperature,Residual PAA , 96 hour LC50 and Coliform are determined on grab samples; all other parameters are determined on 24 hr. flow proportioned composite samples.
(2) Peracetic Acid (PAA) is used as the disinfectant between April 1 to October 31.
(3) Average values containing one or more results below the detection limit are preceded with a "<" symbol.

TABLE 7.9 CONT'D: NORTHWEST LANGLEY WWTP - 2021 ROUTINE MONITORING RESULTS AND PERFORMANCE SUMMARY

MONTH	Total Suspended Solids (mg/L)							AVE TSS % Reduct.	Total Susp. Solids Average Loadings (Tonnes/day)	
	RAW INFLUENT			FINAL EFFLUENT						
	Max.	Min.	Ave.	Max.	Min.	Ave.	***Q Ave***		INF	EFF
JAN	291	179	237	23	15	18		92	4.01	0.31
FEB	300	181	237	29	18	22		90	3.79	0.36
MAR	330	200	262	24	14	19	***20***	93	4.04	0.30
APR	357	223	277	29	13	18		93	4.00	0.26
MAY	386	242	286	28	13	20		93	4.14	0.29
JUN	330	222	268	28	12	16	***18***	94	3.99	0.24
JUL	327	239	277	21	10	14		95	3.95	0.20
AUG	353	206	267	28	11	18		93	3.82	0.25
SEP	380	205	277	17	10	13	***15***	95	4.28	0.20
OCT	297	188	245	22	11	16		93	3.99	0.27
NOV	287	135	214	21	9	15		93	4.12	0.30
DEC	271	160	224	24	13	18	***17***	92	3.86	0.32
# Samples	-	-	364	-	-	365	**-**	364	364	365
Maximum-Yr.	**386**	**-**	**-**	**29**	**-**	**-**	***20***	**97**	**6.13**	**0.78**
Minimum-Yr.	**-**	**135**	**-**	**-**	**9**	**-**	**-**	**85**	**2.98**	**0.14**
Average-Yr.	**-**	**-**	**256**	**-**	**-**	**17**	**-**	**93**	**4.00**	**0.27**
			Total to Date - Suspended Solids Loadings (Tonnes):						**1460**	**100.1**

MONTH	BOD_5 (mg/L)			$CBOD_5$ (mg/L)				AVE BOD_5 % Reduct.	Average BOD_5/$CBOD_5$ Loadings (Tonnes/day)	
	RAW INFLUENT			FINAL EFFLUENT					BOD_5	$CBOD_5$
	Max.	Min.	Ave.	Max.	Min.	Ave.	***Q Ave***		INF	EFF
JAN	327	188	269	25	11	17		94	4.60	0.29
FEB	482	229	295	22	10	16		94	4.89	0.26
MAR	397	244	295	12	8	10	**14**	96	4.67	0.16
APR	372	245	297	14	9	11		96	4.31	0.16
MAY	348	234	289	23	11	14		95	4.30	0.20
JUN	326	234	285	24	9	14	**13**	96	4.27	0.21
JUL	347	250	291	13	8	10		97	4.21	0.14
AUG	303	220	257	14	7	11		95	3.75	0.16
SEP	362	230	294	16	7	12	**11**	96	4.58	0.20
OCT	322	251	282	24	14	18		94	4.71	0.30
NOV	284	155	229	17	<4	<14		94	4.59	<0.28
DEC	298	207	242	13	5	10	**<15**	96	4.14	0.17
# Samples	-	-	101	-	-	158	**-**	101	101	158
Maximum-Yr.	**482**	**-**	**-**	**25**	**-**	**-**	***14***	**98**	**8.73**	**0.45**
Minimum-Yr.	**-**	**155**	**-**	**-**	**<4**	**-**	**-**	**91**	**3.08**	**<0.095**
Average-Yr.	**-**	**-**	**277**	**-**	**-**	**<14**	**-**	**95**	**4.42**	**<0.21**
			Total to Date - Biochemical Oxygen Demand Loadings (Tonnes):						**1612**	**76.7**

(1) Percent reduction is calculated only for days when both influent and effluent samples are tested.
(2) Half the detection limit is used for less than values when calculating the quarterly $CBOD_5$ and TSS averages reported to WSER.
(3) Average values containing one or more results below the detection limit are preceded with a "<" symbol.

TABLE 7.10 NORTHWEST LANGLEY WWTP – 2021 COMPREHENSIVE PROGRAM INFLUENT CONCENTRATIONS SUMMARY

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min.	Average
Aluminum Dissolved (µg/L)	414	99	716	105	146	126	950	236	117	82	208	46	950	46	270
Aluminum Total (µg/L)	7950	634	3840	1400	1090	749	2330	794	606	921	1040	752	7950	606	1840
Arsenic Total (µg/L)	0.8	0.9	0.7	1.2	0.7	0.6	0.6	0.6	0.7	0.9	0.8	0.7	1.2	0.6	0.8
Barium Dissolved (µg/L)	4.3	8.4	5.3	7.9	5.5	7.5	6.7	6.5	6.2	8.5	8.0	9.7	9.7	4.3	7.0
Barium Total (µg/L)	22.3	20.1	22.1	35.8	17.5	15.2	17.5	17.6	21.0	22.6	20.8	21.7	35.8	15.2	21.2
Boron Dissolved (µg/L)	91	95	107	86	105	118	142	128	16	118	92	108	142	16	101
Boron Total (µg/L)	105	101	116	88	111	120	155	169	169	128	101	124	169	88	124
Cadmium Dissolved (µg/L)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cadmium Total (µg/L)	0.2	0.3	0.2	0.4	<0.2	<0.2	<0.2	<0.2	0.3	<0.2	<0.2	<0.2	0.4	<0.2	<0.2
Calcium Total (µg/L)	20300	20800	18800	22500	17200	24100	19300	12700	17400	21200	18700	20800	24100	12700	19500
Chromium Dissolved (µg/L)	3.9	3.9	3.0	2.8	2.9	2.7	2.5	2.7	2.0	2.1	2.4	2.9	3.9	2.0	2.8
Chromium Total (µg/L)	7.2	7.4	7.2	7.4	6.3	5.4	6.3	5.3	5.1	6.5	6.1	6.2	7.4	5.1	6.4
Cobalt Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cobalt Total (µg/L)	0.8	1.0	0.9	1.2	0.9	0.7	0.8	1.4	0.5	0.8	0.7	0.5	1.4	0.5	0.9
Copper Dissolved (µg/L)	23.9	42.4	28.2	30.7	26.0	25.2	22.0	23.0	23.9	29.0	20.4	24.9	42.4	20.4	26.6
Copper Total (µg/L)	87.1	101	107	117	104	94.2	65.0	80.5	101	110	84.9	87.9	117	65	95
Cyanide Total (mg/L)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoride (mg/L)	0.52	0.22	0.94	0.72	0.75	0.50	0.49	0.44	0.45	0.46	0.42	0.43	0.94	0.22	0.53
Hardness as CACO3 (mg/L)	77.9	78.7	73.2	81.9	65.5	79.0	66.6	49.0	65.7	79.5	67.9	78.2	81.9	49.0	71.9
Iron Dissolved (µg/L)	56	168	121	201	180	170	165	234	147	170	152	126	234	56	158
Iron Total (µg/L)	711	774	881	1100	919	645	556	706	646	1170	863	674	1170	556	804
Lead Dissolved (µg/L)	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	4.2	1.3	<0.5	<0.5	<0.5	<0.5	4.2	<0.5	<0.9
Lead Total (µg/L)	1.6	2.3	4.0	2.1	2.0	1.4	14.8	13.9	2.2	3.2	2.3	0.8	14.8	0.8	4.2
Magnesium Total (µg/L)	6590	6520	6370	6240	5450	4570	4450	4210	5420	6480	5130	6350	6590	4210	5650
Manganese Dissolved (µg/L)	26.6	46.8	38.5	56.9	45.2	43.0	34.5	31.1	28.5	35.3	37.1	36.7	56.9	26.6	38.4
Manganese Total (µg/L)	65.2	73.3	76.7	88.4	75.6	64.4	54.9	51.6	52.6	65.9	64.8	59.1	88.4	51.6	66.0
Mercury Total (µg/L)	0.10	<0.05	<0.05	<0.05	<0.05	0.16	<0.05	0.05	<0.05	<0.05	<0.05	<0.05	0.16	<0.05	<0.06
Methylene Blue Active Substanc (mg/L)	1.1	1.0	0.8	1.0	1.6	1.4	1.3	1.3	1.7	1.4	1.0	0.8	1.7	0.8	1.2
Molybdenum Dissolved (µg/L)	1.8	1.9	1.7	2.6	1.7	1.6	2.0	1.4	1.5	1.9	1.5	5.3	5.3	1.4	2.1
Molybdenum Total (µg/L)	2.3	2.3	2.4	3.4	2.4	2.2	2.3	2.1	2.3	2.6	2.0	6.5	6.5	2.0	2.7
Nickel Dissolved (µg/L)	1.6	1.8	1.6	1.7	1.6	1.6	3.0	2.4	1.7	1.6	1.6	1.8	3.0	1.6	1.8
Nickel Total (µg/L)	2.8	3.5	3.6	4.8	3.6	2.9	4.5	5.2	3.3	3.4	2.8	2.7	5.2	2.7	3.6
Nitrogen - Ammonia as N (mg/L)	28.2	30.6	30.2	32.2	33.4	30.7	30.2	32.6	35.0	31.6	24.9	28.5	35.0	24.9	30.7
Nitrogen - Nitrate as N (mg/L)	0.28	0.50	0.41	0.35	0.14	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	0.20	0.50	<0.01	<0.16
Nitrogen - Nitrite as N (mg/L)	0.40	0.14	0.13	0.12	0.06	<0.01	<0.01	0.05	<0.01	<0.01	<0.01	0.11	0.40	<0.01	<0.09
Nitrogen - Total Kjeldahl (mg/L)	44	43	46	49	53	47	49	54	47	47	43	43	54	43	47
Oil & Grease (mg/L)	16	24	20	22	20	19	25	17	30	18	18	18	30	16	21
Phenol (mg/L)	0.05	0.04	0.04	0.04	0.04	0.06	0.08	0.02	0.05	0.05	0.03	0.04	0.08	0.02	0.05
Phosphorus Dissolved (µg/L)	846	2930	1860	3180	4100	4100	2360	4430	3350	2610	2410	2390	4430	846	2880
Phosphorus Total (µg/L)	4590	5230	5130	6270	7250	6660	4620	7480	6510	5390	5120	4790	7480	4590	5750
Selenium Total (µg/L)	0.7	0.6	<0.5	0.9	1.1	0.6	<0.5	<0.5	0.6	0.6	0.5	<0.5	1.1	<0.5	<0.6
Silver Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Silver Total (µg/L)	<0.5	0.5	<0.5	<0.5	0.7	<0.5	<0.5	0.5	0.6	<0.5	0.7	<0.5	0.7	<0.5	<0.5
Sulphate (mg/L)	33.8	35.7	44.1	48.7	42.9	58.3	38.0	32.8	37.6	37.2	28.6	30.6	58.3	28.6	39.0
Zinc Dissolved (µg/L)	32	58	53	56	56	60	56	58	47	45	45	48	60	32	51
Zinc Total (µg/L)	129	146	159	165	154	151	162	191	157	165	141	117	191	117	153

TABLE 7.11 NORTHWEST LANGLEY WWTP – 2021 COMPREHENSIVE PROGRAM EFFLUENT CONCENTRATIONS SUMMARY

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max	Min.	Average
Aluminum Dissolved (µg/L)	128	25	115	159	162	101	149	104	58	35	49	92	162	25	98
Aluminum Total (µg/L)	659	99	2300	2530	2260	2010	227	688	120	106	175	2330	2530	99	1130
Arsenic Total (µg/L)	0.5	0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	0.5	0.6	<0.5	0.6	<0.5	<0.5
Barium Dissolved (µg/L)	5.5	8.1	5.5	4.8	3.0	3.3	4.2	2.4	3.3	5.7	4.0	7.3	8.1	2.4	4.8
Barium Total (µg/L)	8.2	10.5	6.9	6.1	4.4	5.1	5.3	6.6	4.5	7.3	6.0	8.7	10.5	4.4	6.6
Boron Dissolved (µg/L)	88	107	122	100	110	132	148	137	17	133	112	117	148	17	110
Boron Total (µg/L)	90	107	130	100	117	135	166	152	171	137	116	124	171	90	129
Cadmium Dissolved (µg/L)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cadmium Total (µg/L)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Calcium Total (µg/L)	19400	19300	16200	20500	15200	23100	17700	12400	15300	18900	17600	20600	23100	12400	18000
Chromium Dissolved (µg/L)	0.6	1.5	<0.5	<0.5	<0.5	<0.5	1.3	1.0	1.1	1.1	1.0	<0.5	1.5	<0.5	<0.8
Chromium Total (µg/L)	1.3	2.2	0.6	0.7	0.8	1.0	1.7	2.1	1.4	1.5	1.6	0.7	2.2	0.6	1.3
Cobalt Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cobalt Total (µg/L)	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5
Copper Dissolved (µg/L)	9.9	12.4	5.3	12.9	13.6	14.0	18.4	17.8	21.0	18.5	9.2	5.5	21.0	5.3	13.2
Copper Total (µg/L)	21.6	31.7	14.6	18.4	23.5	24.2	25.9	37.1	31.3	33.6	30.0	16.5	37.1	14.6	25.7
Cyanide Total (mg/L)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoride (mg/L)	0.28	0.38	0.19	<0.05	0.34	0.34	0.28	0.39	0.64	0.39	0.37	0.15	0.64	<0.05	<0.32
Hardness as CaCO3 (mg/L)	73.3	73.8	64.6	75.8	58.3	76.6	61.9	48.3	58.8	71.6	66.6	76.6	76.6	48.3	67.2
Iron Dissolved (µg/L)	44	95	30	23	29	26	81	72	70	72	60	23	95	23	52
Iron Total (µg/L)	115	189	70	70	94	91	127	239	119	144	146	59	239	59	122
Lead Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	<0.5	<0.5
Lead Total (µg/L)	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	1.3	1.3	0.7	0.6	0.7	<0.5	1.3	<0.5	<0.7
Magnesium Total (µg/L)	6040	6190	5860	6000	4970	4580	4300	4210	5040	5900	5500	6110	6190	4210	5390
Manganese Dissolved (µg/L)	33.2	46.2	45.5	52.0	43.1	40.6	40.4	20.9	20.7	20.6	30.9	45.8	52.0	20.6	36.7
Manganese Total (µg/L)	38.9	52.5	48.7	56.8	48.7	45.7	46.4	29.0	23.7	25.9	38.8	49.5	56.8	23.7	42.1
Mercury Total (µg/L)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Methylene Blue Active Substanc (mg/L)	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.5	0.3	0.4	0.3	0.3	0.5	0.2	0.3
Molybdenum Dissolved (µg/L)	1.6	1.6	1.3	1.6	1.6	1.7	1.5	1.3	1.7	1.6	1.4	2.8	2.8	1.3	1.6
Molybdenum Total (µg/L)	1.7	1.8	1.4	1.8	1.7	1.8	1.5	1.6	1.8	1.8	1.5	3.1	3.1	1.4	1.8
Nickel Dissolved (µg/L)	1.6	1.8	1.8	1.7	1.7	1.8	2.5	2.5	1.8	1.7	1.8	1.8	2.5	1.6	1.9
Nickel Total (µg/L)	1.7	2.1	1.9	1.8	1.9	1.9	2.5	2.9	1.9	1.9	1.9	1.8	2.9	1.7	2.0
Nitrogen - Ammonia as N (mg/L)	20.1	27.8	31.0	31.1	29.8	22.2	7.2	10.9	17.7	22.9	18.0	26.1	31.1	7.2	22.1
Nitrogen - Nitrate as N (mg/L)	1.43	0.51	0.35	0.58	0.82	3.41	10.1	8.61	6.45	3.53	3.37	0.42	10.1	0.35	3.30
Nitrogen - Nitrite as N (mg/L)	0.23	0.14	0.10	0.23	0.35	1.25	1.98	1.32	0.85	1.13	0.58	0.11	1.98	0.10	0.69
Nitrogen - Total Kjeldahl (mg/L)	23	31	34	38	37	27	11	19	19	27	25	27	38	11	27
Oil & Grease (mg/L)	<3	3	<3	<3	<3	<3	<4	<3	<3	<3	<3	<3	3	<3	<3
Phenol (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus Dissolved (µg/L)	394	2360	36	92	129	251	2930	2610	3190	2490	2090	31	3190	31	1380
Phosphorus Total (µg/L)	1150	3190	554	979	1230	1260	3190	3860	3600	3110	2910	543	3860	543	2130
Selenium Total (µg/L)	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5
Silver Dissolved (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Silver Total (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sulphate (mg/L)	31.7	37.0	115	125	91.3	96.0	38.4	45.4	40.3	42.3	32.6	102	125	31.7	66.4
Zinc Dissolved (µg/L)	28	44	36	39	38	39	56	56	53	44	40	32	56	28	42
Zinc Total (µg/L)	37	53	42	47	48	55	61	73	56	49	52	38	73	37	51

TABLE 7.12 NORTHWEST LANGLEY WWTP – 2021 COMPREHENSIVE PROGRAM LOADINGS SUMMARY

	INFLUENT				EFFLUENT			
	Max.	Min.	Ave.	Tonnes per	Max.	Min.	Ave.	Tonnes per
Parameters	kg/day			year	kg/day			year
Aluminium Dissolved	14	0.8	4.2	1.5	2.3	0.4	1.5	0.6
Aluminum Total	136	8.8	30	11	42	1.5	17	6.4
Arsenic Total	0.018	0.008	0.012	0.004	0.011	<0.007	<0.008	<0.003
Barium Dissolved	0.2	0.1	0.1	0.04	0.1	0.03	0.1	0.03
Barium Total	0.5	0.2	0.3	0.1	0.2	0.1	0.1	0.04
Boron Dissolved	2.1	0.2	1.6	0.6	2.2	0.2	1.7	0.6
Boron Total	2.5	1.3	1.9	0.7	2.5	1.5	2.0	0.7
Cadmium Dissolved	<0.010	<0.003	<0.003	<0.001	<0.010	<0.003	<0.003	<0.001
Cadmium Total	0.006	<0.003	<0.004	<0.001	<0.010	<0.003	<0.003	<0.001
Calcium Total	371	180	305	112	367	176	283	103
Chromium Dissolved	0.07	0.03	0.04	0.02	0.02	<0.01	<0.01	<0.01
Chromium Total	0.12	0.07	0.10	0.04	0.03	0.01	0.02	0.01
Cobalt Dissolved	<0.010	<0.007	<0.008	<0.003	<0.010	<0.007	<0.008	<0.003
Cobalt Total	0.020	0.007	0.013	0.005	0.009	<0.007	<0.008	<0.003
Copper Dissolved	0.7	0.3	0.4	0.2	0.3	0.1	0.2	0.1
Copper Total	1.7	1.0	1.5	0.5	0.6	0.2	0.4	0.1
Cyanide Total	<0.4	<0.3	<0.3	<0.1	<0.4	<0.3	<0.3	<0.1
Fluoride	15	3.4	8.2	3.0	9.3	<0.7	<4.9	<1.8
Hardness as CaCO3	1395	694	1128	413	1366	684	1055	386
Iron Dissolved	3.3	1.0	2.4	0.9	1.5	0.3	0.8	0.3
Iron Total	18	8.2	13	4.6	3.4	1.0	1.9	0.7
Lead Dissolved	0.062	<0.007	<0.014	<0.005	0.012	<0.007	<0.008	<0.003
Lead Total	0.217	0.014	0.063	0.023	0.019	<0.007	<0.011	<0.004
Magnesium Total	113	60	89	32	109	60	85	31
Manganese Dissolved	0.8	0.4	0.6	0.2	0.8	0.3	0.6	0.2
Manganese Total	1.3	0.7	1.0	0.4	0.9	0.3	0.7	0.2
Mercury Total	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Methylene Blue Active Substance	25	13	19	6.8	7.1	3.1	4.9	1.8
Molybdenum Dissolved	0.09	0.02	0.03	0.01	0.05	0.02	0.03	0.01
Molybdenum Total	0.12	0.03	0.04	0.02	0.06	0.02	0.03	0.01
Nickel Dissolved	0.04	0.02	0.03	0.01	0.04	0.02	0.03	0.01
Nickel Total	0.07	0.04	0.06	0.02	0.04	0.03	0.03	0.01
Nitrogen - Ammonia as N	511	443	476	174	487	106	346	127
Nitrogen - Nitrate as N	7.7	<0.1	<2.6	<0.9	148.0	5.5	50	18
Nitrogen - Nitrite as N	6.8	<0.1	<1.4	<0.5	29	1.6	10	3.8
Nitrogen - Total Kjeldahl	810	666	732	268	560	162	414	152
Oil & Grease	438	241	319	117	59	<42	<48	<18
Phenol	1.17	0.28	0.70	0.26	<0.19	<0.14	<0.16	<0.06
Phosphorus Dissolved	63	14	44	16	47	0.6	21	7.8
Phosphorus Total	106	68	89	33	55	8.7	33	12
Selenium Total	0.016	<0.007	<0.010	<0.004	0.009	<0.007	<0.008	<0.003
Silver Dissolved	<0.010	<0.007	<0.008	<0.003	<0.010	<0.007	<0.008	<0.003
Silver Total	0.013	<0.007	<0.008	<0.003	<0.010	<0.007	<0.008	<0.003
Sulphate	841	465	603	221	1841	542	1029	377
Zinc Dissolved	0.9	0.5	0.8	0.3	0.8	0.5	0.7	0.2
Zinc Total	2.7	2.1	2.4	0.9	1.0	0.6	0.8	0.3

8.0 BIOSOLIDS MONITORING

8.0 BIOSOLIDS MONITORING

8.1 ANNACIS ISLAND WWTP BIOSOLIDS MONITORING

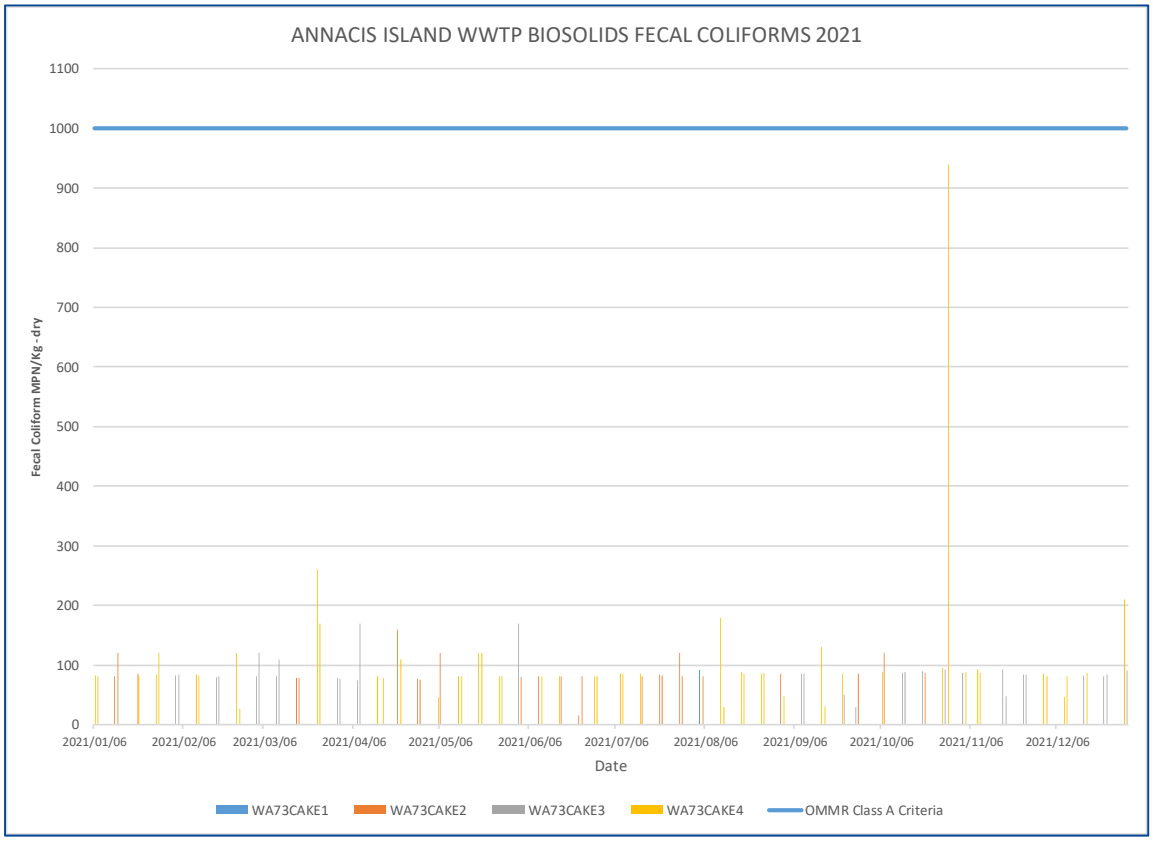
The Annacis Island WWTP produces Class A dewatered biosolids. A summary of results of testing programs for Annacis Island WWTP biosolids and the criteria values required under the Organic Matter Recycling Regulation (OMRR) are shown in Table 8.1.

TABLE 8.1 ANNACIS ISLAND WWTP BIOSOLIDS – ORGANIC MATTER RECYCLING REGULATION

Parameters	Arsenic	Cadmium	Chromium *	Cobalt	Copper *	Lead	Mercury	Moly	Nickel	Selenium	Zinc	Fecal Coliform
Units	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	MPN/g
OMRR Class A Criteria	75	20	1060	150	2200	500	5	20	180	14	1850	1000
2021 MAX	6.9	11.2	69.9	5.0	737	46.7	3.1	11.3	27.2	8.7	1420	940
2021 MIN	3.4	1.6	46.9	3.3	441	26.8	1.0	8.3	18.8	5.5	985	16
2021 AVE	4.6	2.7	55.7	4.0	588	37.8	1.5	9.5	22.5	7.0	1277	99
2021 Number of exceedances	0	0	0	0	0	0	0	0	0	0	0	0
* There are no limits for Chromium and Copper for Class A biosolids; Class B biosolids limits shown for reference.												

Throughout 2021, biosolids produced at the Annacis Island WWTP achieved the Class A criteria for metals and fecal coliforms specified in the OMRR. The highest average concentration of all regulated metals was 69% of the OMRR limit. The maximum fecal coliform concentration was 940 MPN/g, the minimum concentration was 16 MPN/g, and the average of geometric mean for all samples collected in the year was 99 MPN/g (Figure 8.1).

FIGURE 8.1 ANNACIS ISLAND WWTP BIOSOLIDS – FECAL COLIFORMS 2021



8.2 LIONS GATE WWTP BIOSOLIDS MONITORING

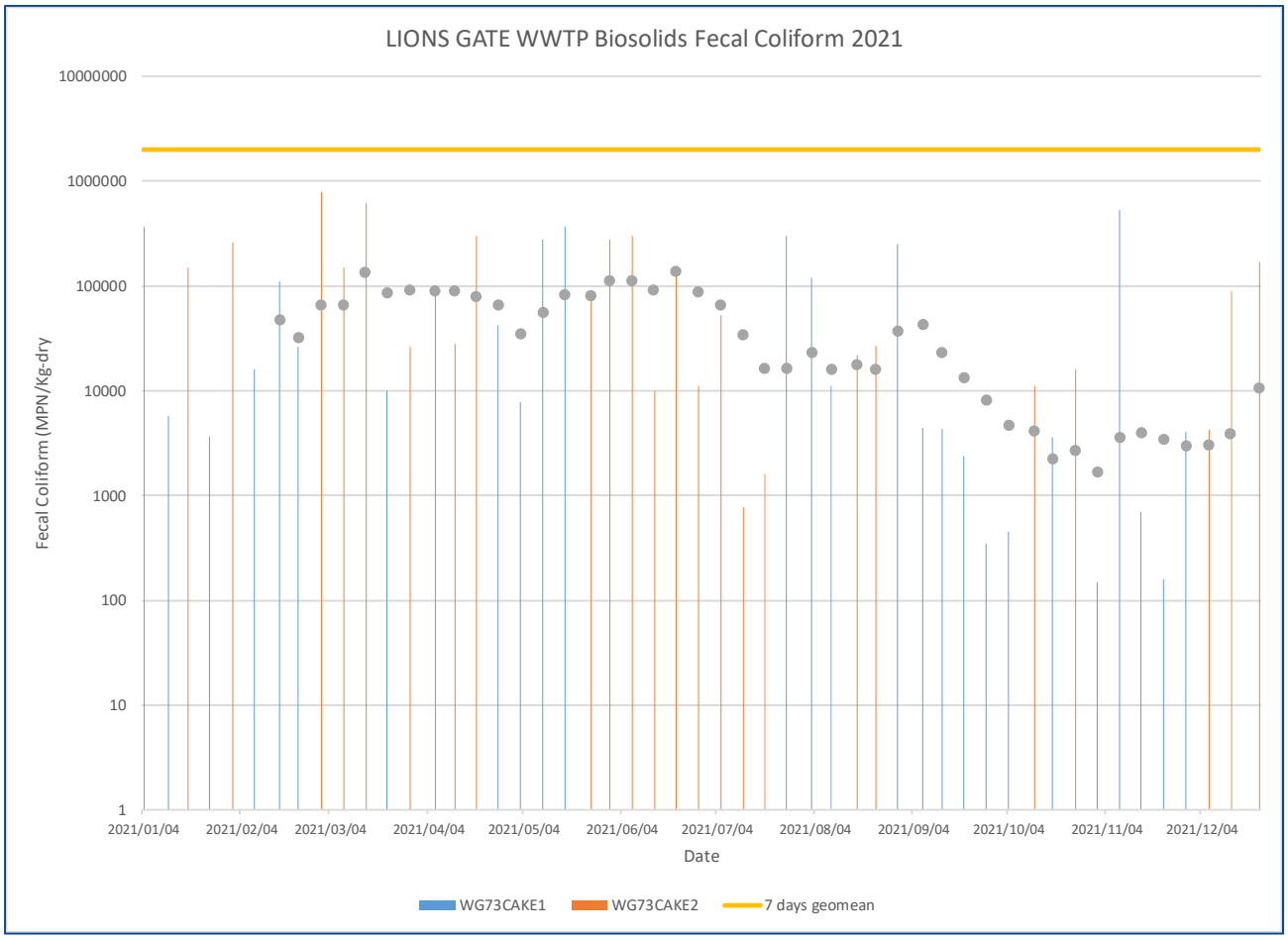
The Lions Gate WWTP produces Class B dewatered biosolids. A summary of results of testing programs for Lions Gate WWTP biosolids and the criteria values required under the OMRR are shown in Table 8.2.

TABLE 8.2 LIONS GATE WWTP BIOSOLIDS – ORGANIC MATTER RECYCLING REGULATION

Parameters	Arsenic	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Moly	Nickel	Selenium	Zinc	Fecal Coliform*
Units	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	MPN/g
OMRR Class B Criteria	75	20	1060	150	2200	500	15	20	180	14	1850	2,000,000
2021 MAX	3.9	2.9	40.4	2.6	605	57.9	1.8	12.8	26.1	6.7	1290	139,051
2021 MIN	2.4	1.7	21.0	1.7	421	37.7	0.7	4.7	13.1	4.3	832	1,668
2021 AVE	3.0	2.1	24.3	2.1	520	46.7	1.2	6.9	15.3	5.4	1072	44,982
2021 Number of exceedances	0	0	0	0	0	0	0	0	0	0	0	0
*The Fecal Coliform values are calculated as the geometric mean from the last seven samples. The minimum, maximum and average are calculated from the geometric mean set.												

Throughout 2021, biosolids produced at the Lulu Island WWTP achieved the Class B criteria for metals and fecal coliforms specified in the OMRR. The highest average concentration of all regulated metals was 58% of the OMRR limit. The highest fecal coliform geometric mean was 139,051MPN/g. The geometric mean for all samples collected during the year was 44,982 MPN/g (Figure 8.2).

FIGURE 8.2 LIONS GATE WWTP BIOSOLIDS – FECAL COLIFORMS 2021



8.3 LULU ISLAND WWTP BIOSOLIDS MONITORING

The Lulu Island WWTP produces Class B dewatered biosolids. A summary of results of testing programs for biosolids and the criteria values required under the OMRR are shown in Table 8.3.

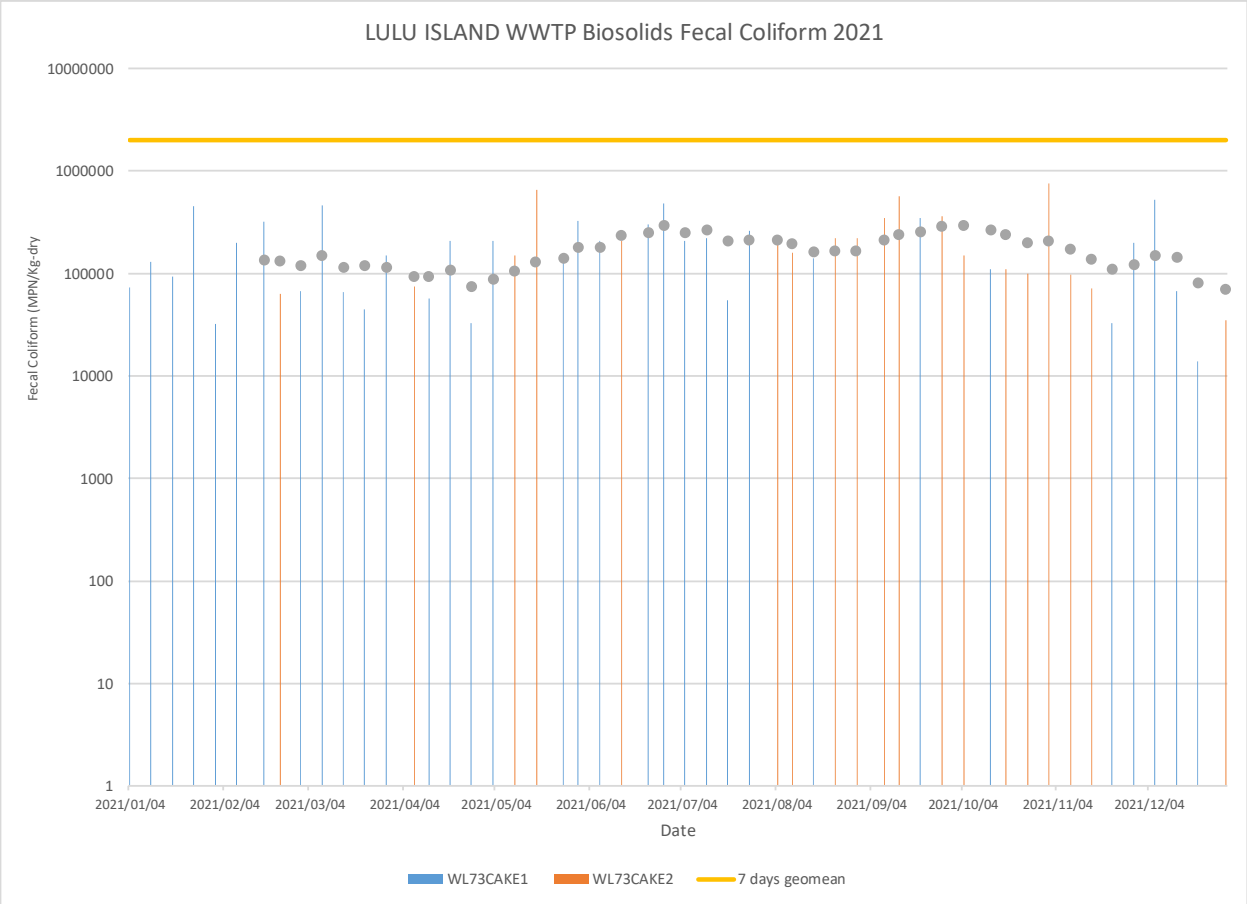
TABLE 8.3 LULU ISLAND WWTP BIOSOLIDS – ORGANIC MATTER RECYCLING REGULATION

Parameters	Arsenic	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Moly	Nickel	Selenium	Zinc	Fecal Coliform*
Units	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	MPN/g
OMRR Class B Criteria	75	20	1060	150	2200	500	15	20	180	14	1850	2,000,000
2021 MAX	5.7	2.7	36.6	5.3	555	42.8	1.4	13.3	30.0	7.3	1410	294,829
2021 MIN	3.7	1.7	25.5	3.8	414	20.9	0.7	8.1	20.3	4.5	1120	69,998
2021 AVE	4.6	2.3	30.4	4.4	467	29.6	1.0	9.8	24.3	5.7	1246	171,912
2021 Number of exceedances	0	0	0	0	0	0	0	0	0	0	0	0

*The Fecal Coliform values are calculated as the geometric mean from the last seven samples. The minimum, maximum and average are calculated from the geometric mean set.

Throughout 2021, biosolids produced at the Lulu Island WWTP achieved the Class B criteria for metals and fecal coliforms specified in the OMRR. The highest average concentration of all regulated metals was below 68% of the OMRR limit. The highest fecal coliform geometric mean was 294,829 MPN/g. The geometric mean for all samples collected during the year was 171,912 MPN/g (Figure 8.3).

FIGURE 8.3 LULU ISLAND WWTP BIOSOLIDS – FECAL COLIFORMS 2021



8.4 IONA ISLAND WWTP LAND-DRIED BIOSOLIDS AND DIGESTED SLUDGE MONITORING

The Iona Island WWTP operates mesophilic digesters which produce digested sludge that is further processed via lagoon stabilization and land-dried in a stockpile at the plant site. Samples are collected from the digested sludge discharged to the lagoons as well as from the land-dried biosolids stockpile prior to hauling to beneficial use project sites. A summary of results of testing programs for the digested sludge prior to lagoon stabilization and the criteria values required under the OMRR are shown in Table 8.4.

TABLE 8.4 IONA ISLAND WWTP DIGESTED SLUDGE – ORGANIC MATTER RECYCLING REGULATION

Parameters	Arsenic	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Zinc	Fecal Coliform
Units	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	MPN/g
OMRR Class B Criteria	75	20	1060	150	2200	500	15	20	180	14	1850	2,000,000
2021 MAX	4.73	2.62	33.0	5.10	448	56.4	1.97	7.2	20.0	5.45	1040	NA
2021 MIN	3.11	0.76	24.9	3.64	230	34.5	0.66	3.9	13.5	2.31	490	NA
2021 AVE	4.06	1.21	27.4	4.30	359	42.6	1.08	5.6	16.9	4.07	771	NA
2021 Number of exceedances	0	0	0	0	0	0	0	0	0	0	0	0

*Fecal coliforms are not analyzed in the sludge from Iona Island WWTP.
**OMRR Class B Criteria are not applicable to sludge from Iona Island WWTP as the sludge is further processed in lagoons and land-dried.

In 2021, land-dried biosolids at the Iona Island WWTP achieved the Class B criteria for metals and fecal coliforms specified in the OMRR for biosolids sent to beneficial use projects. A summary of results from 2021 for Iona Island WWTP land-dried biosolids and the criteria values required under the OMRR are shown in Table 8.5. The maximum average concentration of all regulated metals in the land-dried biosolids was 40% of the OMRR limit. The highest fecal coliform geometric mean was 224 MPN/g and the geometric mean for all fecal coliform samples collected during the year was 6 MPN/g.

TABLE 8.5 IONA ISLAND WWTP LAND-DRIED BIOSOLIDS – ORGANIC MATTER RECYCLING REGULATION

Parameters	Arsenic	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Zinc	Fecal Coliform*
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	MPN/g
OMRR Class B Criteria	75	20	1,060	150	2,200	500	15	20	180	14	1,850	2,000,000
2021 Maximum	8.5	7.24	112	7.9	756	349	4.8	7	47.8	4.1	774	224
2021 Minimum	3.3	2.15	34	3.4	323	65.1	1.47	2.8	16.6	0.7	248	0
2021 Average	5.6	3.9	68.1	6.1	482	191.4	2.8	4.1	31.7	2.1	435.4	6
Number of exceedances	0	0	0	0	0	0	0	0	0	0	0	0

*The Fecal Coliform values are calculated as the geometric mean from the last seven samples. The minimum, maximum and average are calculated from the geometric mean set.

8.5 NORTHWEST LANGLEY WWTP TRUCKED SLUDGE

In 2021, undigested thickened secondary sludge from the Northwest Langley WWTP was trucked to the Annacis Island WWTP where it was digested and dewatered into biosolids.

9.0 ENVIRONMENTAL MANAGEMENT PROGRAMS

9.0 ENVIRONMENTAL MANAGEMENT PROGRAMS

In 2021, Metro Vancouver's five WWTPs collected and treated about 451 billion litres of wastewater before discharging to the receiving environment. The location of Metro Vancouver's WWTPs is shown in Figure 9.1.

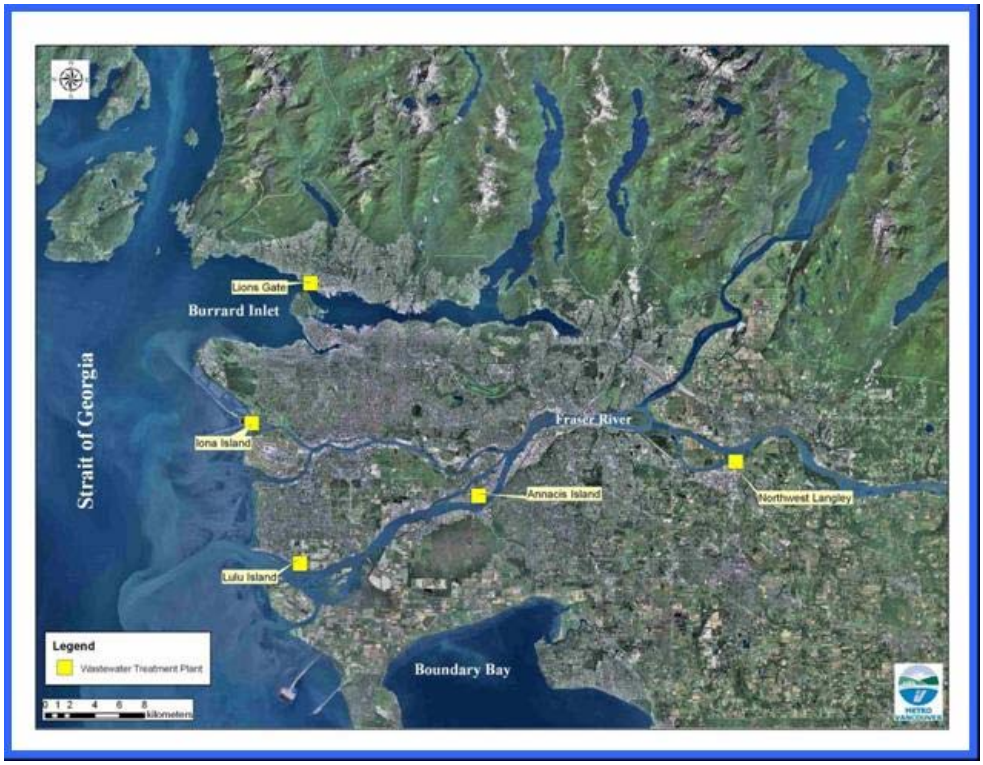
The Iona Island and Lions Gate WWTPs discharge primary treated wastewater into marine waters of the Strait of Georgia and Burrard Inlet, respectively. The Annacis Island, Lulu Island, and Northwest Langley WWTPs discharge secondary treated wastewater into the Main Arm of the Fraser River. The dispersed treated wastewater in the receiving environment must meet applicable Water Quality Objectives (WQOs).

Environmental management programs form a major part of Metro Vancouver's integrated approach to managing liquid waste. In addition to its environmental monitoring and assessment, Metro Vancouver conducts special studies and research projects.

The Environmental Monitoring Committee, a technical advisory committee to Metro Vancouver under the ILWRMP, guides and reviews the monitoring programs and other environmental initiatives. The committee is made up of representatives from the federal and provincial governments, member municipalities, Metro Vancouver, and universities.

The following chapters present an overview of the environmental monitoring and management programs and initiatives associated with the operation of Metro Vancouver's wastewater collection and treatment system.

FIGURE 9.1 LOCATION OF METRO VANCOUVER'S WASTEWATER TREATMENT PLANTS



10.0 OVERFLOW MONITORING

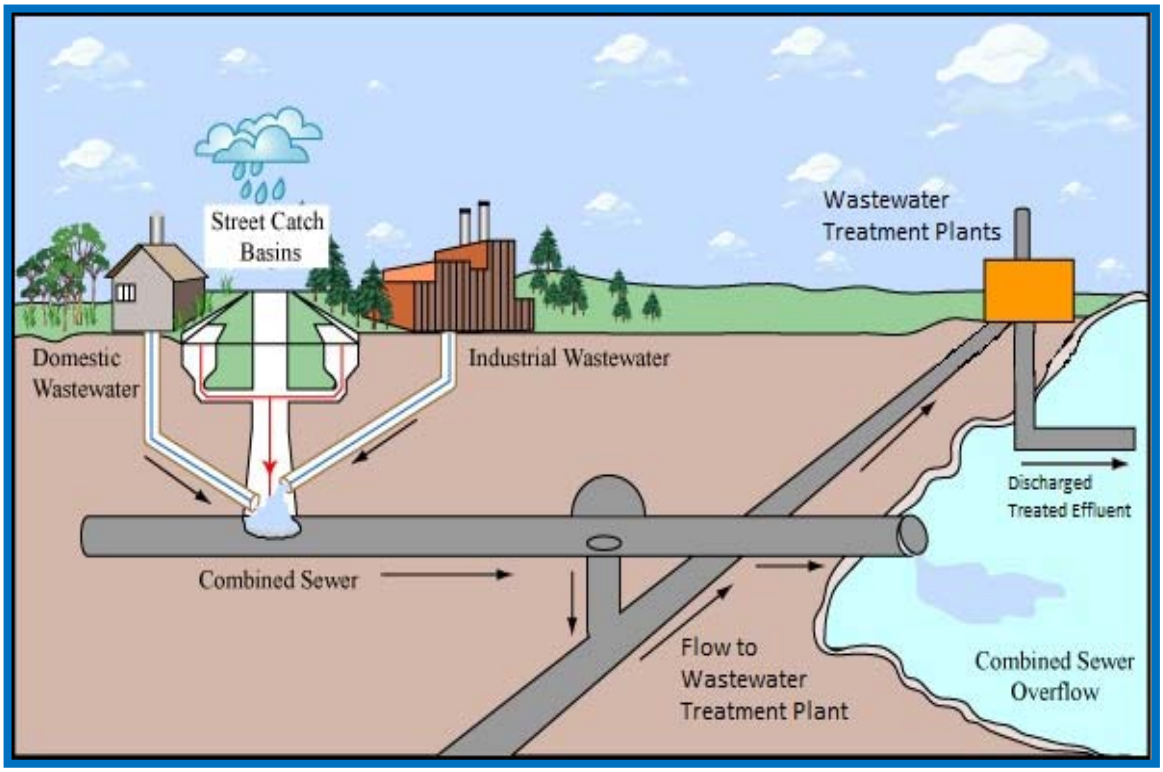
Sewer systems are designed to collect domestic and industrial wastewater in the same pipe. Some older systems, such as combined sewer systems, also collect surface water runoff. During periods of heavy rain, and snowmelt, inflow and infiltration to the sewer system can cause the wastewater volume to exceed the capacity of the sewer collection system or treatment plant. Sewer systems are designed to overflow when inputs exceed conveyance capacity and to discharge excess wastewater directly to nearby water bodies. Metro Vancouver monitors these discharges to determine potential effects on the receiving water bodies.

10.1 COMBINED SEWER OVERFLOW (CSO) QUALITY MONITORING

Early in the twentieth century, before wastewater was treated, the accepted practice was to consolidate sanitary and stormwater (surface water) flows into a single pipe. This type of collection system is called a combined sewer. Metro Vancouver no longer builds combined sewer systems, but they are still present throughout the region.

WWTPs typically receive and treat all combined and sanitary sewer flows in dry to moderate rainfall periods. During heavy rainfall, the water levels in the combined sewer pipe network can rise beyond their conveyance capacity due to increased surface water runoff. To prevent sewer water from backing up into homes and businesses, the combined sewer systems were designed with relief points to discharge overflow wastewater and stormwater directly to the receiving waters via Combined Sewer Overflows (CSOs), as illustrated in Figure 10.1.

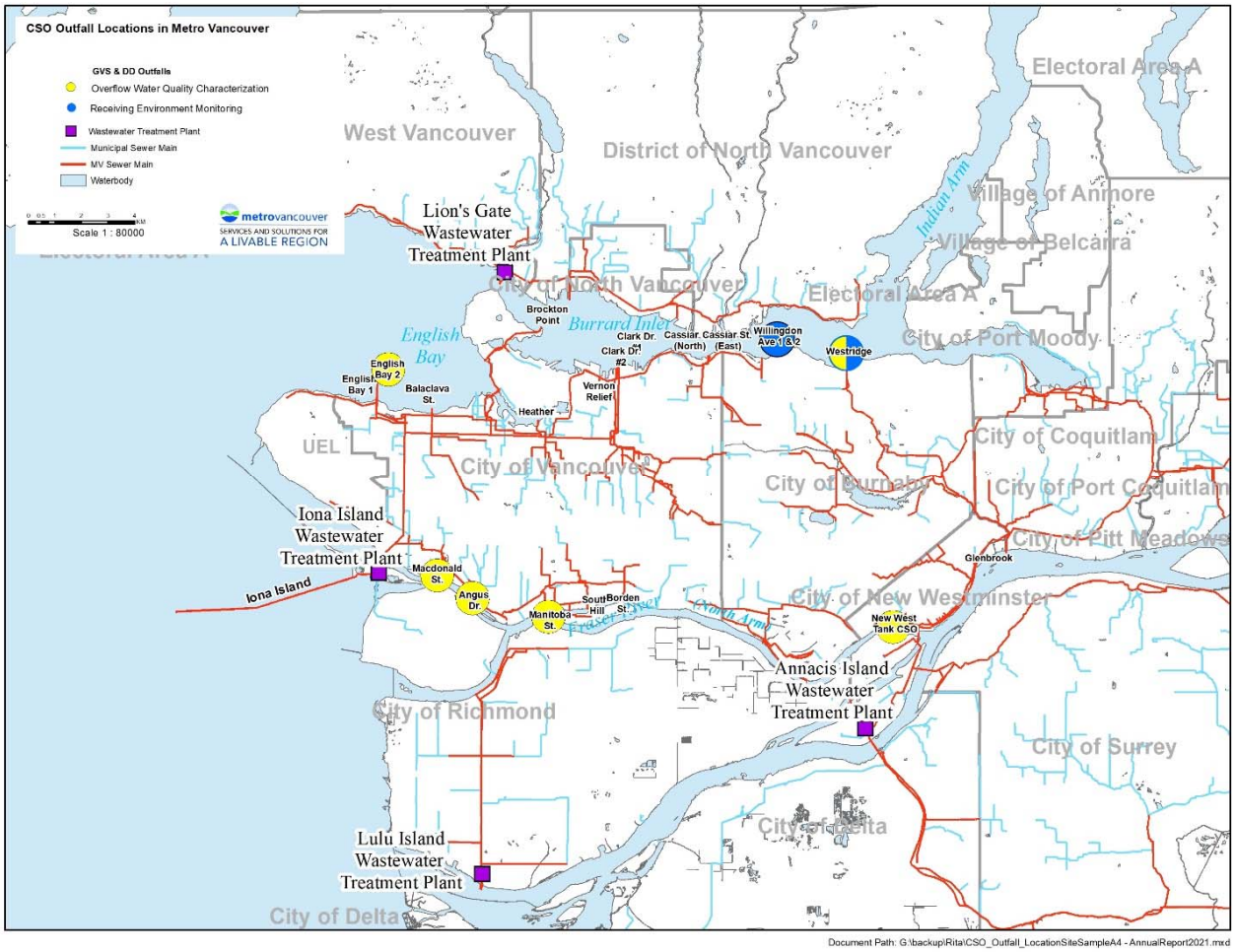
FIGURE 10.1 TYPICAL COMBINED SEWER SYSTEM (FROM ADAMS, 2006, SLIDE 17)



Metro Vancouver's ILWRMP states that Metro Vancouver will not build new combined sewers in its region and that it will separate existing combined sewers into storm and sanitary sewers. Separation is completed via infrastructure replacement or sewer capacity upgrade programs. As CSOs continue to operate, the Minister's approval of the ILWRMP includes a requirement to monitor and characterize the quality of CSO discharges.

Substances in CSO discharges may result in exceedance of WQOs in receiving water bodies. Currently, Metro Vancouver operates 20 CSO outfalls at 15 locations (Figure 10.2). These CSOs exist in addition to those owned and operated by the cities of Vancouver, Burnaby, and New Westminster.

FIGURE 10.2 METRO VANCOUVER COMBINED SEWER OUTFALL LOCATIONS MONITORED IN 2021



10.1.1 CSO MONITORING PROGRAM

OVERVIEW

Since 1996, Metro Vancouver has undertaken an annual effluent quality monitoring program for CSOs under its ownership. The purpose of the CSO Monitoring Program is to characterize the quality of CSO discharges by collecting representative samples for the analysis of targeted parameters. Routinely monitored parameters include microbiological indicators, conventional parameters, and metals. When sample volume permits, select organics such as polycyclic aromatic hydrocarbons (PAHs), extractable petroleum hydrocarbons (EPH), 6PPD quinone, personal care products and pharmaceuticals are also analyzed. Volatiles analyses and toxicity testing is only conducted periodically when grab samples can be collected, as volatiles are not suitable for automated sampling, and toxicity tests require larger volumes than are available through the automated sampling system.

Since 2018, up to 5 grab and/or composite samples from select sites were analyzed for polybrominated diphenyl ethers (PBDEs) and polychlorinated biphenyls (PCBs).

Since the sampling system was automated, a monitoring plan has been developed to monitor and characterize Metro Vancouver's 15 CSO locations:

- over a five-year cycle;
- at a rate of three to five locations per year; and
- with up to ten overflow events sampled at each location.

The program is being continuously improved over time by identifying and addressing inefficiencies and upgrading autosampling infrastructure. As priorities change due to site related interests and activities, so can the monitoring plan.

AUTOSAMPLER INFRASTRUCTURE

Autosamplers are installed where technically feasible at CSO locations upstream of the outfalls. Most sampling sites consist of prefabricated above-ground metal kiosks or in-ground concrete vaults, while one sampling site is located inside an existing pump station. The kiosks and vaults are secured structures that house each autosampler, which is connected to sampling lines and associated communication electronics (Figure 10.3).

Each sampling site utilizes existing Metro Vancouver water-level monitoring electronics to communicate with the autosampler. When the water-level monitor detects flows exceeding a pre-established level specific for each CSO location, the autosampler will trigger and begin sampling. When automatic triggering is not available, manual (grab) samples are collected whenever possible.

FIGURE 10.3 CSO INFRASTRUCTURE: SAMPLING KIOSK (LEFT), KIOSK WITH AUTOSAMPLER (CENTER), SAMPLER COMMUNICATION ELECTRONICS (RIGHT)

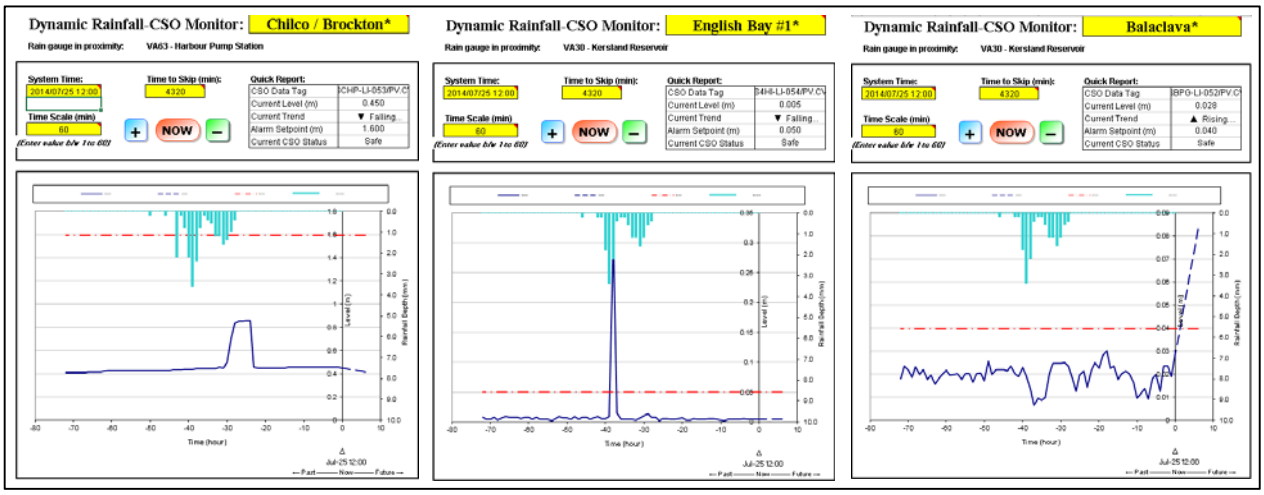
CSO MONITORING APPROACH

Successful monitoring is challenging even with the automated sampling system. To achieve sampling efficiency, developing storms are tracked using online forecasting tools, such as weather networks and the Global Forecast System, along with information from Metro Vancouver's rain gauges. Autosamplers are programmed before the beginning of a storm for time-based interval sampling of the combined sewer discharge during an overflow.

The objective of CSO monitoring is to sample a given CSO event with emphasis on collecting its "first flush." First flush occurs at the beginning of the overflow and is characterized by the re-suspension of accumulated solids in the sewer system and impervious surfaces above. This re-suspension results in higher constituent concentrations during the initial discharge, which incoming stormwater will dilute. This concentrated first flush would represent the worst-case scenario (i.e., highest loading) in the combined discharge pipe. To aid in capturing the "first flush" of an overflow, programming of the autosampler is specific to each CSO site. The drainage area characteristics, and the rain forecast will affect the aliquot volume and sampling frequency programmed into the autosampler.

Another challenge to successful sample collection is the unique response to rainfall at each of the CSO sites. Figure 10.4 compares three CSO sites that are located in close proximity to each other during the same rainfall period and demonstrates that overflow characteristics are drainage area specific.

FIGURE 10.4 COMPARISON OF RAINFALL AND OVERFLOW EVENTS AT CHILCO-BROCKTON, ENGLISH BAY, AND BALACLAVA CSO LOCATIONS



- Chilco-Brockton (left panel) did not approach the overflow level (and demonstrated a delayed response to the rain).
- English Bay #1 (centre panel) overflowed (i.e., the water level crosses the red dashed line indicating an overflow) at peak rainfall.
- Balaclava (right panel) flows fluctuated near the overflow level, without ever actually overflowing.

2021 CSO MONITORING LOCATIONS

Six Metro Vancouver CSO locations were monitored in 2021: Angus Drive, English Bay, Macdonald, Manitoba, New Westminster Tank, and Westridge. Table 10.1 shows a description of the level of effort undertaken for these sites in 2021.

TABLE 10.1 2021 CSO MONITORING EFFORT AND STATUS

CSO Location	2021 Monitoring
Angus Drive	A total of three samples were collected, one grab and two composite. All samples were analyzed for routine parameters; two samples for PCBs and PBDEs; and one for PAHs, VOCs, EPH, PPCPs and toxicity.
English Bay	A total of six samples were collected, two grab and four composite. All samples were analyzed for routine parameters; two samples for PAHs, VOCs, EPH, PCBs and PBDEs; and one sample was analyzed for toxicity.
MacDonald	A total of four samples were collected, two grab and two composite. All samples were analyzed for routine parameters; three for PPCPs and one for each of the following parameters: PAHs, VOCs, EPH, Toxicity and 6-PPD Quinone.
Manitoba	A total of two samples were collected, one grab and one composite. All samples were analyzed for routine parameters; two samples were analyzed for PPCPs and one sample was analyzed for each of the following parameters: PAHs, VOCs, EPH, Toxicity, PCBs, PBDEs and 6-PPD Quinone.
New Westminster Tank	A total of four samples were collected, two grab and two composite. All samples were analyzed for routine parameters, PCBs and PBDEs; two for PAHs, VOCs, EPH and PPCPs; and one for toxicity and 6-PPD Quinone.
Westridge	A total of nine samples were collected, four grab samples and five composite. All samples were analyzed for routine parameters and PPCPs; four for PAHs, VOCs, PCBs, PBDEs, toxicity and 6-PPD Quinone; and 3 for EPH.

CSO MONITORING RESULTS

Table 10.2 summarizes estimates of CSO discharge duration, number of events, and total discharge volume for 2021. The total discharge volume for all of Metro Vancouver CSOs in 2021 was 35.22 million cubic meters.

In 2021, the samples collected from Angus Drive, English Bay, MacDonald, Manitoba, New Westminster Tank, and Westridge CSOs were submitted for microbiology and routine physical-chemical analyses. A total of seventeen samples were analyzed for PPCPs; 14 samples for PCBs and PBDEs; eleven samples for volatiles, EPH, and PAHs; nine samples were tested for toxicity; and seven samples were analyzed for 6-PPD quinone. Samples analyzed for organics, EPH, PAHs, VOCs and PPCPs were collected from all six sites. Samples analyzed for 6-PPD quinone were collected from MacDonald, Manitoba, New Westminster Tank and Westridge. Results are provided in Appendix A.

Sampling occurred during the rainfall periods of fall and winter months. Of the rainbow trout acute toxicity samples collected from the six 2021 CSO sampling locations, none were acutely toxic.

TABLE 10.2 GVS&DD 2021 CSO DISCHARGE DURATION, EVENTS, AND VOLUME

Receiving Water	CSO Outfall	Total Duration of Discharges (hours)	Number of Discharge Events	Total Discharge Volume (million m^3)
Burrard Inlet - Second Narrows to Roche point	Westridge	864	79	0.23
	Willingdon	916	98	0.33
Burrard Inlet - First to Second Narrows	Cassiar	2,263	112	7.74
	Clark/Vernon (Clark #1, Clark #2, Vernon)	2,708	288	15.02
	Brockton	58	25	0.14
Burrard Inlet - False Creek	Heather	252	63	0.74
Burrard Inlet – Outer Harbour	Balaclava	197	43	1.71
	English Bay / Alma Discovery (English Bay #1, English Bay #2)	281	80	0.29
Fraser River – North Arm	Macdonald	6	6	0.02
	Angus [1]	266	89	2.98
	Manitoba	214	53	0.94
	South Hill	631	117	1.14
	Borden	717	106	0.37
	New Westminster CSO Tank	361	17	0.76
Fraser River – Main Stem	Glenbrook	1,056	108	2.83
Total Discharge Volume (from GVS&DD monitoring sites) [2]				**35.22**

Notes:
1) Sum of results from two monitoring sites
2) Excludes municipal connections downstream of GVS&DD monitoring sites

10.1.2 CSO RECEIVING ENVIRONMENT MONITORING PROGRAM

OVERVIEW

The objective of the CSO receiving environment monitoring (REM) program is to assess the possible effects of CSO discharges on the receiving environment at selected CSO outfall locations.

Previously collected CSO discharge characterization data (physical, chemical, toxicological, and bacteriological), information on the nature of the receiving environment, and results of previously completed CSO receiving environment studies were used in a weight of evidence approach to prioritize CSO sites for environmental effects surveys. The program includes determination of receiving environment water quality; measurement of receiving water during an overflow event (if feasible); and assessment of sediment physical, chemical, and toxicological parameters and benthic invertebrate community structure.

In 2021, the 2018-20 English Bay, 2018-19 Borden, 2020 Heather and 2020 South Hill CSO REM Programs were completed and the results are presented below. Field work was completed for the Willingdon and Westridge CSOs.

APPROACH

WATER

Receiving environment water quality at the edge of the IDZ is estimated based on CSO discharge monitoring data and the modelled dilution at the edge of the IDZ. Dependent on a CSO occurring during the REM program field survey, receiving water samples are collected prior to sediment sampling, if feasible. Receiving environment water samples were collected at the English Bay and Borden CSOs. For English Bay CSO, an overflow event did not occur at the time receiving environment water quality samples were collected and as a result, these samples did not meet study objectives. For CSO REM studies conducted after 2019 (e.g., Heather, South Hill, Willingdon, and Westridge), receiving environment water quality samples were not collected due to the logistical challenges associated with sampling during CSO overflow events.

Of nineteen receiving environment water samples collected at the Borden CSO, six samples (B-12 to B-17) were analyzed for microbiological parameters (*E. coli*, enterococci, and fecal coliforms) only. The remaining thirteen water samples (B-1 to B-11 and two reference samples) were analyzed for:

- physical properties;
- microbiological parameters;
- anions;
- nutrients; and
- total and dissolved metals.

In addition, reference samples, quality control samples, and four samples collected within the Borden IDZ were analyzed for PAHs.

SEDIMENT

For the English Bay CSO and Heather CSO programs, which discharge to Burrard Inlet and False Creek respectively, a radial survey gradient was applied. For the Borden CSO and South Hill CSO REM programs, which discharge to the Fraser River, an upstream-downstream survey gradient was applied. The planned distances between sampling stations followed a geometric series, with some adjustment in the field to target fine sediments. Figures 10.5, 10.6, 10.7, 10.8, and 10.9 show sediment monitoring stations for the 2018-20 English Bay CSO REM, 2018-19 Borden CSO REM, 2020 Heather CSO REM, and 2020 South Hill CSO REM, respectively.

The English Bay CSO field program had two parts, sediment monitoring in December 2018 around the CSO outfall, which later was confirmed through dive inspections to be plugged and not functioning as originally designed, and sediment monitoring in January 2020 around two maintenance holes through which the CSO currently discharges.

For the four CSOs, collected sediments were analyzed for the following:

- physical parameters;
- microbiology (*E. coli*, enterococci, fecal coliforms);
- acid volatile sulfide / simultaneously extracted metals (AVS/SEM);
- nutrients;
- total metals;
- stable carbon and nitrogen isotopes;
- select trace organics, specifically: PAHs and alkylated PAHs, PBDEs, PCBs, alkylphenols, organochlorine pesticides, and select hormones and sterols;
- toxicity analysis using a marine or freshwater amphipod survival and avoidance/growth test; and
- benthic invertebrate community structure, including enumeration and identification.

Results of the English Bay, Borden, Heather, and South Hill CSO REM Programs are presented below.

Additionally, REM field work was completed at the Willingdon and Westridge CSOs in 2021. These reports are under preparation.

FIGURE 10.5 2018 ENGLISH BAY CSO SEDIMENT MONITORING STATIONS

FIGURE 10.6 2020 ENGLISH BAY CSO SEDIMENT MONITORING STATIONS

FIGURE 10.7 2018-19 BORDEN CSO SEDIMENT MONITORING STATIONS

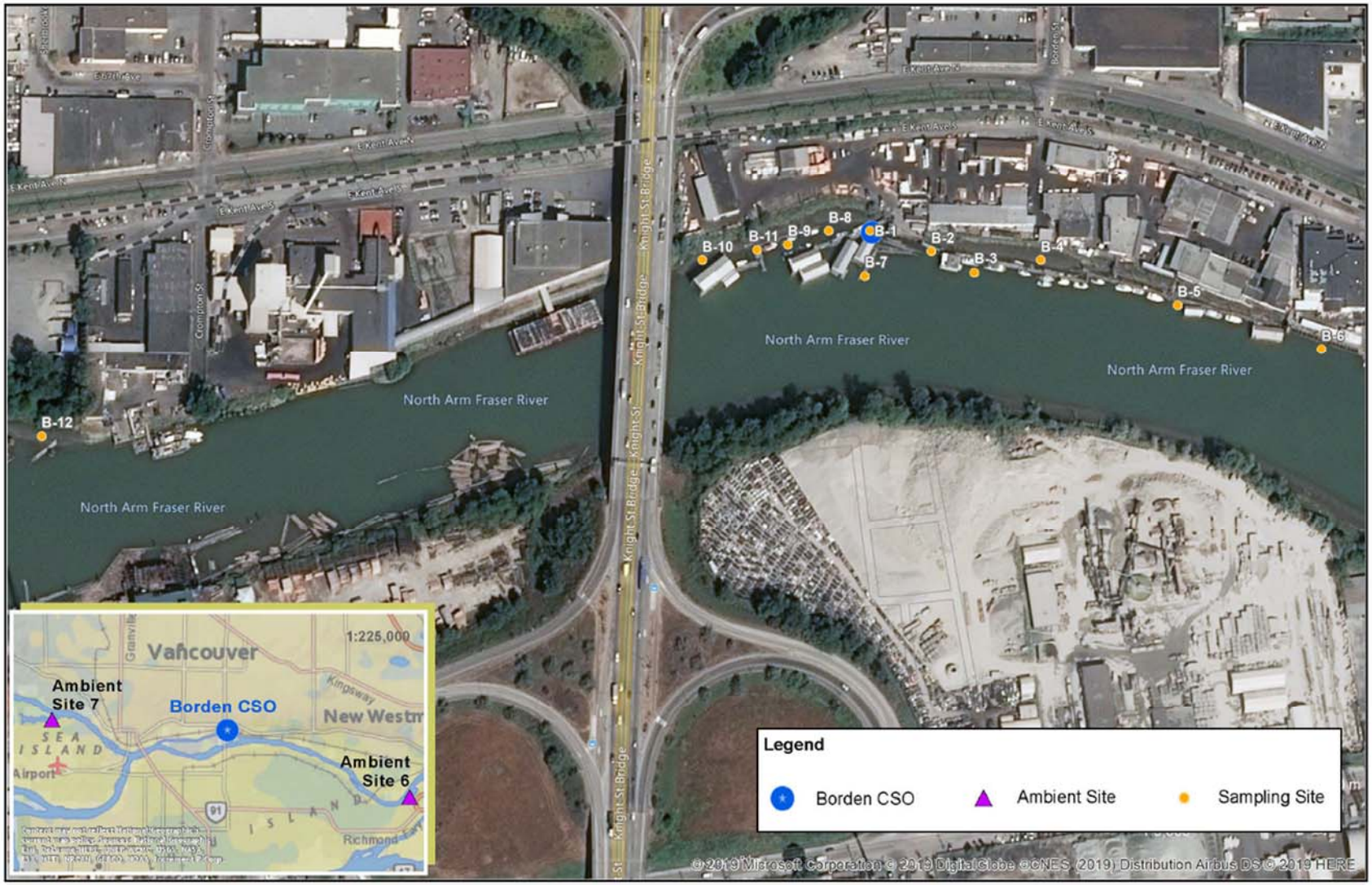
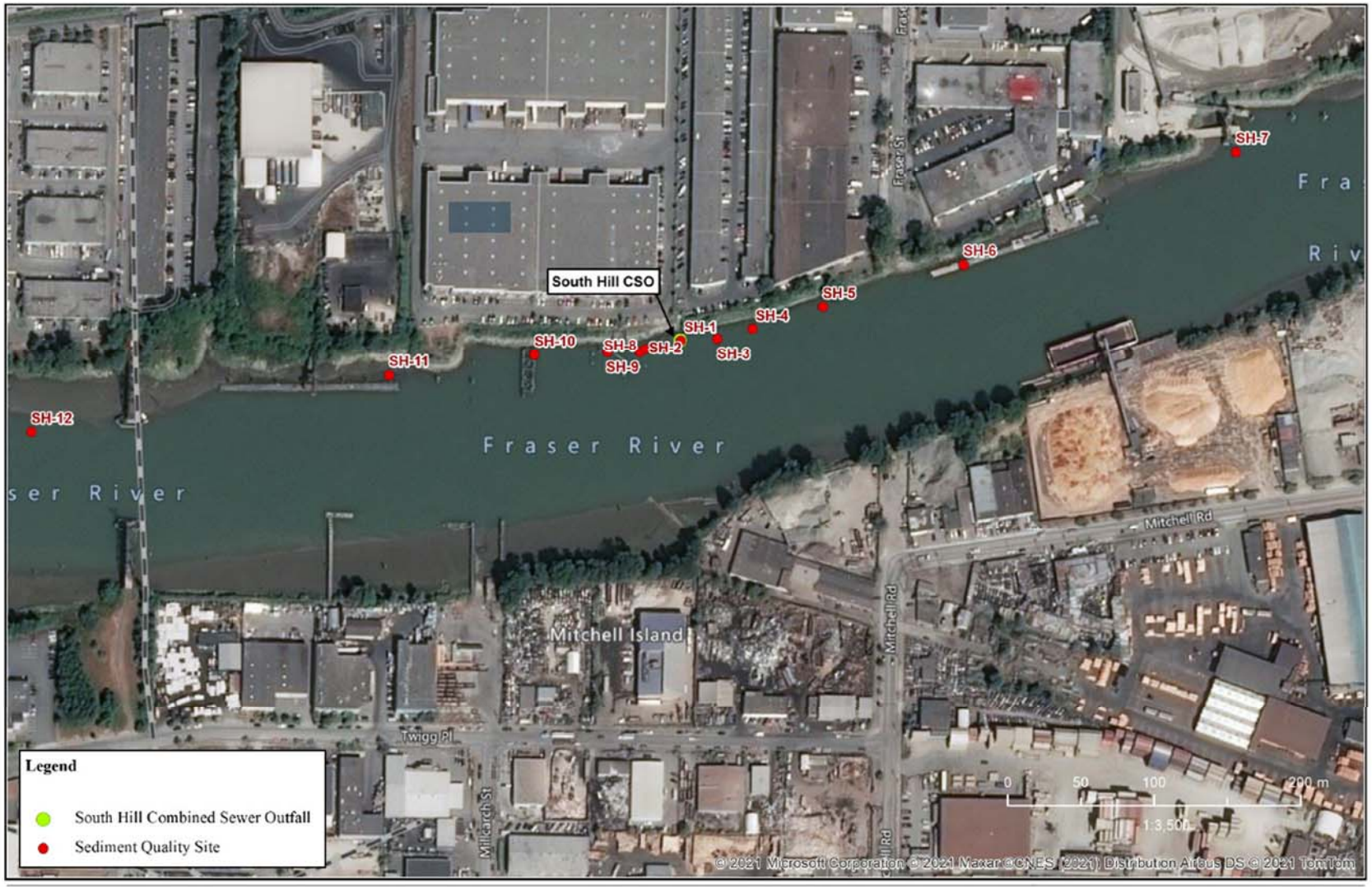


FIGURE 10.8 2020 HEATHER CSO SEDIMENT MONITORING STATIONS

FIGURE 10.9 2020 SOUTH HILL CSO SEDIMENT MONITORING STATIONS



RESULTS

WATER

BORDEN CSO

Results of receiving water monitoring indicated that concentrations of parameters ≤100m from the outfall met the seasonally applicable Fraser River Water Quality Objectives, with the exception of dissolved oxygen, *E.coli*, and total copper.

Water quality predictions based on CSO discharge quality data for the Borden CSO and a site-specific estimated dilution factor indicate that the concentration of fecal coliforms, *E. coli*, enterococci, TSS and total copper 100m from the outfall could exceed Fraser River maximum and/or 30-day average objectives. The average concentration of total mercury might exceed the BC guideline in the case that methylmercury is >3.0% of total mercury.

SEDIMENT

ENGLISH BAY CSO

For sediment samples collected around the English Bay CSO original outfall (2018, Figure 10.5), the spatial distribution of silver showed a historical exposure gradient to the CSO and measured concentrations of lead, mercury, silver, total PCBs, total chlordane, total DDD, total DDE, and total DDT were above objectives or guidelines at one or more sites. Measured concentrations of PAHs above objectives were widespread and not clearly related to the historical CSO discharge. For sediment samples collected around the two maintenance holes (2020, Figure 10.6), measured concentrations of mercury, nickel, silver, indeno (1,2,3-cd) pyrene, BDE-209, total DDD, and total DDT were above objectives or guidelines at one or two sites, with no clear spatial distribution pattern around these two discharge points. Some wastewater indicators (fecal coliforms, enterococci, coprostanol) showed concentration patterns of exposure consistent with the predominant Burrard Inlet current directions in the vicinity of the maintenance holes.

Sediment samples collected around the original CSO outfall showed toxicity effects to the marine amphipod, *Eohaustorius estuarius,* at all sites, which had statistically lower amphipod survival than the laboratory control. No clear pattern of chemical exposure (number of objectives/guidelines) and distance from the original English Bay CSO outfall and amphipod survival was apparent. The benthic invertebrate community composition suggested a mild to moderate response within 100 m of the original CSO outfall and possibly at two more distant sites (E-2, E-4).

Amphipod survival for samples collected around the two maintenance holes were statistically lower for two sites (EM5, E-12) than the laboratory control, with no statistical difference in amphipod survival for the other sites. E-12 had the most analytes (three) above guidelines/objectives, while EM5 had one. The results for E-12 are consistent with 2018 sediment toxicity test results and suggest potential for historical CSO discharge exposure, and for other sites there was no clear relationship to sediment quality or exposure to the more recent English Bay CSO discharge. The benthic invertebrate community composition also showed no consistent spatial patterns with sediment chemistry or CSO exposure within the vicinity of the two maintenance holes.

Historical exposure from the original English Bay CSO discharge was apparent from the spatial distribution of some wastewater indicators (silver), measured concentrations of metals and organic compounds above guidelines/objectives, and benthic community response. The sediment quality triad study within the vicinity of more recent English Bay CSO discharge from the two maintenance holes suggest little or no evidence of exposure to or effects from this CSO (ENKON, 2021a).

BORDEN CSO

The measured concentrations of copper, nickel, and naphthalene were above the guideline or objective in all samples collected around the Borden CSO (Figure 10.7), although the copper concentrations at most sites and nickel concentrations at all sites were comparable to background concentrations in the Fraser River. At several sites, arsenic concentrations were equal to the guideline within the limits of analytical precision. Concentrations of ten other PAHs and BDE-99 exceeded the objectives/guidelines at one or more sites around the Borden CSO. Site B-6 had the highest concentration of PAHs, however, there does not appear to be differences in land use or activities at B-6 compared to other sites.

Sediment samples were non-toxic to the freshwater amphipod, *Hyalella azteca*, at all sites except site B-5. This site had statistically lower amphipod survival than the reference site, but did not differ significantly from laboratory control. Site B-5 had fewer instances of environmental objective/guideline exceedances compared to other sites. These results indicate that the relatively lower survival in B-5 was not due to the Borden CSO discharge.

Some wastewater indicators (fecal coliforms, coprostanol, and silver), TOC, and arsenic concentrations in sediment exhibited an exposure gradient approximately 100m downstream and 64m upstream of the Borden CSO outfall. Spatial distributions of other analytes did not show distribution patterns related to the CSO discharge. Exposure to the Borden CSO did not appear to affect sediment toxicity, and had little or no effect on the benthic invertebrate community (ENKON 2022a).

HEATHER CSO

In sediment samples collected for the Heather CSO (Figure 10.8), the measured concentrations of cadmium, copper, lead, silver, zinc, PAHs, PCBs, and total DDD above objectives or guidelines were widespread. Although the maximum concentrations of copper and silver occurred at the outfall station, H-1, no clear relationship with the Heather CSO discharge was shown for concentrations of other metals and organic compounds, with exception of BDE-99. Concentrations of BDE-99 were negatively correlated with distance from the outfall, suggesting the Heather CSO as a source of this compound.

Sediment samples were non-toxic to the marine amphipod, *Eohaustorius estuarius*, at most sites except H-4, H-5, H-6, and H-11, which had statistically lower amphipod survival than the laboratory control. These sites had varying instances of environmental objective/guideline exceedances compared to other sites, with no clear pattern of number of objective/guideline exceedances and amphipod survival. These results showed no evidence of toxicity related to the Heather CSO discharge.

Some wastewater indicators (fecal coliforms, enterococci, and coprostanol), organic carbon, and BDE-99 in sediment exhibited an exposure gradient to the Heather CSO outfall. Spatial distribution of other analytes did not show patterns related to the CSO discharge and based on the discharge quality data, is

likely confounded by discharges from other municipal CSOs and storm sewer outfalls, and historical contamination of False Creek sediments. While exposure to the Heather CSO did not appear to affect sediment toxicity, the benthic invertebrate community appeared to respond to the CSO exposure gradient with lower taxa richness and diversity and with most sites less than 70 m from the outfall dominated by indicator organisms of organic enrichment (ENKON 2021b).

SOUTH HILL CSO

Concentrations of arsenic, chromium, nickel and copper in some or all South Hill CSO sediment samples (Figure 10.9) were above objectives/guidelines, although concentrations of these metals in South Hill sediment samples were less than background concentrations of the Fraser River. Measured concentrations of organic analytes were less than the applicable objective/guidelines, except for naphthalene in all samples and BDE-99 in one sample (SH-11).

No evidence of toxicity to the freshwater amphipod, *H. azteca* was found at South Hill CSO sites. Survival and growth in sediment from all sites were similar to both reference and laboratory control sediments.

Overall, sediment organic content, chemistry, and benthic invertebrate assemblages did not show any evidence of a gradient relative to the South Hill CSO outfall. The distribution of analytes, both from the South Hill CSO and other sources, is patchy and apparently dependent on localized depositional conditions (ENKON 2022b).

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ENKON Environmental Limited. (2022a) CSO Receiving Environment Program: 2018-19 Borden Effects Surveys. Commissioned by Metro Vancouver. Burnaby, BC: Metro Vancouver.

ENKON Environmental Limited. (2022b) CSO Receiving Environment Program: 2020 South Hill Effects Survey. Commissioned by Metro Vancouver. Burnaby, BC: Metro Vancouver.

10.1.3 CSO RISK ASSESSMENT

In 2021, Metro Vancouver continued making progress on the project to conduct a Human Health and Ecological Risk Assessment of Metro Vancouver CSOs, which began in 2020. The purpose of this risk assessment is to assist in decision making around prioritizing CSO management options.

The scope of work completed in 2021 included the assessment of 7 CSO outfalls at 7 locations that discharge to the Fraser River. This assessment is currently still underway.

Metro Vancouver analyzed the available data on CSO effluent, the characteristics of the receiving environment(s), and exposure pathways that may result in human health risk or ecological risk in a ranking framework to aid in decision making. Specifically, hydrodynamic models were used on a range of scales and over a range of environmental conditions (e.g. various tidal conditions and seasons) to model the dilution and dispersion of potential overflows in the receiving environment(s) from each CSO outfall.

A risk ranking framework was developed with the aim of ranking the CSOs according to their level of risk to both human health and ecological receptors. The framework was comprised of scoring mechanisms applied to a broad range of metrics falling under the general categories of site sensitivity, discharge characteristics and exposure characteristics:

- Site sensitivity metrics included land and shoreline uses, accessibility and visibility, expected human activities, presence of sensitive species and habitats, benthic invertebrate community structure and the spatial extent of the CSO plume.
- Discharge characteristics included a Water Quality Index (WQI) based on Substances of Potential Concern (SOPC) exceedances of Environmental Quality Objectives (EQOs), effluent and sediment toxicity, and expected effects on dissolved oxygen.
- Exposure characteristics included CSO frequency and volume, plume dilution, sedimentation rates and the duration of the CSOs and their associated effects.

Results

The risk ranking analysis for CSO outfalls discharging to the Fraser River is currently underway.

10.2 SANITARY SEWER OVERFLOW (SSO) MONITORING

The sanitary sewer system typically conveys all sanitary sewer flows to the WWTPs in dry or moderate rainfall periods. However, heavy rainfall events, power outages, instrumentation, or mechanical issues may cause water levels in the sanitary sewer pipe network to rise beyond their conveyance capacity. To prevent sewer backups into homes and businesses, the sanitary sewer systems were designed with relief points to overflow untreated wastewater directly to receiving waters via emergency outfalls.

Metro Vancouver's ILWRMP requires that Metro Vancouver monitor SSO effluents and their receiving environments to assess the fate and effects at significant SSO locations. The ILWRMP also requires prevention of wet weather SSOs for 24-hour storm events of less than one in five years return period. To fulfill this requirement, Metro Vancouver conducted SSO characterization monitoring at significant SSO locations between 2009 and 2016 inclusive, as well as receiving environment water quality monitoring after each SSO event. The information collected was used to conduct human health and ecological risk assessments for significant SSO locations. As risk assessments for significant SSO sites are complete, SSO characterization monitoring has been discontinued.

Metro Vancouver continues to conduct receiving environment water quality monitoring following each SSO. Receiving environment water quality data, observations, and impact assessments are provided to regulatory agencies and municipalities in end-of-spill reports that include information on SSO location, date, start and end time, duration, volume, estimated cause, immediate actions taken to minimize duration of the SSO and mitigate the impact, and planned long-term actions to eliminate it.

Table 10.4 summarizes estimates of SSO discharge duration, number of events, and total discharge volume for 2021. The total discharge volume for all of Metro Vancouver SSOs in 2021 was 1.1 million cubic metres.

TABLE 10.4 GVS&DD 2021 SSO DISCHARGE DURATION, EVENTS, AND ESTIMATED VOLUME

Final Receiving Water	**Total Duration of Discharges (hours)**	**Number of Discharge Events**	**Total Estimated Discharge Volume (million m^3)**
Burrard Inlet	94.46	20	0.068
Fraser River	385.16	38	0.979
Boundary Bay	249.68	4	0.003
Burnaby Lake	195.34	2	Unknown
Lynn Creek	34.67	2	0.004
Nicomekl River	50.62	7	0.043
Serpentine River	38.33	1	Unknown
Burns Bog	47.25	1	Unknown
Katzie Slough	1.08	1	Unknown
Mosquito Creek	8.93	1	Unknown
Oliver Slough	55.08	1	Unknown
Stoney Creek	74.7	2	Unknown
Watershed Creek	129.78	1	Unknown
Ditch	0.08	1	Unknown
Total Discharge Volume			**1.097**

11.0 WHOLE EFFLUENT MONITORING

11.1 EFFLUENT TOXICITY TESTING

Chemical analysis of an effluent cannot predict toxicity by itself. Many chemical substances are either not detectable by common methods of chemical analysis, or the methods for these substances have yet to be developed. In addition, when different substances are combined in a mixture such as effluent, the apparent toxicity of the combined substances can be different from the toxicities of the individual substances. Therefore, whole effluent toxicity monitoring is conducted to determine the potential total toxic effect of an effluent sample when measured directly with an aquatic organism in a toxicity test.

The suite of toxicity tests conducted in 2021 are summarized in Table 11.1 below. The 96-h rainbow trout acute lethality test is a requirement of both the wastewater treatment plant (WWTP) operational certificates (OCs) and the wastewater effluent systems regulation (WSER). The remainder of the testing is not required, but is conducted to better understand the potential for effects in the receiving environment.

TABLE 11.1 METRO VANCOUVER WWTP EFFLUENT TOXICITY TESTING IN 2021

Component	Test Organism	Frequency
Acute	96-hour Rainbow trout 48 hour *Daphnia magna*	Annacis, Lulu, Iona and Lions Gate: monthly Northwest Langley: quarterly
Chronic	7-day *Ceriodaphnia dubia* 7-day Fathead Minnow	Follow-up study at all WWTPs: Quarterly (plus 3 additional *Ceriodaphnia dubia* tests at Northwest Langley, Iona and Lions Gate only)
	7-day Topsmelt (*Atherinops affinis*) 10-minute Echinoderm 48-hour Giant Kelp	Special study at Iona and Lions Gate: summer season (3 events)

11.1.1 ACUTE TOXICITY TESTING

OVERVIEW

Acute toxicity testing measures the survival of test organisms when exposed to effluent over a short period of time. The primary objective of the testing is to ensure that the treated wastewater is protective of aquatic life.

Testing of effluent with rainbow trout is conducted in accordance with each WWTP's OC. Samples of whole effluent are screened for acute toxicity following Environment Canada and Climate Change' (ECCC's) test protocols.

APPROACH

The standard method for determining acute lethality of effluents to rainbow trout is to expose test fish to a series of effluent dilutions and determine the fish survival rate at the end of a 96-hour exposure period. The final result is reported as the 96-h LC50 value (median lethal concentration), which is the percent by volume of the original effluent sample that is estimated to be lethal to 50% of the test fish.

A test pass for all municipal effluents requires that the LC50 value must be equal to or greater than 100%. This means that 50% or more of the test fish must survive for 96 hours in the original undiluted sample of effluent. If an effluent sample does not pass the toxicity test, a toxicity identification evaluation is conducted with the objective to identify, and ultimately correct for, the probable cause of the observed toxicity.

In 2008, ECCC published an add-on test procedure along with a corresponding guidance document for pH stabilization during the testing of acute lethality that is only applicable to municipal effluents. The purpose of pH stabilization is to replace the carbon dioxide lost due to aeration in order to maintain the pH throughout the test at the same levels observed at the start of the test. This add-on procedure recognizes that the toxicity observed in municipal wastewater effluents may be due to a shift in pH which is an artifact of the standard reference method.

In June 2012, the Government of Canada introduced the WSER under the Fisheries Act. Under these regulations, acute toxicity testing of effluent can be conducted either by Reference Method EPS 1/RM/13 with or without the add-on procedure for pH Stabilization EPS 1/RM/50. Metro Vancouver WWTP effluent samples met all three conditions of the add-on pH stabilization procedure, so in August 2012, Metro Vancouver began conducting acute toxicity tests using rainbow trout on its effluent samples using the reference method with the add-on pH stabilization procedure to prevent the generation of any false-positive results.

In addition to the rainbow trout acute toxicity testing, monthly (or quarterly for the Northwest Langley WWTP since 2015) effluent testing of *Daphnia magna* acute toxicity, as recommended by the Canada-wide Strategy for the Management of Municipal Wastewater Effluent (CWS-MMWE), has been conducted since 2009.

In 2021, acute toxicity testing conducted by Bureau Veritas using standardized Environment Canada approved protocols occurred monthly for Annacis, Lulu, Iona, and Lions Gate and quarterly (February, May, August and November) for Northwest Langley WWTP effluents.

RESULTS

All tests followed Environment Canada's test protocols. In 2021, all monthly rainbow trout toxicity tests passed with the following exceptions: 1) two effluent samples for Annacis Island WWTP where the cause was determined to be ammonia for one test and undetermined for the other, 2) one effluent sample for Lulu Island WWTP where the cause was undetermined, 3) one effluent sample for Iona Island WWTP where the cause was high oxygen demand, 4) three effluent samples for Lions Gate WWTP where the cause was determined to be anionic surfactants. In 2021, all monthly *Daphnia magna* toxicity tests in 2021

passed with one exception for Lions Gate WWTP where the cause was determined to be anionic surfactants. All quarterly toxicity tests for NW Langley WWTP passed for both test species.

11.1.2 CHRONIC TOXICITY TESTING

OVERVIEW

Chronic toxicity testing measures adverse health effects from repeated exposures, often at lower levels over a longer period of time (e.g., weeks or years). Chronic testing results are reported as both lethal concentration (i.e., LC50) and inhibition concentration (i.e., IC25 or IC50). These endpoints are concentrations (represented as percent by volume) at which there is a lethal or inhibition (reduced growth or reproduction) response observed in 25% or 50% of the organisms tested. The primary objective of the testing is to demonstrate that the treated wastewater beyond the initial dilution zone (IDZ) boundary is protective of aquatic life.

APPROACH

In 2021, whole effluent testing was conducted between four to seven times depending on the test species and the WWTP. ECCC's biological seven-day test methods (i.e., Environment Canada 2007 and 2011) were used (CCME Canada-wide Strategy for the Management of Municipal Wastewater Effluent, 2009):

- 7-day tests of larval growth and survival using fathead minnows *(Pimephales promelas)*
- 7-day tests of reproduction and survival using the water flea *(Ceriodaphnia dubia)*

These tests are used to determine the potential chronic toxicity of effluent to different types of organisms in the aquatic environment. The fathead minnow test measures whether an effluent sample affects the growth and survival of very young (larval) minnows. Similarly, the water flea test measures whether the sample affects the reproduction and survival of the water flea.

In 2021, additional testing was conducted for Iona and Lions Gate WWTP effluents using marine species in June, July, and August. These tests were conducted in parallel with the aforementioned fathead minnow and water flea chronic test species:

- 7-day Pacific topsmelt (*Atherinops affinis*) survival and growth test.
- 10-minute echinoderm (*Strongylocentrotus purpuratus*) fertilization test
- 48-hour giant kelp (*Macrocystis pyrifera*) germination and germ tube growth test

Additionally, a water sample is also collected quarterly from the Fraser River for testing to provide information on background environmental conditions. This water sample is collected at a reference area located at Derby Reach Regional Park, which is upstream of Metro Vancouver's secondary WWTPs and beyond their zone of influence.

Chronic toxicity can provide guidance regarding the potential for effects of wastewater in the receiving environment at the initial dilution zone (IDZ) boundary. The CCME Strategy indicates that chronic toxicity be assessed at the edge of the allocated mixing zone in the same way environmental quality objectives

are derived from chemical guidelines. Therefore, results from whole effluent sample chronic toxicity testing are considered in the context of the receiving environment.

RESULTS: THE POTENTIAL FOR CHRONIC TOXICITY AT THE IDZ BOUNDARY

Although some chronic toxicity was observed in effluent samples tested in 2021 (Table 11.2), chronic toxicity was not predicted to occur at the initial dilution zone (IDZ) boundary except for Ceriodaphnia dubia (Cerio) in two of the five Lulu Island WWTP effluent samples tested in 2021 (Table 11.3). For all other WWTP effluent samples and test species chronic toxicity would not be predicted at the IDZ boundary.

TABLE 11.2 CHRONIC TOXICITY TESTING RESULTS FOR 2021

WWTP	Species[a]	# tests	Observed range for each endpoint					
			Survival LC50 %v/v (min - max)		Growth/Reproduction/ Viability IC50 %v/v (min - max)		Growth/Reproduction/ Viability IC25 %v/v (min - max)	
Annacis	FHM	5	55.8	>100	55.8	>100	51.1	82.8
	Cerio	6	73.5	>100	53.3	>100	26.2	>100
Lulu	FHM	4	49	70.7	43.1	67.3	29.6	55.2
	Cerio	5	57.4	>100	2.86	80.3	<1.56	63.3
NWL	FHM	4	>100	>100	>100	>100	>100	>100
	Cerio	7	>100	>100	19.5	100	<1.56	>100
Iona	FHM	4	38.8	>100	41.6	>100	32.3	92.2
	Cerio	7	50	>100	34	>100	27.9	74.4
	Topsmelt	3	46.5	76.4	55.1	75.2	41.8	59
	Echinoderm	3			5.1	25.1	3.9	18.3
	Kelp	3			50.4	70.7	18.3	52.2
Lions Gate	FHM	5	34.9	>100	44.7	>100	30.1	>100
	Cerio	7	33	>100	28.1	>100	16.9	>100
	Topsmelt	4	45.4	70.7	40.6	65.2	26.1	52.6
	Echinoderm	4			4.7	7.5	3.7	5.2
	Kelp	4			36.5	62.1	18.6	43.9
Fraser River	FHM	5	11.6	>100	11.6	>100	<1.56	>100
	Cerio	5	>100	>100	>100	>100	40.9	>100

[a] FHM (fathead minnow), Cerio (*Ceriodaphnia dubia*), Echinoderm (Echinoderm embryo), Kelp (giant kelp)

TABLE 11.3 POTENTIAL FOR CHRONIC TOXICITY AT THE INITIAL DILUTION ZONE (IDZ) BOUNDARY

WWTP	Species	# tests	Max dilution needed to eliminate potential for toxicity at the IDZ boundary (100/Endpoint)			Average modelled dilution at IDZ boundary (X:1)[a]	Samples that predict toxicity at IDZ Boundary (#)
			LC50	IC50 Growth/ Reproduction	IC25 Growth/ Reproduction		
Annacis	FHM	5	1.7	1.8	2.1	40	0
	Cerio	6	1.4	1.9	3.8		0
Lulu	FHM	4	2.0	2.3	3.4	30	0
	Cerio	5	1.7	35.0	>64.1		2
NWL	FHM	4	0	0	0.0	575	0
	Cerio	7	0	5.1	>64.1		0
Iona	FHM	4	2.6	2.4	3.1	176	0
	Cerio	7	2.0	2.9	3.6		0
	Topsmelt	3	2.2	1.8	2.4		0
	Echinoderm	3		19.6	25.6		0
	Kelp	3		2.0	5.5		0
Lions Gate	FHM	5	2.9	2.2	3.3	250	0
	Cerio	7	3.0	3.6	5.9		0
	Topsmelt	4	2.2	2.5	3.8		0
	Echinoderm	4		21.3	27.0		0
	Kelp	4		2.7	5.4		0

[a] Modelled average dilution sources: Annacis (Seaconsult and ABR, 1997), Lulu (Seaconsult, 1997), Iona (Seaconsult, 1999), Lions Gate (Seaconsult and EVS, 1999) and NWL (Seaconsult, 2002).

The chronic TIE study conducted previously by Nautilus (2021) attributed toxicity in the WWTP effluent samples to non-persistent substances that would not be expected to accumulate in the receiving environment (i.e., ammonia for all WWTP effluent samples, and oxygen demand and anionic surfactants in primary WWTP effluent samples). Ammonia toxicity is a related to the proportion of unionized ammonia, and its concentration increases with increasing pH. A shift in pH often happens during the fathead minnow and water flea chronic toxicity tests as a result of diffusion of CO2. The previous chronic TIE study and parallel CO2 stabilization tests conducted in 2021 (including the aforementioned Lulu Island WWTP effluent samples) indicate that with CO2 stabilization, ammonia toxicity is reduced. Further, ammonia is not expected to persist in the environment as it would be affected by the turbulence in the receiving environment.

11.1.3 AMMONIA AS A POTENTIAL TOXICANT

Ammonia in wastewater effluent can be toxic and harmful to aquatic life, especially fish. Ammonia dissolved in water is a substance specified on the List of Toxic Substances in Schedule 1 of the Canadian Environmental Protection Act (CEPA). Sources of ammonia in the environment include municipal and industrial wastewater, as well as agricultural runoff and natural processes.

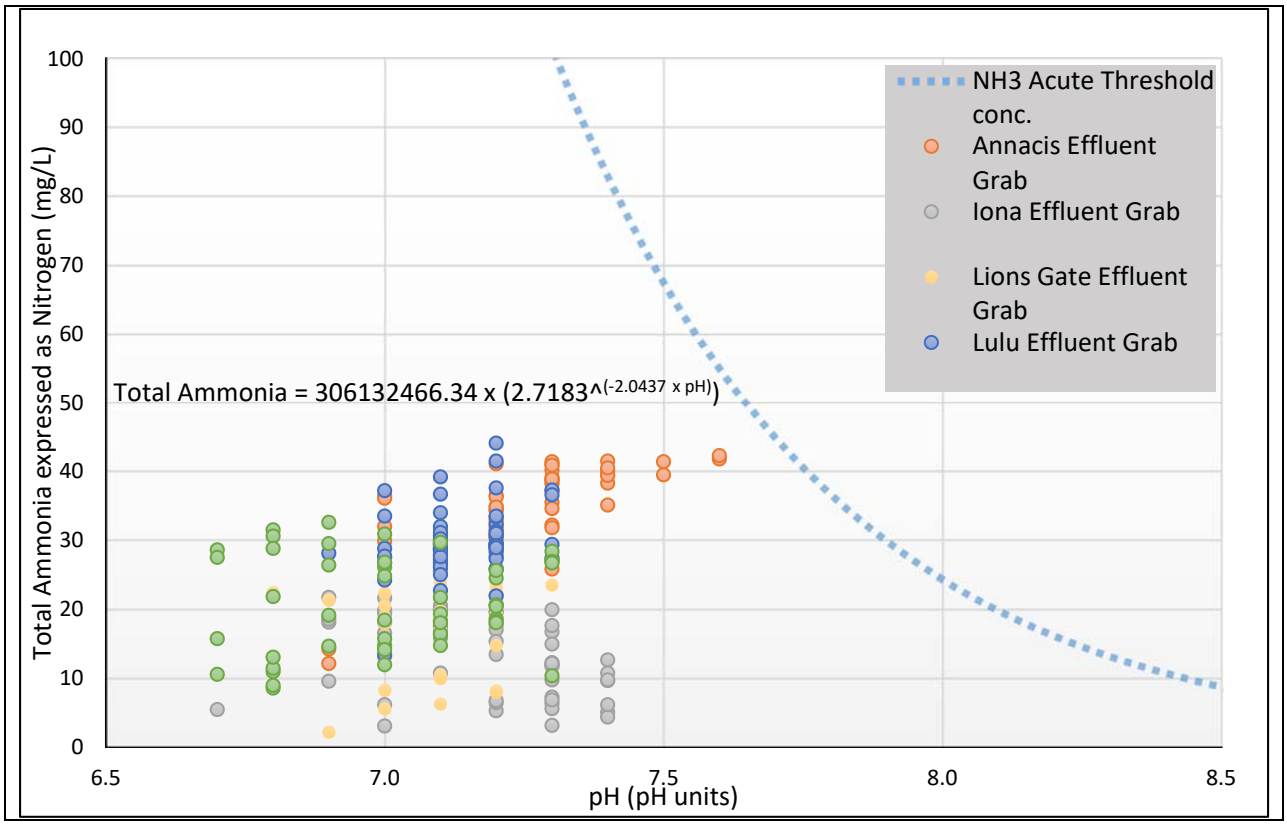
In keeping with the national strategy for the management of municipal wastewater, ECCC developed the CEPA threshold toxicity curve which can be used to determine the potential for acute ammonia toxicity. The pH of the effluent is a factor in ammonia toxicity and the CEPA ammonia toxicity threshold curve takes this into account. Metro Vancouver monitors the quality of the final effluent for the ammonia concentration and pH level on a weekly basis at each of its WWTPs.

If the data point for ammonia and pH falls below the CEPA curve, the effluent would be predicted to not contain an acutely lethal concentration of ammonia. Conversely, if the data point falls on or above the curve, the effluent would be predicted to contain an acutely lethal concentration of ammonia.

In conjunction with the CEPA ammonia toxicity threshold curve, Figure 11.1 shows the 2021 monitoring results for ammonia in the final effluent for each of Metro Vancouver's WWTPs plotted on one graph. All effluent results for all of the treatment plants were below the threshold acute concentration curve for ammonia at the measured pH value of the effluent. This predicts that the effluent did not contain an acutely lethal concentration of ammonia.

Potential for chronic toxicity due to ammonia is also a consideration. There is either a provincial WQO or guideline for total ammonia that is applicable in the receiving waters for each WWTP. Previous studies by Metro Vancouver in the vicinity of the wastewater discharges have shown that the provincial WQO or guideline (as applicable) for total ammonia was met in the aquatic environment.

FIGURE 11.1 COMPARISON OF 2021 WWTP EFFLUENT QUALITY WITH THE ACUTE AMMONIA THRESHOLD TOXICITY CURVE



11.2 SPECIAL CHEMICAL CHARACTERIZATION

Although chemical characterization can be challenging, it is included in the CWS-MMWE. In 2014, the characterization of wastewater from all five WWTPs for the trace organics listed in the strategy was started and continued through 2021. The trace organic substances required to be analyzed by the Strategy include organochlorine pesticides (OCPs), PCBs, PAHs, volatile organic compounds, phenolic compounds, and surfactants.

Although the Strategy indicates "other substances specifically associated with industrial or commercial activities that discharge into the sewer system," there are other types of trace organics that are also of concern and not necessarily specific to industrial or commercial activities, such as PBDEs, hormones and sterols, pharmaceuticals and personal care products (PPCPs), and other types of pesticides. These substances are also being analyzed selectively.

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12.0 REGIONAL WATER BODY MONITORING

A key component of Metro Vancouver's ILWRMP involves monitoring, assessment, and forecasting to evaluate potential effects of liquid waste discharges, such as WWTP effluents, into the receiving water bodies. Monitoring determines if the discharges meet site specific Water Quality Objectives (WQOs) and guidelines (WQGs) at the edge of the IDZ for WWTPs, characterizes the receiving environment, provides background data, develops indicators of environmental change, and assesses long-term trends.

The data collected is required to evaluate the overall health of regional water bodies that receive wastewater and stormwater discharges, provides information necessary for effective management of liquid waste discharges, and is used to determine the need and priority for facility upgrades.

In the past, receiving and ambient environment monitoring programs have been implemented in regional water bodies where water quality has the potential to be affected by wastewater and stormwater discharges. Receiving environment monitoring (REM) has been specific to a given WWTP or CSO outfall, while ambient environment monitoring (AEM) has been conducted to improve understanding of background conditions so any potential effects from outfall discharges can be assessed.

Currently Metro Vancouver is enhancing its REM and AEM programs to amalgamate them into an environmental monitoring program for each water body in order to provide a more holistic approach and understanding of potential effects from wastewater discharged to the aquatic environment. This process had been initiated for Burrard Inlet and the Lions Gate WWTP outfall discharge in 2018, and in 2021 began for the Fraser River and the Annacis Island WWTP outfall discharge. The Strait of Georgia AEM program will continue to be conducted jointly with the University of British Columbia (UBC) under NSERC's Alliance grant from 2021 until 2026. The Iona Island WWTP outfall REM programs will be led by Metro Vancouver, however, lateral collaboration between Metro Vancouver and UBC continues to enhance the Iona Island WWTP REM programs. During this transition period, the various amalgamated programs, or still separate REM and AEM programs, are presented by water body in this report.

Monitoring reports that incorporate the results and provide assessments of the monitoring work are produced annually. Depending on the type of study, time of year, and corresponding analyses undertaken, these annual reports may be offset by about one year to allow for completion of data analysis and interpretation, as well as report production and review.

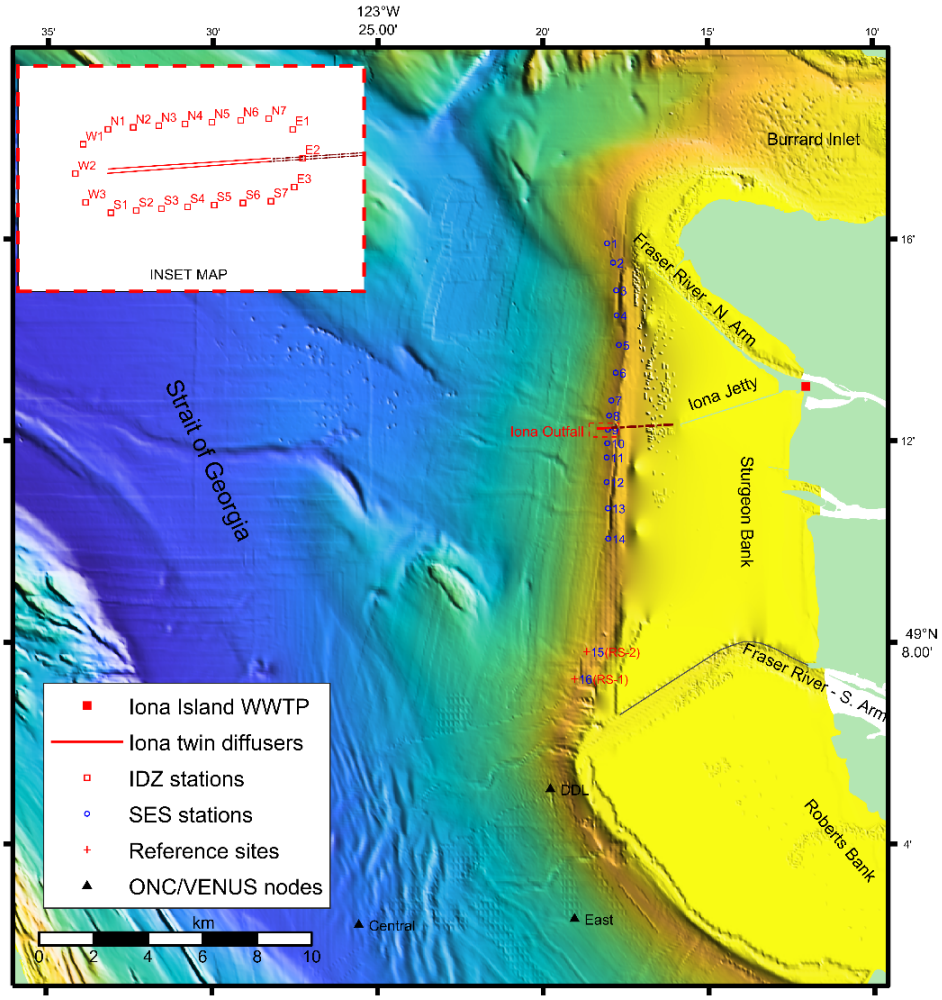
12.1 STRAIT OF GEORGIA

12.1.1 IONA DEEP SEA OUTFALL RECEIVING ENVIRONMENT MONITORING PROGRAM

The Iona Deep Sea Outfall REM Program has occurred annually since 1986, including two years of baseline monitoring prior to the operation of the deep sea discharge in 1988. Prior to 1988, wastewater was discharged directly to the intertidal region of Iona Beach. The Iona deep sea outfall discharges primary-treated effluent from the Iona Island WWTP at an average depth of about 90 m, through a diffuser system into the Strait of Georgia. The deep sea outfall consists of two 7 km long pipes, each connected to a 505 m long diffuser with 100 ports. Each diffuser is composed of three pipe sections with decreasing pipe diameter and increasing port size towards the offshore direction.

The study area of the Iona Deep Sea Outfall REM program is shown in Figure 12.1 below.

FIGURE 12.1 STRAIT OF GEORGIA ENVIRONMENTAL MONITORING – STUDY AREA



Developed in 2000, the overall objective of the Iona Deep Sea Outfall REM Program is to determine possible short- and long-term effects of the discharge to the receiving environment.

The work conducted under the monitoring program has included assessments of effluent quality, plume near-field mixing and far-field dispersion modeling, receiving water quality, sediment quality, composition and structure of the organisms that dwell in and on the sediments, and contaminant uptake and overall health of fish and crab. In 2021, findings of the 2020 field work were reviewed and compiled into the report. The 2020 program included an annual sediment effects survey (SES) and Initial Dilution Zone Boundary Monitoring (IDZ) program.

12.1.2 2020 IONA SEDIMENT EFFECTS SURVEY

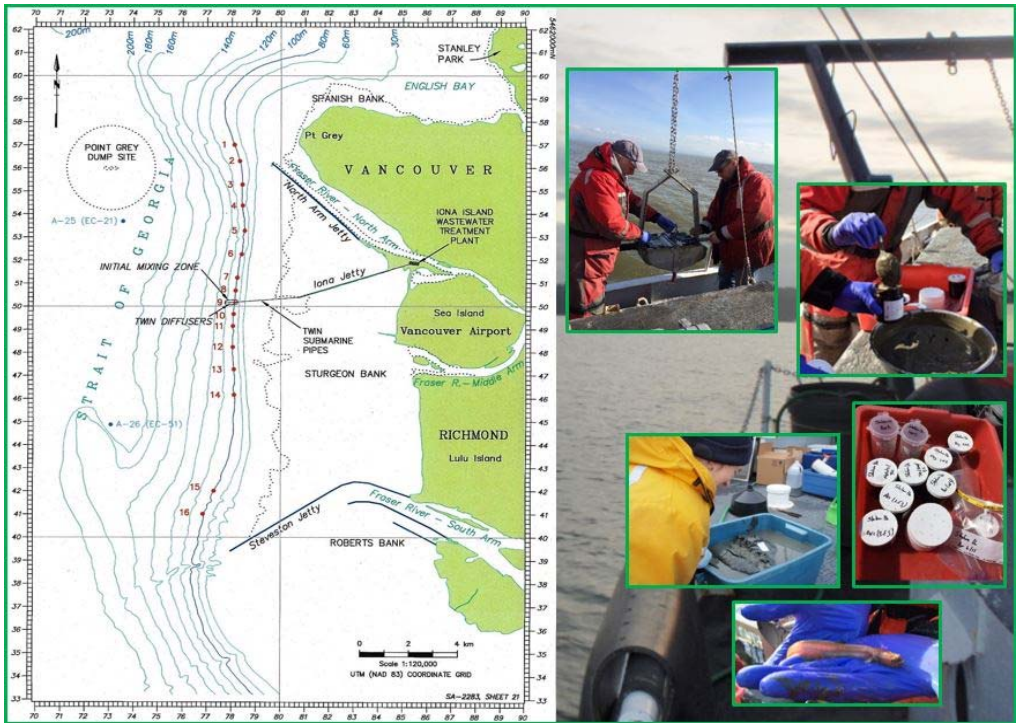
OVERVIEW

The 2020 Iona SES included monitoring of sediment chemistry and bacteriology in addition to benthic infaunal community structure. These components have been monitored annually since 2000, typically in March/April under pre-freshet conditions, allowing for the evaluation of potential long-term effects on the receiving environment.

APPROACH

The survey included 16 established monitoring stations that are located on a north-south transect on the 80 m depth contour in the Iona outfall study area (Figure 12.2). At all 16 stations, sediment samples were collected and analysed for physical, chemical, and bacteriological parameters, as well as benthic community structure. The chemical analysis included metals and organic compounds such as alkylphenols, polycyclic aromatic hydrocarbons (PAHs), alkylated PAHs, hormones and sterols, polychlorinated biphenyls (PCBs), polybrominated diphenylethers (PBDEs), and perfluorinated componds (PFCs).

FIGURE 12.2 IONA DEEP SEA OUTFALL SEDIMENT EFFECTS MONITORING



RESULTS

Generally, wastewater constituent concentrations were highest at the outfall and to the north of the outfall at Stations 9 to 4. Most of the 2020 sediment chemistry and bacteriology results were within their historical range at all stations except for bacteria (fecal coliforms, enterococci, and *E. coli*), several PAHs and BDE-209 which were elevated near the outfall.

Most wastewater constituent concentrations in sediment were below provincial and federal guidelines for the protection of aquatic life. The noted exceedances of metals included arsenic, copper, and nickel. However, these metals were also noted to be in exceedance of guidelines at the reference sites, indicating potential influences from other sources, such as discharges from the Fraser River. As for organics, naphthalene and 2-methylnaphthalene marginally exceeded the lower sediment quality guideline at a single station (station 3) located north of the outfall. Concentrations of PCBs and PBDEs were above the sediment quality guidelines at most stations.

A four-step multivariate analysis was performed on the cumulative sediment dataset in order to identify the spatial extent of the Iona Island WWTP discharge on sediments and wastewater constituents associated with the biochemical fingerprint of the impacted sediment. Fecal coliforms and sterol ratios identified that the effects of wastewater on sediment were greatest near the outfall and decreased slowly to the north and quickly to south of the outfall. Potential wastewater constituents spatially associated with human feces (as indicated by fecal coliforms concentrations and sterol ratios) included stable nitrogen isotopes ($\delta^{15}N$), cadmium, alkylphenols, PBDEs, and bacteria (enterococci). Temporal analysis indicated that sediment concentrations of alkylphenols, PAHs, several PCBs and several PBDEs are decreasing over time. Cadmium concentrations in sediment increased over the monitoring period from 2000 to approximately 2010 but have since plateaued. Cadmium concentrations were below the method detection limit in the Iona Island WWTP effluent and is found naturally in the Strait of Georgia.

As in previous years, benthic infaunal community patterns mirrored the sediment chemistry patterns with lower abundance, lower taxa richness, and lower shell staining of A. serricata adults at stations immediately north of the outfall (Stations 5 to 8). The infaunal communities have been further shaped by influences other than WWTPs, such as the Fraser River, with cyclical trends in total and species-specific abundances likely reflecting larger-scale climatic or hydrographic patterns. Overall, there is no indication of increasing impacts to the benthic infaunal community within the Iona study area. Results of the 2021 Iona SES are under review and the report is under preparation.

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12.1.3 2020 IONA INITIAL DILUTION ZONE BOUNDARY MONITORING

OVERVIEW

A monitoring program for the edge of the Iona Island WWTP IDZ was included as an annual component of the REM in 2010, after earlier surveys in 1989 and 1996. The objective of this component of the overall REM program is to establish compliance with water quality guidelines at the boundary of the IDZ, as currently there are no site-specific WQOs available for the Strait of Georgia.

The IDZ is defined as the zone extending up to 100 m horizontally in any direction from a discharge, but not to exceed more than 25% of the width of the water body at the discharge point. The boundary of the IDZ is the regulatory and compliance boundary where WQOs and guidelines begin to apply.

Between 2010 and 2017, water samples were collected from fixed locations identified in the program design and at reference area sampling locations. The samples were analyzed for chemical and biological parameters and the results were compared with the applicable water quality guidelines. In 2018, the Iona IDZ monitoring program was conducted in the form of an effluent dye tracer study to better characterize near-field effluent plume mixing and to update a near-field mixing model. Based on the results of the 2018 dye study, various improvements to the monitoring program have been implemented since 2019.

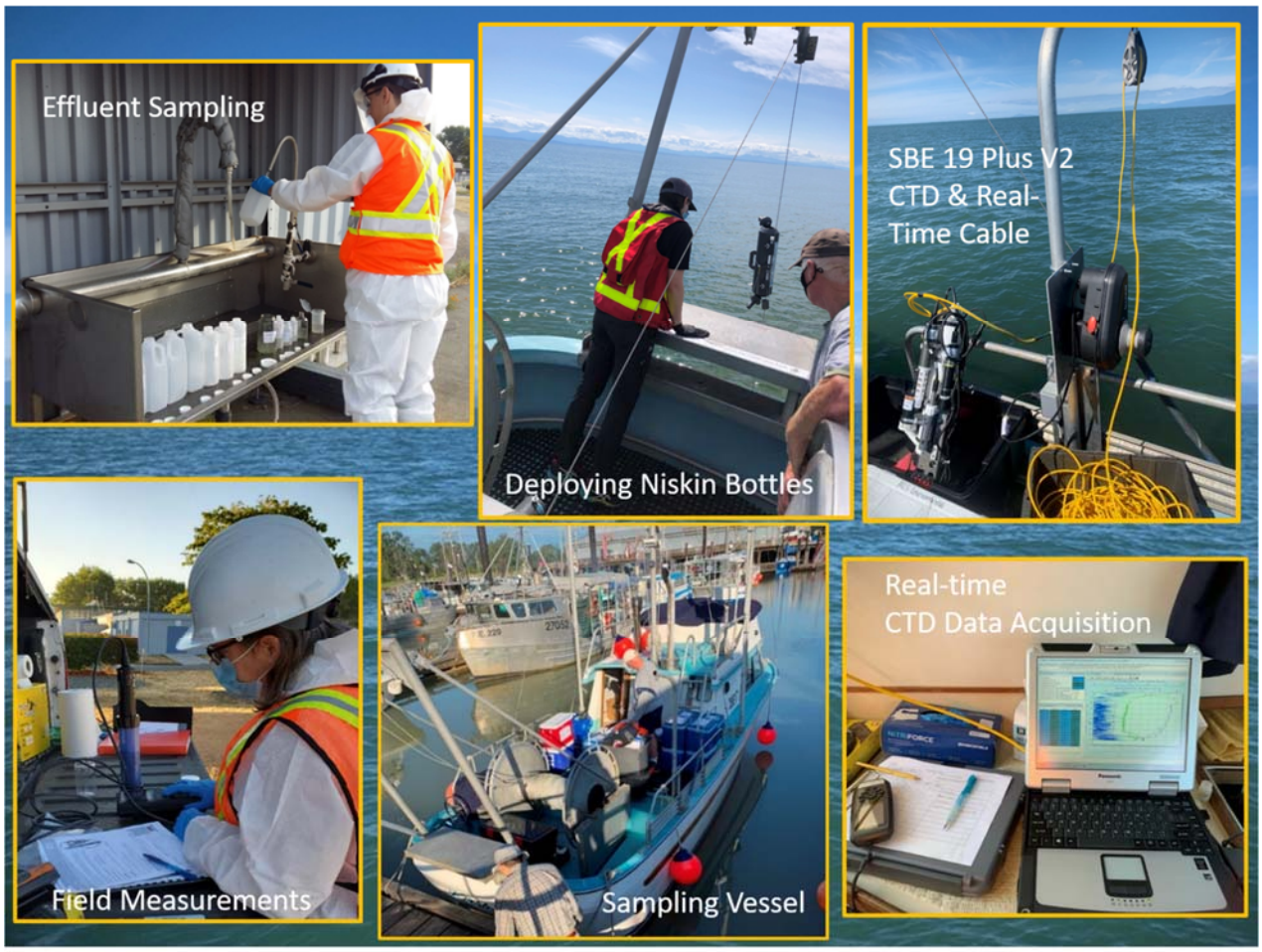
APPROACH

Water quality sampling is designed to allow for the assessment of both short-term (acute) and long-term (chronic) water quality objectives and guidelines. In line with the previous Iona IDZ sampling years, sampling was conducted following a weekly schedule in order to facilitate the calculation of a 5 sample over 30-day long-term average (referred as a 5-in-30 average). The 2020 Iona IDZ monitoring program was conducted between July 21 and August 18, 2020. Sampling times were selected to reflect various tidal conditions (ebb, flood and slack) at the edge of the IDZ boundary.

The location of the plume was determined in the field using a Sea-Bird Electronics (SBE) 19plusV2 CTD (Conductivity Temperature Depth) profiler with real-time feed of CDOM (Colored Dissolved Organic Matter), DO (Dissolved Oxygen), tryptophan and light transmittance measurements. Due to COVID-19 safety protocols, a reduced sampling program was carried out in 2020. Six samples were collected from a single station at the IDZ boundary each week, in comarson with 12 samples collected at two stations each week in 2019. Samples were collected in 4.2 L Niskin water samplers affixed to a winch wire and, spaced 2 to 5 m depending on the observed plume thickness.

Samples were also collected from the Iona Island WWTP effluent and at the reference location. A total of 114 parameters were analyzed which included physical parameters, bacteriology, nutrients, metals, and organics such as alkylphenols, PAHs, hormones and sterols, pyrethroid pesticides and PBDEs.

FIGURE 12.3 MATERIAL AND METHODS

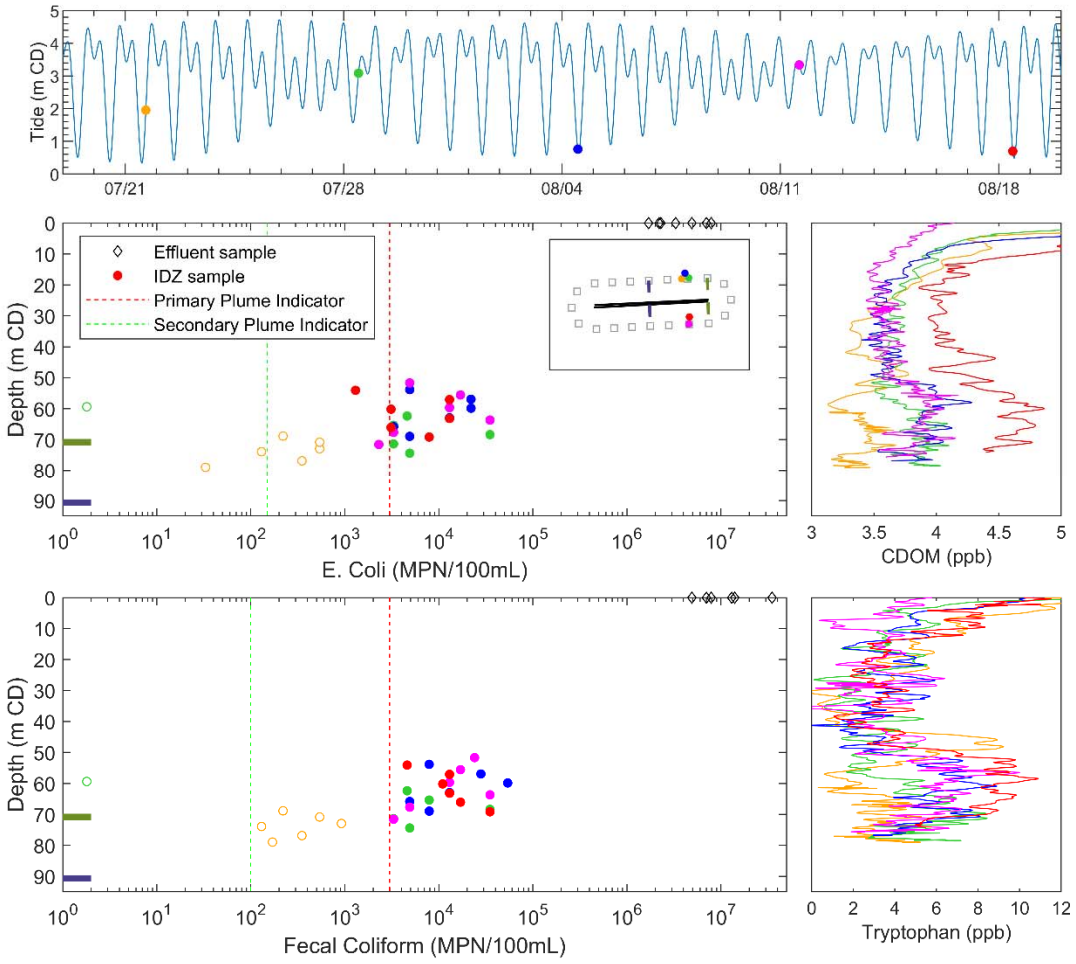


RESULTS

The effluent plume was captured over a wide depth range (55 – 80m), reflecting the fact that a wider range of oceanographic conditions were captured during the 2020 sampling program. Bacterial concentrations positively correlated with CTD profiles confirming that the new field methods were accurate in identifying the effluent plume (Figure 12.4). The Iona Island WWTP effluent plume was successfully captured in 77% of samples collected during the 2020 survey.

Consistent with the 2019 results, water quality parameters exhibited a greater range of concentrations with higher peaks using the revised sampling methods. Despite capturing higher concentrations, all water quality guidelines at the IDZ boundary were met except for total boron and dissolved oxygen (DO). The observed boron concentrations are a result of natural background conditions in the marine environment. The BC water quality guideline for dissolved oxygen is applicable to surface and near-surface waters and therefore does not apply to coastal subsurface intermediate water depths where low natural oxygen levels are expected (BC ENV 1997). DO concentrations were not statistically different from the concentrations at the reference location, which indicates that DO concentrations are not directly attributable to the Iona discharge and reflect the regional conditions of the Strait of Georgia.

FIGURE 12.4 CONFIRMATION OF EFFLUENT PLUME CAPTURE - COMPARISON OF BACTERIA INDICATORS WITH CTD INDICATORS (CDOM AND TRYPTOPHAN)



Methylmercury and PBDEs are considered persistent, bioaccumulative and toxic substances (PBTs). As a result, they are not allowed a mixing zone and effluent concentrations must meet water quality guidelines (CCME, 2008). Effluent grab samples collected in the 2020 program had concentrations of methylmercury, total pentaPBDEs, PBDE-99 and PBDE-100 greater than long-term guidelines however concentrations were within the ranges observed over the period 2014 to 2019. Overall, there is no indication of increasing impacts to the water quality within the Iona study area.

The field work for the 2021 Iona IDZ monitoring program has been completed and the final report is under preparation.

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12.1.4 STRAIT OF GEORGIA AMBIENT MONITORING PROGRAM

OVERVIEW

The Strait of Georgia Ambient Monitoring Program was initiated in 2004. For the first 10 years the program was conducted in partnership with the Department of Fisheries and Oceans' Institute of Ocean Sciences (IOS). This program largely focused on sediment characterization. Since 2013, Metro Vancouver has continued the monitoring program with the Department of Earth, Ocean and Atmospheric Sciences (EOAS) of the University of British Columbia (UBC).

The program's overall objective is to understand how the water column conditions (circulation, mixing, biological productivity, and turbidity) affect contaminant dispersion and removal from the Strait of Georgia water column. The components of the monitoring program include measuring and quantifying spatial and temporal patterns of circulation; elucidating the modes of dispersion and removal of PCBs, PBDEs, silver, cadmium, and copper from the Strait of Georgia water column; development of a planktonic food web; and trace analysis of metals in zooplankton.

APPROACH

With the continued operation of Ocean Networks Canada/Victoria Experimental Network Under the Sea (ONC/VENUS) coastal observatory, it is possible to monitor the state of the Strait and to provide a context for more efficient examination of circulation and mixing processes in the Strait. The investigation included field sampling through dedicated ship time and analysis of data archives from various existing monitoring initiatives, such as VENUS' seabed monitoring nodes, the Ferry Monitoring System, Coastal Ocean Dynamics Applications Radar (CODAR), Moderate-Resolution Imaging Spectroradiometer (MODIS) images from Aqua satellite, IOS quarterly water quality survey cruises, and biweekly survey cruises conducted by Pacific Salmon Foundation under the Salish Sea Marine Survival Project.

Intensive field programs were conducted in 2017 and 2018. Temporal and spatial sampling programs included the measurements of conductivity, temperature, salinity, density, turbidity, chemical concentrations (e.g., dissolved oxygen, PBDEs, PCBs, silver, cadmium, and copper), and collections of biological samples. In addition, Fraser River outflow was tracked using surface drifters. The 2020 program focussed on analysis of data collected from these field programs including the development of plankton food web models.

RESULTS

The surface and near surface water properties (temperature, salinity, and chlorophyll) in the southern Strait of Georgia are strongly influenced by the Fraser River plume. Fraser River flow has a well-defined seasonal cycle with substantial year to year variability in timing and volume. In 2020, the Fraser River freshet (spring melt) was not very pronounced but had the largest annual discharge of the past decade. The total annual loading of riverine particulate to the Strait was also high relative to previous years. The spring bloom had a well-defined start and end period. There is a great deal of year-to-year variation in bloom timing, without an obvious trend. Chlorophyll levels in the Strait were somewhat low during the summer compared to the last several years.

Long-term trends of intermediate and deep water properties (temperature, salinity, and dissolved oxygen) of the Strait of Georgia have been extended using the latest archival data. In general, observed long-term changes were small compared to seasonal and inter-annual variability. Water characteristics from 2014 to 2016 were somewhat anomalous but have returned to more typical conditions.

FIGURE 12.5 STRAIT OF GEORGIA AMBIENT ENVIRONMENT MONITORING – SAMPLE COLLECTION.

The pathway of intermediate water (50 -200m) of the Strait of Georgia is important to the fate and transport of Iona Island WWTP effluent since the effluent is discharged at a depth range of about 70 to 105 m into the southern strait. The pathways of intermediate water within the Strait of Georgia were

studied using an amalgamation of conductivity, temperature, and depth (CTD) profiles and particle tracking technique based on a three-dimensional Strait of Georgia circulation model (SalishSeaCast). Preliminary results provide a comprehensive overview of the circulation pattern in the Strait of Georgia. The vigorously mixed water in Haro Strait ventilates the intermediate water through an up-strait boundary current that flows along the eastern shores of the southern basin. Passing Iona Island WWTP deep sea outfall on its route, this southern inflowing water is either incorporated into the interior of the southern basin, recirculated southwards, or transported into the northern basin. The time scale for the southern inflow to reach the northern basin is estimated to be about 140 days. A second significant input into the intermediate water is through the Discovery Passage from the north. This northern inflow travels southward along Vancouver Island and reaches the southern basin in about 30 days.

Further evaluation of intermediate water circulation patterns will be included in future work. The investigation of deep water renewal was initiated in 2020.

Plankton are the first trophic level in the pelagic food web. Existing foodweb models use a simplified approach to represent planktonic species. A refined plankton food web model was proposed in order to gain insight into the role of plankton in the overall foodweb. Parameterization and initial validation of a zooplankton in the food web model was conducted in 2020. Model development will continue in 2021 with parameterization and validation of phytoplankton.

Analysis of zooplankton biomass, concentrations of copper, cadmium and silver in zooplankton, and trophic position of zooplankton collected from the Strait of Georgia continued in 2020. The biomass results indicated that zooplankton biomass and abundance have a strong seasonal variability that is highest in June and lowest in December. Overall, biomass estimates were consistent with previous studies and indicate that the zooplankton community has been stable for several decades. Concentrations of copper, cadmium, and silver in zooplankton were all below reported toxicity levels although the cadmium and silver concentrations in the largest zooplankton were approaching concentrations of concern. Finally, the observed zooplankton trophic positions ranged from the second to third trophic level in the zooplankton food web. Future work will determine the trophic level and metal concentrations in Pacific Hake (*Merluccius productus*), and Spiny Dog fish (*Squalus acanthias*) such that trophic magnification factors for copper, cadmium and silver in the Strait of Georgia can be calculated.

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12.2 BURRARD INLET ENVIRONMENTAL MONITORING PROGRAMS

The Lions Gate WWTP discharges primary treated effluent into the turbulent First Narrows area of Burrard Inlet through a diffuser located just to the west of the Lions Gate Bridge in West Vancouver. The average diffuser depth is approximately 20 m and discharges occur about 184 m offshore. The effluent is dispersed initially throughout inner and outer Burrard Inlet before entering the Strait of Georgia. Between May and September 30, the effluent is disinfected.

The Lions Gate Outfall REM Program has been conducted annually since 2003 to monitor potential effects of the discharge. The REM Program was founded by an initial workshop that proposed a set of 15 monitoring and investigative activities. Based on these recommendations and subsequent investigative studies, a framework for the Lions Gate WWTP REM program was developed.

The Lions Gate REM initiated with an SES in 2003 that assessed potential effects to sediment chemistry and the benthic invertebrate community. In 2009, the REM program included an annual water column component to confirm water quality guidelines and objectives are met at the boundary of the Initial Dilution Zone (IDZ), 100 m from the diffuser.

In addition to the REM Program, the Burrard Inlet Ambient Monitoring Program (BIAMP) was established in 2007 to describe the spatial and temporal difference in water, sediment, and fish tissue quality within Burrard Inlet. The BIAMP was conducted independent of considerations from the Lions Gate WWTP discharge, instead focusing on Burrard Inlet as a whole.

Metro Vancouver amalgamated the Lions Gate Receiving Environment and Burrard Inlet Ambient Monitoring Programs in 2018 with the primary objective to focus on understanding the influence of Metro Vancouver discharges in Burrard Inlet. Changes that have been implemented are outlined below.

12.2.1 BURRARD INLET WATER COLUMN MONITORING

OVERVIEW

With the redesign and amalgamation of the REM Program and BIAMP opportunities were identified to increase sampling and analysis efficiencies through the use of different sampling equipment and new data analysis approaches. These field methods and data analysis approaches were introduced in the 2018 program to improve certainty of the overall data interpretation. The 2019 program built upon these methods through the inclusion of additional sampling stations and statistical analyses. The third iteration of the consolidation of the two programs was undertaken in 2020.

APPROACH

Sampling was successfully conducted on six separate days between October 20th and December 2, 2020. Daily activities included collecting depth-stratified water chemistry samples paired with water column profiles from all seven established BIAMP stations, one additional ambient station established in 2019 (Figure 12.6), and up to four stations along the down-current edge of the IDZ boundary (Figure 12.7). Physical water column profiles were also conducted at up to 16 additional stations along the IDZ boundary and throughout Burrard Inlet.

All sampling was conducted using a Sea-Bird Electronics (SBE) ECO55 Sea Carousel integrated with a SBE 25Plus Conductivity, Temperature, Depth (CTD) profiler. At the IDZ boundary, a WetLabs ECO fluorimeter was used to measure the concentration of Coloured Dissolved Organic Matter (CDOM) as an indicator of the effluent plume. Based on visual interpretation of the real-time CDOM readings, the effluent plume was identified and manual closure of water bottles facilitated a plume capture rate of 73%.

FIGURE 12.6 BURRARD INLET ENVIRONMENTAL MONITORING PROGRAM – 2020 WATER COLUMN AMBIENT SAMPLING STATIONS

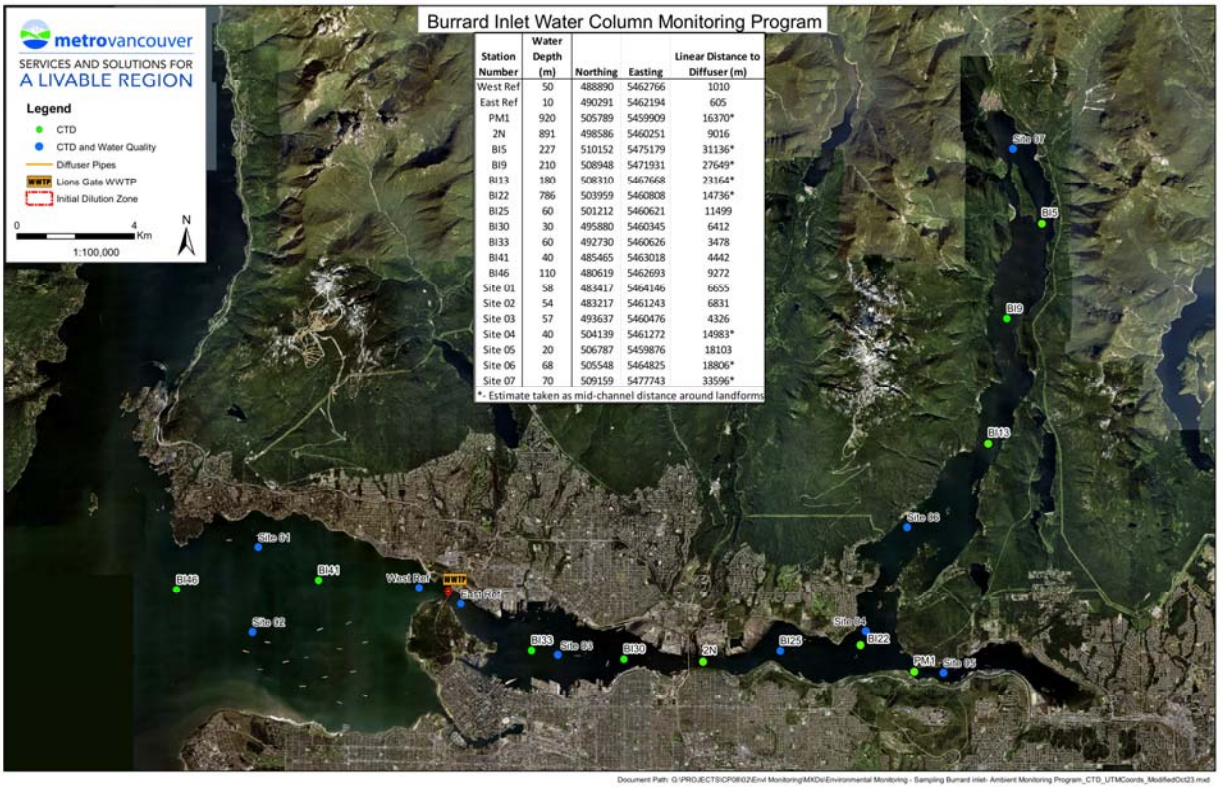
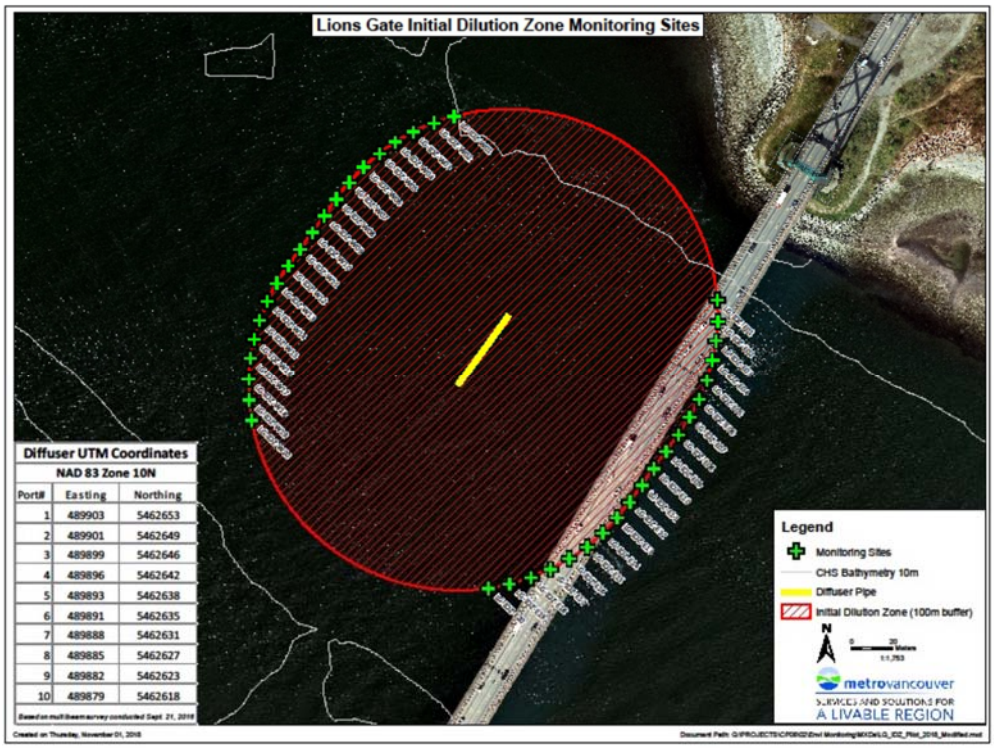


FIGURE 12.7 BURRARD INLET ENVIRONMENTAL MONITORING PROGRAM – 2020 WATER COLUMN INITIAL DILUTION ZONE SAMPLING STATIONS



RESULTS

All WQOs and water quality guidelines at the IDZ boundary were met, except for dissolved oxygen, total boron, and a minimal number of measurements for turbidity, TSS and temperature. Additionally, PBDE-99, PBDE-100, total PentaBDE, PCB-126, and total PCBs exceeded their respective ambient water quality guidelines in the effluent. These substances are persistent, bioaccumulative and toxic (PBT) substances, and as such are not permitted a dilution zone and guidelines are intended to be met in the effluent. However, the noted QC issues with trace organic constituents confound this conclusion for some analytes.

Effluent concentrations of total boron were ten times lower than the applicable water quality guideline, while effluent dissolved oxygen concentrations were often comparable to measurements in the receiving environment. A statistical analysis comparing the newly defined effluent plume concentration metric CDOM anomaly confirmed no significant relationship between the Lions Gate WWTP effluent plume and either of these two constituents. With respect to the three IDZ samples that did not meet the BC ENV and CCME temperature guidelines, the deviation was small (i.e., <0.35 °C below the guideline). As effluent temperature exceeded receiving water temperatures in all cases, it is not possible for Lions Gate WWTP effluent to have caused this deviation from the guideline. Turbidity exceedances were observed in samples collected from surface water along the eastern IDZ boundary, and are likely unrelated to WWTP effluent, as corresponding plume-associated deep-water samples did not exhibit any exceedances. More rather, these high values are likely related to incoming freshwater from the nearby Capilano River. With respect to TSS, the Burrard Inlet Short-Term WQO was exceeded by 1.6 mg/L in a single bottom water sample on November 2nd. Given the high concentrations of fecal coliforms in this sample, the TSS

exceedance may be related to LG WWTP discharge. However, WWTP-related TSS exceedances at the IDZ are uncommon and likely short-lived. Further, TSS concentrations throughout Burrard Inlet, including far-field stations, were frequently similar to or higher than concentrations at the IDZ. Therefore, these observed water quality guideline exceedances were likely due to background conditions of Burrard Inlet rather than the Lions Gate WWTP effluent. In the case of dissolved oxygen and boron, this conclusion is supported by the Burrard Inlet-wide data which also consistently reported concentrations that did not meet the relevant WQOs and guidelines.

With regards to PBT substances, all individual PCB congeners met their respective water quality guidelines, except for PCB-126. PCB-126 concentrations were less than the analytical detection limit (DL), but the DL was higher than the guideline for all samples. Lower DLs are not commercially available. Total PCBs reported was calculated from the sum of all PCBs detected and confirmed (i.e., does not contain any congeners in which results are flagged with data quality issues), and exceeded the BC MOE Short-term Water Quality Guideline. However, it should be noted that CCME guidelines for water were rescinded and no longer apply because environmental exposure is predominantly via sediment and/or tissue for which guidelines still exist. PBDE-99 and PBDE-100 exceeded their respective guidelines exceedances; however, there was some contamination of travel blanks and method blanks. As a result, concentrations for these congeners may be overestimated. Additionally, other congeners that are included in the Total pentaBDE estimate were also confounded, and as a result both the individual and the total penta- concentration are viewed as potentially over-estimated.

Other water quality measurements including bacteriology (fecal coliforms, E. coli, and enterococci), some metals (copper, nickel and barium), and nutrients (organic carbon, ammonia, and Total Kjeldahl Nitrogen, or TKN) were statistically elevated at the IDZ boundary compared to the up-current reference station. Although concentrations of these constituents were elevated relative to background conditions, applicable WQOs and guidelines were still met. Additionally, the elevated concentrations of these wastewater-associated constituents were not observed at adjacent Burrard Inlet stations in the Inner or Outer Harbour, confirming that no measurable effects on water quality occurred outside the IDZ boundary.

Several other water quality constituents, specifically heavy metals, were observed at higher concentrations elsewhere in Burrard Inlet. Both the average and maximum concentrations of lead were higher in southern Indian Arm, Central Harbour, and Port Moody Arm. Zinc and nickel had generally low or below DL concentrations throughout Burrard Inlet, with the exception of several samples in Indian Arm. Copper concentrations were similarly below DL, except for discrete elevated samples in southern Indian Arm and the Inner Harbour. The average Lions Gate IDZ concentrations were often equal to, or slightly less than the farther east stations. This pattern suggests the influence of metal inputs other than the Lions Gate WWTP discharge. Elevated concentrations of these heavy metals often co-occur with elevations in TSS and turbidity, suggesting that higher concentrations in metals may be related to suspended sediments in the shallow areas of Burrard Inlet after strong tidal mixing occurs over Second Narrows and the sill to Indian Arm.

The Lions Gate WWTP effluent has significantly decreased with respect to the concentrations of acenaphthene, dissolved iron, total manganese, and 4-nonylphenol since 2006, and increased in

concentration of total aluminum. At the IDZ boundary, a significant decrease in DO has occurred since 2006. However, over the same period of time, significant declines in DO have also occurred in the surface waters of the Inner and Outer Harbour. No corresponding decreasing trends were observed farther east into Burrard Inlet, where DO levels are naturally low. A decrease in nitrate and magnesium at the IDZ boundary was also observed. Aluminum, cadmium and iron significantly increased at the IDZ over the time period examined.

Throughout Burrard Inlet, many temporal trends in constituent concentrations were isolated, often to specific sampling stations and depths. Consistent with trends at the Lions Gate IDZ boundary, DO decreased significantly at several stations. Several metals including calcium, magnesium, cadmium and nickel decreased at two or more stations. Further, some trends were reported in wastewater-associated constituents, with a significant decrease in ammonia at five stations but an increase in TKN at six stations. Enterococci concentrations increased at several locations. However, this trend may be due to a change in methodology in 2018 as compared to earlier data. No concomitant increases were observed for E. coli or fecal coliforms, for which no methodology change occurred. Given the locations of these stations and lack of concomitant trends at the IDZ boundary or in effluent, these trends are unlikely to be related to the Lions Gate WWTP discharge, but rather to changes in local sources and/or reduction through natural mechanisms.

Burrard Inlet environmental monitoring for the 2021 Water Column Program was conducted in November and December 2021, following the methods described above. The report is currently under preparation.

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12.2.2 SEDIMENTS EFFECTS SURVEY

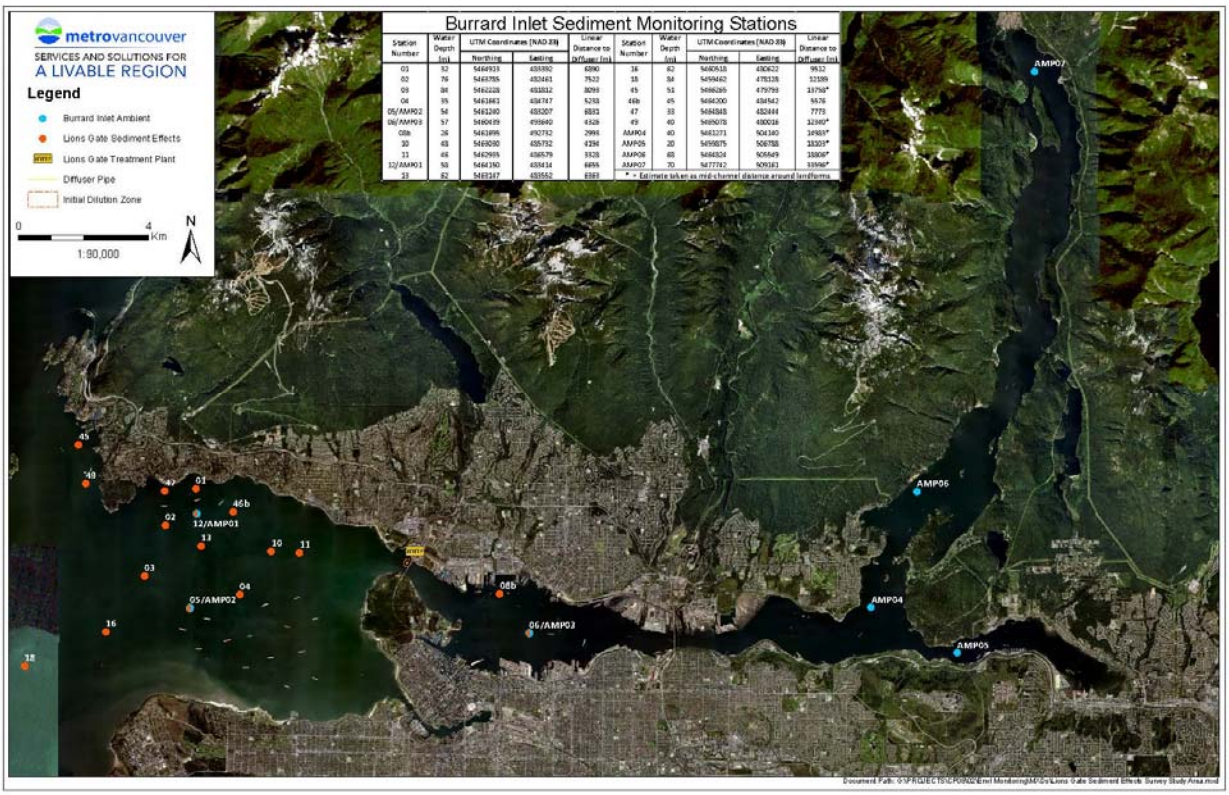
OVERVIEW

The 2020 SES included sediment quality characterization and an evaluation of the benthic invertebrate community structure (Figure 12.8) between March 17 and 30. Sediment samples were collected and analysed for physical, chemical, and bacteriological parameters, as well as benthic community structure at the 17 established SES stations within Burrard Inlet (Figure 12.9). The chemical analysis included metals, stable isotopes and several organic analyte groups including alkylphenols, polycyclic aromatic hydrocarbons (PAHs), alkylated PAHs, hormones and sterols, polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs), and perfluorinated organic compounds (PFCs).

In addition to the core 17 SES stations, four additional BIAMP stations were combined with the REM Program. Until 2015, the BIAMP included a sediment monitoring program that sampled seven sites. Three of these sites overlapped with the Lions Gate SES. By adding the four non-overlapping BIAMP sites to the larger REM Program, Metro Vancouver has amalgamated monitoring efforts into a single program encompassing all of Burrard Inlet (Figure 12.8). The 2018-2020 results from the BIAMP only sites are not presented herein, as they will be reviewed and reported together in 2021.

FIGURE 12.8 LIONS GATE WWTP MONITORING OF OUTER BURRARD INLET

FIGURE 12.9 METRO VANCOUVER'S BURRARD INLET SEDIMENT SAMPLING STATIONS



APPROACH/RESULTS

In 2020, most parameters analyzed met respective provincial or federal guidelines. The exceptions were arsenic, cadmium, copper, lead, mercury, nickel, zinc, several PAHs, PBDE-99, pentaPBDEs and total PCBs; however, exceeding analytes either showed no difference throughout the study area or lower concentrations at wastewater influenced sites than uninfluenced sites (e.g., arsenic, zinc, acenapthylene) or were not strongly correlated with wastewater indicators (e.g., PBDE-9 and pentaPBDE).

A four-step multivariate analysis was performed on the cumulative sediment dataset in order to identify wastewater constituents that exhibited a strong relationship with the biochemical fingerprint of the Lions Gate WWTP effluent. The identified wastewater indicators used for Lions Gate discharge included sediment fecal coliforms, enterococci, and sterols ratios (including coprostanol, epicoprostanol, cholestanol and cholesterol).

The sediment sampling stations were then defined as influenced or non-influenced by the Lions Gate WWTP based on a cluster analysis using the established biochemical fingerprint of the Lions Gate effluent. From this analysis, it was determined that Stations 16 and 18 in southwest Burrard Inlet were consistently found to highly correlated with the wastewater indicators; however, currents and dispersion models suggest that this influence was from the Iona Island WWTP. Stations 06 and 08b were also consistently found to be influenced by wastewater, although the heavily industrial nature of the Inner Harbour likely also confounds the source of contaminants. Concentrations of wastewater indicators including human-

derived sterols (e.g., coprostanol and epicoprostanol), as well as, *E.coli* and fecal coliforms were higher at influenced than uninfluenced stations. Whereas several northwest/Outer harbour stations, with low sediment wastewater indicators, had higher concentration for various analytes (e.g., PCBs, PBDEs, metals, carbon and nitrogen) than southwest stations, but similar to influenced stations in the inner harbour. Based on these results, sediment contaminant deposition likely occurs from a wide range of sources throughout the heavily developed and urbanized Burrard Inlet. While most analytes showed either decreasing or no significant temporal trends, sediment concentrations of arsenic, extractable nickel and silt content showed increasing trends over all stations.

The results suggest the Lions Gate WWTP discharge did not significantly affect most sediment chemistry and benthic invertebrate community characteristics. Patterns of benthic invertebrate community composition and shell-staining of the clam *Axinopsida serricata* suggest there was oxygen depletion and organic enrichment at Inner Harbour stations that may be influenced by the Lions Gate WWTP outfall, as well as other point and non-point discharges. Consistent with this observation, several species known to be sensitive to organic enrichment were inhibited at Inner Harbour stations, but more abundant at influenced southwest stations, suggesting organic enrichment at the Inner Harbour. However, there was no correlation between wastewater indicators and biotic indicators, suggesting that both nutrient and contaminant distributions in Burrard Inlet are confounded by sources other than the Lions Gate WWTP (e.g., riverine inputs, stormwater). Therefore, the observed changes in the infaunal community are more influenced by other factors rather than the Lions Gate WWTP.

Burrard Inlet Environmental Monitoring for the 2021 Sediment Effects Survey was conducted in March 25 to April 7th. The report is currently under preparation.

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12.3 FRASER RIVER

Metro Vancouver owns and operates three secondary WWTPs that discharge treated effluent into the Main Arm of the Fraser River. The largest of these plants is the Annacis Island WWTP, which discharges into the Fraser River immediately downstream of the Alex Fraser Bridge. The other two plants that discharge into the Fraser River are the Lulu Island WWTP at the foot of Gilbert Street in Richmond and the Northwest Langley WWTP downstream of 201st Street in Langley.

In 2021, the Fraser River WWTP REM (Annacis IDZ) and Fraser River Ambient Water Column Monitoring Programs were amalgamated into one program (Fraser River Environmental Monitoring Program (FREMP)) to improve the assessment of REM data in the context of background conditions in the Fraser River. The FREMP comprises both Annacis IDZ and Fraser Ambient water programs during the same 5-week period, aligns analyses of parameters of interest and presents results in one report.

12.3.1 FRASER RIVER ENVIRONMENTAL MONITORING PROGRAM - WASTEWATER TREATMENT PLANT OUTFALLS RECEIVING ENVIRONMENT WATER QUALITY

The Fraser River REM program for Metro Vancouver's three secondary WWTPs was designed to be cyclical and includes the following program components: annual IDZ boundary water column monitoring, bi-annual chronic effluent toxicity testing (see Section 11.1.2), and sediment quality monitoring conducted once during the five-year cycle (Gartner-Lee, 2003). Chronic toxicity is now tested monthly at the Annacis Island and Lulu Island WWTPs and quarterly at the Northwest Langley WWTP in adherence with the CWS-MMWE.

Water column monitoring at the IDZ boundary is the primary receiving environment monitoring program and is focused on the Annacis Island WWTP outfall. The effluent plume at the Annacis Island WWTP outfall can be sampled with a relatively high success rate, compared to the highly transient plumes located at the Lulu Island and Northwest Langley WWTP outfalls. In addition, the effluent discharge rate at the Annacis Island WWTP is substantially greater than at either the Lulu Island or Northwest Langley WWTPs. Consequently, indicators of potential effects, if present, would likely be detected in the Annacis Island WWTP receiving environment first. Therefore, monitoring has been focused on the Annacis Island WWTP since 2003.

The ILWRMP was approved by the MOECCS with the condition that "monitoring near the outfalls for all five wastewater treatment plants" is undertaken (see Ministerial Condition #6). As a result, Metro Vancouver is reviewing the feasibility of monitoring for the more transient plumes at the Lulu Island and Northwest Langley WWTPs. Pilot studies were undertaken at the Lulu Island WWTP in 2014–2015 and at Northwest Langley WWTP in 2017–2018.

12.3.1.1 ANNACIS ISLAND WWTP INITIAL DILUTION ZONE (IDZ) BOUNDARY MONITORING

OVERVIEW

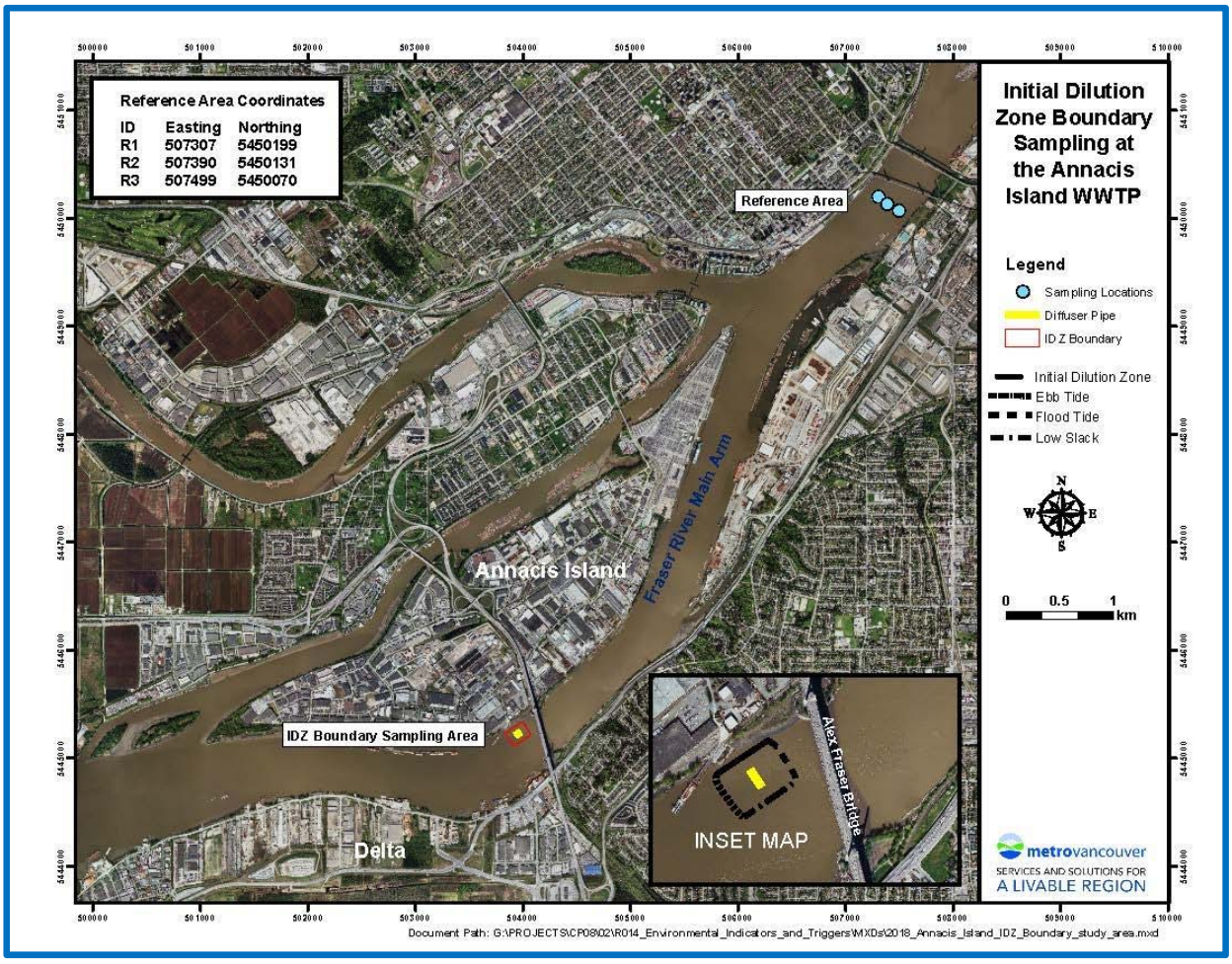
The objective of the Annacis Island WWTP IDZ monitoring program is to assess whether site-specific WQOs and guidelines are being met at the IDZ boundary for Metro Vancouver's Fraser River WWTP discharges.

The Annacis Island WWTP IDZ monitoring program includes annual winter IDZ monitoring that occurs between the last week of January and first week in March, typically during low river flows to reflect the worst-case water quality at lowest dilution.

Samples are collected from a reference area upstream of the Fraser River Trifurcation near the SkyTrain Bridge in New Westminster, and from within the plume at the edge of the IDZ at the Annacis Island WWTP. Concurrently, effluent samples are collected at Annacis Island WWTP to assist with interpretation of the receiving environment water samples.

The study area for the IDZ boundary monitoring program at the Annacis Island WWTP is shown in Figure 12.10.

FIGURE 12.10 ANNACIS ISLAND WWTP IDZ BOUNDARY MONITORING STUDY AREA



Annacis IDZ Study Area (above), and Sampling Vessel at the Annacis Outfall (left). Metro Vancouver Photo.

APPROACH

Five weekly sampling events are conducted within 30 days to allow for comparison with 30-day average WQOs. During each of the five monitoring events, three samples are collected from the reference area (at 5 m depth) and five samples are collected from within the effluent plume (depth 3 to 8 m) at the edge of the IDZ boundary. These samples are subject to laboratory analysis for bacteriology, as well as field water quality measurements. In addition, depth profiles for temperature, pH, conductivity, salinity, turbidity, and dissolved oxygen are measured at one reference and one IDZ boundary site.

Confirmation that samples are collected from within the plume is based on bacteriological analyses.

All reference area samples and IDZ boundary samples confirmed to have been collected from the effluent plume[3] are also analyzed for conventional wastewater parameters, nutrients, low-level total and dissolved metals, total and dissolved organic carbon (TOC and DOC) and chlorophyll a. In addition, samples are periodically collected and submitted for analyses of select trace organics. Since many of these compounds are difficult to detect in the receiving environment, concentrations are derived based on dilution calculations.

RESULTS - 2021

See 2021 Water Monitoring Results for FREMP (FRAMP and ANNACIS REM).

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[3] Fecal coliform concentration ≥1000 MPN/100 mL, and/or enterococci concentrations ≥300 MPN/100 mL are deemed to have captured the plume.

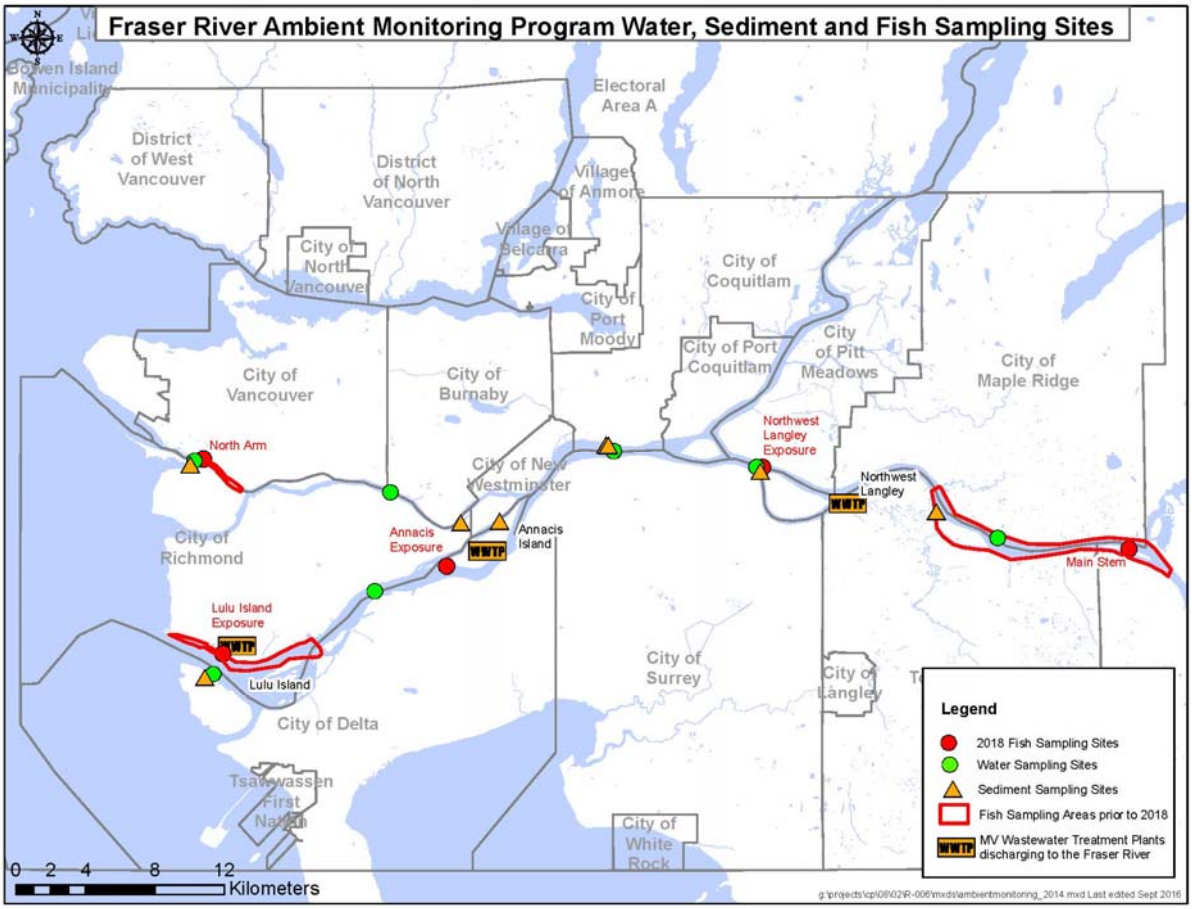
12.3.1.2 FRASER RIVER AMBIENT MONITORING PROGRAM

OVERVIEW

The Fraser River Ambient Monitoring Program (FRAMP) was initiated in 2003. Ambient water quality is monitored yearly, while sediment and fish tissues and health are monitored once in a five-year cycle.

Historically, the program included seven monitoring sites for water and sediment, and in 2007 and 2012 three sampling areas for fish. In 2018, the fish monitoring program was modified to focus more specifically on potential effects of the WWTPs that discharge to the Fraser River and included five sampling areas for fish (Figure 12.11). This program covers the Fraser River within the geographic area of Metro Vancouver, including the Main Stem, Main Arm, and North Arm. In 2021, an eighth water monitoring site was added immediately upstream of the boundary between Metro Vancouver and Fraser Valley Regional District to assess water quality entering Metro Vancouver.

FIGURE 12.11 FRASER RIVER AMBIENT WATER, SEDIMENT, AND FISH MONITORING SITES



APPROACH

WATER

The water monitoring program was designed to be completed during the annual low flow period in the river and to coincide with the highest period of rainfall to capture the worst-case conditions of minimum dilution and high probability of SSOs, CSOs, and rainfall runoff.

Because the lower Fraser River is influenced by tides, a saltwater wedge originating from the Strait of Georgia can travel as far upstream as Annacis Island. Although there is mixing, the freshwater of the river and from runoff, SSOs, and CSOs tends to float on top of the saltwater wedge. To ensure that samples are representative of river water, sample collection is done within one metre of the surface at the end of an ebb (outgoing) tide to avoid the saltwater wedge.

Water quality has been monitored annually at seven sites since 2003 for physical parameters, bacteriology, nutrients, dissolved oxygen, metals, and surfactants. An eighth site was added in 2021

SEDIMENT

Sediment monitoring is timed to target the highest levels of accumulated contaminants in the river sediments. Sediment deposition occurs during the winter low flow period; however, during freshet deposited sediments are likely to be re-suspended or moved due to high river flows. Thus, the highest levels of accumulated contaminants coincide with the pre-freshet period in late February through March.

Sediment sampling was conducted in March 2006, March 2011, April 2016 and April 2021. Sediments are monitored for physical parameters, total organic carbon (TOC), bacteriology, nutrients, metals, organic contaminants, hormones, and surfactants.

FISH

Historically, fish were collected from three areas representing the Main Stem, Main Arm, and North Arm of the Fraser River. Two species of fish were surveyed: Peamouth Chub (*Mylocheilus caurinus*) and Largescale Sucker (*Catostomus macrocheilus*). Fish sampling is conducted in September to allow for gonad growth after spring spawning.

The first ambient fish survey was conducted in 2003–2004. However insufficient fish were captured, so a second survey was completed in 2007 and subsequently in 2012.

The 2018 Fraser River Fish Community Monitoring Program involved collecting fish from within 1 km upstream or downstream of five locations in the Fraser River (Figure 12.10). These locations represent an up-river control in the Main Arm of the Fraser River; exposure areas for the Northwest Langley, Annacis Island, and Lulu Island WWTPs; and a Fraser River North Arm site. In 2018, the target fish species was Peamouth Chub (*Mylocheilus caurinus*), with supplementary sampling of Threespine Stickleback (*Gasterosteus aculeatus*) and Northern Pikeminnow (*Ptychocheilus oregonensis*).

The fish monitoring program encompasses fish community assessments, analytical analyses, and data interpretation within the context of Metro Vancouver WWTP discharges. Fish are surveyed for health indicators, metals, organic contaminants, and biochemical markers of exposure to contaminants.

A companion study to assess the prevalence of pharmaceuticals and personal care products (PPCPs) in fish tissue was conducted alongside the Fraser River Fish Community Monitoring Program in 2018 (Hatfield Consultants, 2019). Fish tissue samples collected from a subset of sites from the aforementioned program (i.e., up-river reference, Annacis Island, and North Arm) were also tested for PPCPs. Otherwise the study design and methods were generally consistent with the primary study.

RESULTS

2021 FREMP WATER MONITORING RESULTS (FRAMP AND ANNACIS REM)

In 2021, ambient samples were collected between February 1 and March 1 and REM samples were collected between February 3 and March 3.

The REM component of FREMP was successful in sampling from the effluent plume at the edge of IDZ based on fecal coliform and enterococci concentrations; with 100% of the samples capturing the effluent plume.

In addition to all samples being analyzed for microbiological and physical parameters, nutrients, and metals, the Annacis effluent samples were analyzed for ultra low-level mercury and methylmercury.

The 2021 Fraser River analytical results were compared with Fraser River WQOs, BC AWQG and WWQGs, or CCME Canadian Environmental Quality Guidelines. All parameters met their respective water quality objectives or approved BC WQGs guidelines at both the IDZ boundary and the reference area throughout the 2021 survey, with the exception of dissolved aluminum in one of 15 samples collected from the reference area. This sample was anomalous with a concentration more than five times the next highest dissolved aluminum concentration measured at the reference area in 2021.

All parameters met their respective water quality objectives or approved British Columbia guidelines at all eight ambient monitoring sites.

Spatial patterns were relatively consistent over the 19-years of Fraser River ambient monitoring (2003-2021). Mann-Kendall trend tests showed increasing concentrations of the following parameters with distance downstream from Site 1 (McMillan Island): specific conductance, enterococci, ammonia, nitrate, phosphorus, total suspended solids, and total copper. Fecal coliforms did not show a significant spatial trend. There are several explanations for the spatial patterns, including:

- Increased loadings with increasing degree of urbanization (most parameters);
- The Annacis Island WWTP discharge affecting concentrations of fecal coliforms at the IDZ boundary and possibly affecting the Annacis reference area during flood tides;
- Contributions from seawater intrusion in the Main Arm and North Arm (conductivity, ammonia, and nitrate); and
- Contributions from the Pitt River (TSS and some metals).

The results of the 2003-2021 annual Fraser River monitoring programs were compared to identify temporal trends, if any, over the 19 years. The conclusions of the trend analysis were as follows:

- There were statistically significant increasing trends in total ammonia and total phosphorus concentrations at the Annacis IDZ boundary over the 19 surveys. Other parameters monitored at the IDZ boundary (fecal coliforms, nitrate, total suspended solids, total copper, and total iron) and all parameters monitored at the reference area showed neither increasing nor decreasing trends.
- There were statistically significant increasing trends in total copper concentrations at the Main Stem and upper Main Arm ambient monitoring sites. These trends contrast with the results for the Annacis IDZ boundary monitoring program likely because the ambient sites were sampled only during ebb tides, while the Annacis sites were sampled under ebb, flood, and slack tide conditions. It appears that the increasing concentrations of total copper are coming from upstream and that the trend at the Annacis sites is masked on the flood tides when more saline water moves upstream.
- Most parameters measured at the Annacis IDZ boundary and the ambient monitoring sites during the 2003-2021 monitoring programs have routinely met applicable water quality objectives or guidelines. Exceptions are primarily total metals (copper, iron, and manganese), which have been elevated during years with higher-than-normal river flows. The elevated total metals concentrations were associated with elevated concentrations of suspended solids, which are typical of high flow periods, and reflect background conditions.

2021 Fraser River Ambient Sediment

In 2021, field work for the Fraser River Ambient Sediment Monitoring Program was completed. The report is under preparation.

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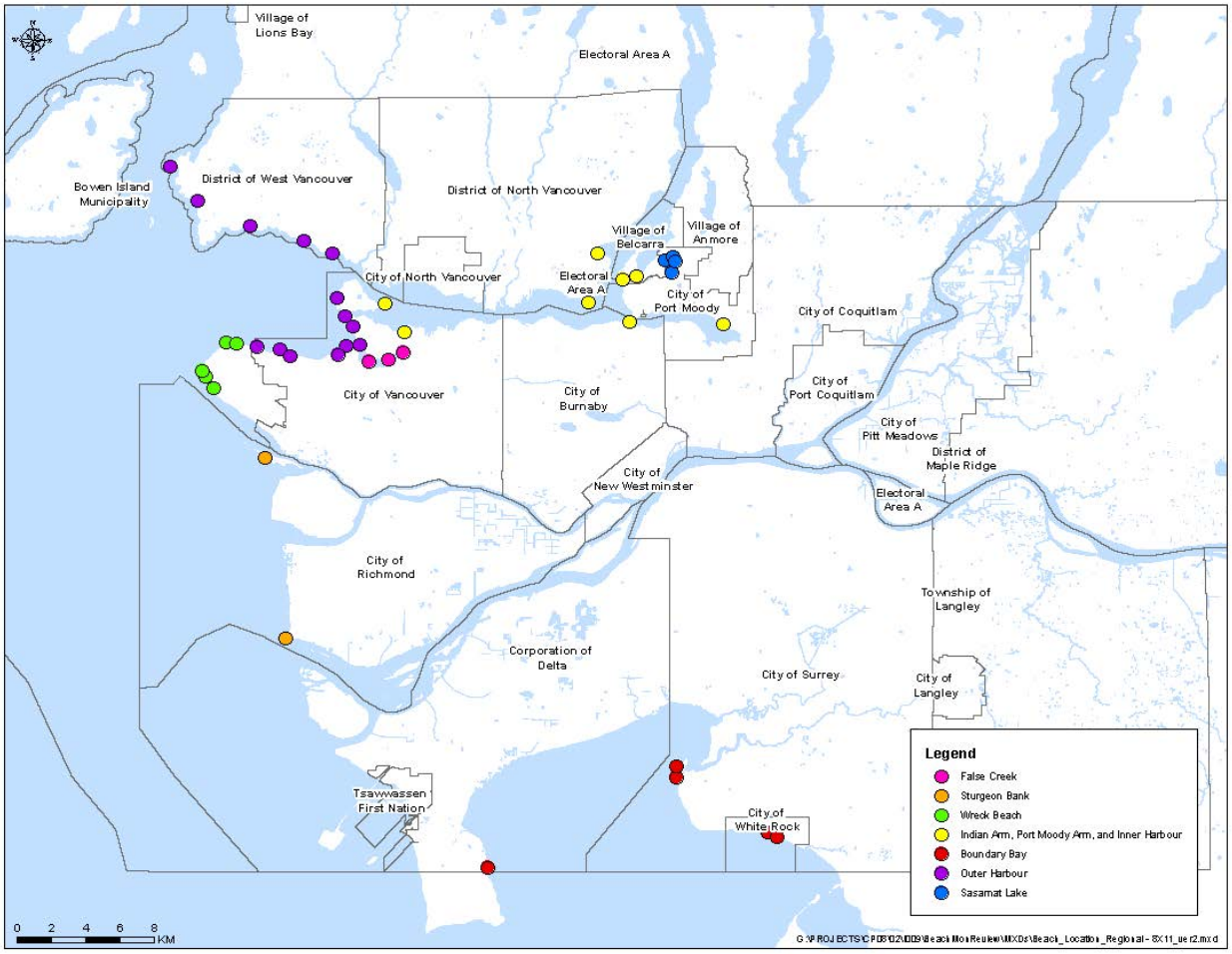
12.4 RECREATIONAL WATER QUALITY MONITORING PROGRAM

Metro Vancouver monitors the bacteriological quality of local recreational waters on a weekly basis throughout the beach season from May to September (Figure 12.12). Sampling outside of the beach season may also be conducted, but at a lower frequency. Both bathing (swimming) and non-bathing beaches are monitored.

FIGURE 12.12 COLLECTING RECREATIONAL WATER SAMPLES

The Recreational Water Quality Monitoring Program has been in place for more than 50 years. During this time, many monitoring sites have been added to the program. The 2021 program included monitoring of 114 sites across 41 locations (Figure 12.13). A minimum of five samples are collected from each site within a 30-day period.

FIGURE 12.13 RECREATIONAL WATER QUALITY MONITORING PROGRAM BEACH LOCATIONS



E. coli bacteria are used by Metro Vancouver as an indicator of fecal contamination to determine the safety of waters for recreational activities such as swimming, windsurfing, waterskiing, boating and fishing. *E. coli* are found in the intestinal tract of warm-blooded animals such as mammals and birds and lead to fecal contamination, which can increase the risk of gastrointestinal illnesses for recreational water users.

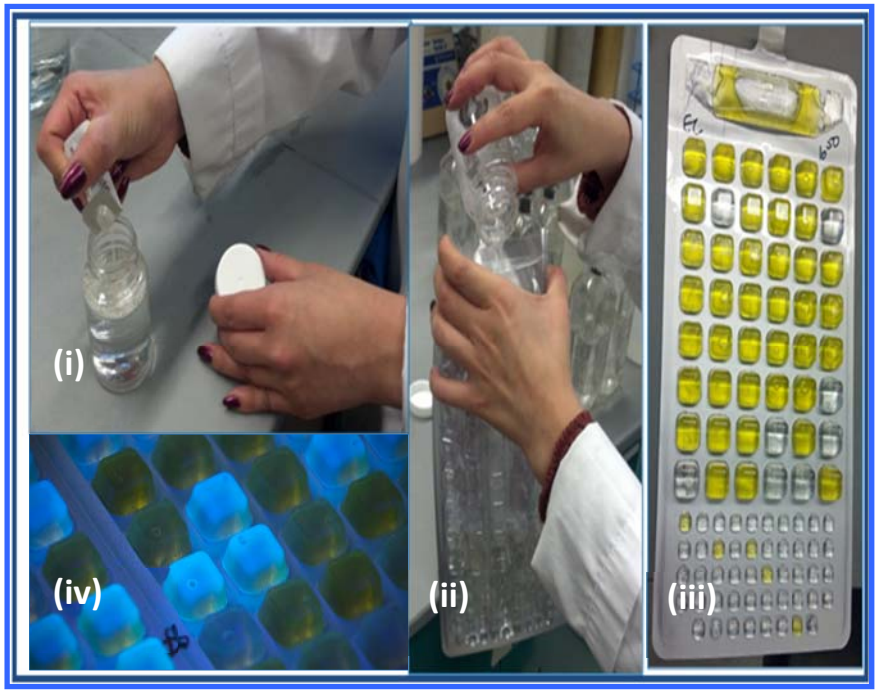
Common sources of fecal contamination in recreational waters may include the following:

- feces from humans, pets and birds
- agricultural and stormwater runoff
- combined and sanitary sewer overflows
- malfunctions in wastewater collection or treatment systems
- improperly maintained septic tanks
- release of raw sewage from boat holding tanks

12.4.1 TESTING

Metro Vancouver measures E. coli abundance using the Colilert-18® system which uses the Quanti-Tray / 2000™ manufactured by IDEXX® (Figure 12.14). This system is recognized by the International Organization for Standardization (ISO 9308-2:2012) as the standard for water and wastewater (IDEXX, 2012). It is also approved by United State Environmental Protection Agency (EPA) and is included in the Standard Methods for the Examination of Water and Wastewater, Section 9223 (SMWW, 22nd Edition, 2012).

FIGURE 12.14 QUANTI-TRAY™ TESTING METHOD



In the photo panel, clockwise from top left, the pictures show the following:

(i) packet of Colilert-18® reagent being added to a diluted sample;
(ii) sample being poured into the sterile Quanti-Tray™ that will be sealed before an 18-hour incubation;
(iii) post-incubated tray showing yellow colouring in wells;
(iv) the tray is placed under a UV light and fluorescing wells are enumerated to determine *E. coli* levels

12.4.2 REPORTING

Metro Vancouver reports test results to both the local health authorities (Vancouver Coastal Health and Fraser Health) and the beach operators (member municipalities and Metro Vancouver Parks). Metro Vancouver, on a weekly basis, calculates and reports the 30-day running geometric mean concentration of *E. coli* for each beach location so compliance with appropriate guidelines can be determined. This results in a new geometric mean being calculated every time a beach is sampled. Notifications of any elevated counts is also given at the time of reporting (i.e., when a beach geometric mean is approaching the guideline or the guideline is exceeded).

12.4.3 GUIDELINES

The local health authorities set the monitoring requirements, and have the overall responsibility to determine whether recreational water is safe for public use. Guidelines for recreational waters are outlined in a Health Canada document titled *"Guidelines for Canadian Recreational Water Quality"* (2012), and in a BC Ministry of Environment and Climate Change Strategy document titled "Recreational Water Quality Guidelines: Guideline Summary. Water Quality Guideline Series" (2017). The primary objective of these guidelines is the protection of public health.

Health Canada defines *primary contact* as a recreational activity in which there is the intentional or incidental immersion of the whole body or the face and trunk, and where it is likely some water will be swallowed. Primary contact activities include swimming, windsurfing and waterskiing.

For primary or whole body contact activities, the guidelines establish a maximum concentration limit for the geometric mean of less than or equal to 200 *E. coli* bacteria per 100 mL of recreational water. This concentration is based on at least five samples taken during a period not to exceed 30 days. A single sample maximum guideline is also applied for individual sampling events with a maximum concentration limit of 400 *E.coli* bacteria per 100 ml or recreational water. The single sample maximum is used to advise authorities on short-term water quality concerns. A working guideline is also available for secondary (incidental) contact activities, such as boating and fishing, in which substantial contact (as described above) with water is rare. The working guideline is set at 1,000 *E. coli* bacteria per 100 mL of recreational water. This is equivalent to five times the guideline value for the geometric-mean concentration for primary-contact recreation.

The local health authorities are responsible for making an assessment of the recreational water quality results to determine the possible health risks and the most effective approach to protecting the health of recreational water users. The health authorities may require the beach operator to post a warning sign indicating that the water is unsafe for swimming or wading. These swimming advisory signs are left in place for as long as necessary and removed once the health authority determines that the health hazard no longer exists.

12.4.4 RESULTS

PRIMARY CONTACT BEACHES

In 2021, the bacteriological water quality for primary-contact recreation was met for most bathing beaches from May through September. However, guideline exceedances at several beaches did result in swimming advisories being posted this year. English Bay had a swimming advisory posted for 4 days due to single sample maximum exceedances and Wreck Beach Trail 7 - Oasis was posted for 10 days due to exceedances of the 30-day geometric mean guideline. Deep Cove had a swimming advisory posted for 12 days as a result of single sample exceedances which was then extended due to the 30-day geometric mean exceeding the guideline. Lastly, *E. coli* concentrations at Crab Park also exceeded the primary contact geometric mean guideline for 49 days but, as it is not a designated swimming beach, it was not posted.

SECONDARY CONTACT BEACHES

False Creek is not a designated swimming beach but is used for secondary contact activities; therefore, the working guideline, five times that of the primary contact guideline, was applied. In 2021, bacterial counts in all basins in False Creek – West, Central, and East – met the geometric mean working guideline.

However, water quality samples collected from East and Central False Creek exceeded the single sample maximum for secondary contact activities on 9 and 2 of the 34 sampling days, respectively.

COMPARISON TO GUIDELINES OVER TIME

Table 12.1 provides a list of the monitoring areas and locations for recreational waters along with a record of attainment of the guideline for primary contact recreation during the beach season for the past 10 years. If the guideline at a given location was not met, then the number of days that the guideline was above the guideline for a given year is shown. In addition, if a given location was posted due to possible fecal contamination, then the number of days a swimming advisory was posted is given (note that the number of days a beach is posted is obtained from information made available to Metro Vancouver from Beach Operators and Health Authority Websites, and Metro Vancouver cannot warrant its accuracy). This record does not include any advisories and postings for other types of biological or chemical hazards, if any.

TABLE 12.1 RECREATIONAL WATER MONITORING LOCATIONS & RECORD OF GUIDELINE ATTAINMENT

Area	Location	Recreational Water Quality Guideline Met Since 2012		
		If no, then number of days GMEAN over guideline	**If no, then number of days posted**	**If no, then number of days single samples over guideline**
Outer Harbour	Whytecliff Park	No: 2014 (27 days); 2015 (14 day)	No: 2014 (27 days); 2015 (12 days); 2018 (2 days)	No: 2013 (4 days), 2014 (23 days), 2015 (18 days), 2016 (3 days), 2017 (5 days), 2018 (5 days)
	Eagle Harbour	No: 2013 (2 days); 2014 (39 days)	No: 2013 (3 days); 2014 (39 days)	No: 2013 (19 days), 2014 (18 days), 2015 (7 days), 2016 (10 days), 2017 (5 days), 2018 (7 days), 2019 (3 days), 2020 (5 days), 2021 (10 days)
	**Sandy Cove	No: 2014 (21 days)	No: 2014 (27 days); 2018 (2 days)	No: 2014 (16 days), 2016 (3 days), 2018 (11 day)
	Dundarave	No: 2014 (21 days)	No: 2014 (27 days)	No: 2013 (8 days), 2014 (16 days), 2015 (13 days), 2017 (3 days), 2018 (1 day), 2020 (2 days), 2021 (1 day)
	Ambleside	No: 2014 (24 days)	No: 2014 (27 days); 2018 (2 days); 2019 (6 days)	No: 2012 (11 day), 2013 (20 days), 2014 (31 day), 2015 (22 days), 2016 (22 days), 2017 (8 days), 2018 (8 days), 2019 (18 days), 2020 (15 days), 2021 (5 days)
	Third Beach	Yes	Yes	No: 2012 (2 days), 2013 (7 days), 2014 (20 days), 2017 (1 day), 2018 (3 days), 2019 (2 days), 2021 (6 days)
	Second Beach	No: 2013 (3 days)	No: 2013 (4 days)	No: 2012 (2 days), 2013 (13 days), 2014 (12 days), 2016 (2 days), 2018 (4 days), 2019 (5 days), 2020 (1 day), 2021 (7 days)
	English Bay Beach	No: 2018 (3 days)	No: 2018 (3 days), 2021 (4 days)	No: 2012 (2 days), 2013 (14 days), 2014 (20 days), 2015 (5 days), 2016 (13 days), 2017 (3 days), 2018 (7 days), 2019 (5 days), 2020 (18 days), 2021 (24 days)
	Sunset Beach	No: 2013 (5 days); 2014 (37 days); 2018 (12 days); 2019 (6 days)	No: 2013 (6 days); 2014 (63 days); 2018 (7 days); 2019 (25 days); 2020 (5 days)	No: 2012 (14 days), 2013 (25 days), 2014 (40 days), 2015 (4 days), 2016 (8 days), 2017 (15 days), 2018 (19 days), 2019 (35 days), 2020 (13 days), 2021 (14 days)
	Kitsilano Point	Yes	No: 2018 (6 days)	No: 2012 (3 days), 2013 (7 days), 2014 (13 days), 2016 (3 days), 2017 (14 days), 2018 (8 days), 2019 (22 days), 2020 (15 days), 2021 (4 days)
	Kitsilano Beach	No: 2018 (9 days)	No: 2018 (6 days); 2019 (6 days)	No: 2012 (21 day), 2013 (9 days), 2014 (13 days), 2016 (2 days), 2017 (9 days), 2018 (19 days), 2019 (16 days), 2020 (8 days), 2021 (4 days)

	Jericho Beach	Yes	No: 2018 (4 days)	No: 2013 (13 days), 2014 (15 days), 2015 (6 days), 2017 (10 days), 2018 (10 days), 2019 (1 day), 2020 (5 days), 2021 (4 days)
	Locarno Beach	Yes	Yes	No: 2014 (8 days), 2015 (6 days), 2016 (15 days), 2017 (6 days), 2018 (17 days), 2019 (7 days), 2020 (3 days), 2021 (5 days)
	Spanish Banks	Yes	Yes	No: 2012 (4 days), 2017 (7 days), 2020 (1 day)
***False Creek**	West False Creek	No: 2014 (20 days)	Yes	No: 2014 (22 days), 2015 (4 days), 2017 (5 days), 2019 (5 days), 2020 (11 day)
	Central False Creek	No: 2014 (33 days); 2020 (2 days)	Yes	No: 2013 (4 days), 2014 (40 days), 2015 (11 day), 2017 (8 days), 2018 (38 days), 2019 (23 days), 2020 (16 days), 2021 (11 day)
	East False Creek	No: 2014 (64 days); 2015 (52 days); 2018 (84 days); 2019 (12 days); 2020 (26 days)	Yes	No: 2012 (56 days), 2013 (54 days), 2014 (109 days), 2015 (93 days), 2016 (31 day), 2017 (100 days), 2018 (124 days), 2019 (104 days), 2020 (75 days), 2021 (46 days)
Indian Arm, Port Moody Arm & Inner Harbour	Cates Park	Yes	Yes	No: 2014 (7 days), 2015 (3 days), 2019 (2 days), 2020 (1 day), 2021 (4 days)
	Deep Cove	No: 2021 (5 days)	No: 2019 (2 days), 2021 (12 days)	No: 2012 (8 days), 2013 (3 days), 2014 (15 days), 2015 (3 days), 2017 (6 days), 2018 (12 days), 2019 (9 days), 2020 (3 days), 2021 (15 days)
	Bedwell Bay	Yes	No: 2014 (7 days)	No: 2014 (10 days), 2015 (10 days), 2017 (2 days), 2020 (4 days), 2021 (7 days)
	Belcarra Park - Picnic Area	Yes	Yes	No: 2014 (6 days), 2015 (2 days), 2016 (7 days), 2019 (3 days)
	Old Orchard Park	No: 2014 (1 day)	No: 2014 (15 days)	No: 2012 (2 days), 2013 (3 days), 2014 (12 days), 2016 (7 days), 2018 (3 days), 2019 (2 days), 2021 (3 days)
	Rocky Point Park	Yes	Yes	No: 2014 (12 days)
	Barnet Marine Park	Yes	No: 2014 (7 days); 2018 (21 days)	No: 2013 (7 days), 2014 (5 days), 2015 (2 days), 2016 (1 day), 2018 (17 days), 2019 (2 days), 2020 (1 day), 2021 (2 days)
	**Crab Park	No: 2020 (10 days), 2021 (49 days)	Yes	No: 2014 (17 days), 2016 (8 days), 2017 (10 days), 2018 (13 days), 2019 (3 days), 2020 (34 days), 2021 (54 days)
	Brockton Point	Yes	Yes	No: 2013 (21 day), 2014 (13 days), 2015 (11 day), 2017 (11 day), 2018 (16 days), 2019 (17 days), 2020 (10 days), 2021 (13 days)

Wreck Beach	Foreshore East	Yes	Yes	No: 2013 (5 days), 2014 (5 days), 2015 (5 days), 2017 (5 days), 2020 (2 days)
	Foreshore West (Acadia Beach)	Yes	Yes	No: 2012 (11 day), 2015 (3 days), 2016 (9 days), 2017 (4 days), 2018 (2 days), 2019 (2 days), 2020 (4 days), 2021 (2 days)
	Trail 4 (Towers Beach)	Yes	Yes	No: 2012 (1 day), 2013 (6 days), 2014 (16 days), 2017 (2 days), 2019 (5 days), 2020 (6 days)
	Trail 6 (North-Arm Breakwater)	Yes	Yes	No: 2013 (13 days), 2014 (7 days), 2020 (5 days), 2021 (2 days)
	Trail 7 (Oasis)	No: 2016 (8 days), 2021 (9 days)	No: 2016 (7 days), 2021 (10 days)	No: 2012 (14 days), 2013 (5 days), 2016 (9 days), 2018 (12 days), 2019 (1 day), 2020 (4 days), 2021 (3 days)
Sturgeon Bank	Iona Beach	Yes	Yes	No: 2014 (3 days), 2015 (7 days), 2017 (2 days), 2018 (5 days), 2020 (7 days)
	Garry Point	Yes	Yes	No: 2015 (10 days), 2017 (1 day), 2018 (4 days), 2019 (8 days), 2020 (3 days)
Boundary Bay	Centennial Beach	Yes	Yes	No: 2013 (15 days), 2014 (5 days), 2015 (3 days), 2016 (6 days), 2018 (3 days)
	Crescent Beach North	Yes	Yes	Yes
	Crescent Beach	Yes	Yes	Yes
	``White Rock Beach (East and West)	Yes	Yes	No: 2012 (6 days), 2013 (1 day), 2014 (11 days), 2015 (5 days), 2016 (3 days), 2017 (9 days), 2018 (1 day), 2020 (2 days), 2021 (2 days)
Sasamat Lake	Sasamat Lake - Float Walk	Yes	Yes	Yes
	Sasamat Lake - Outdoor Centre	Yes	Yes	No: 2020 (6 days)
	Sasamat Lake - White Pine Beach North	No: 2020 (29 days)	No: 2020 (37 days)	No: 2012 (20 days), 2013 (2 days), 2016 (2 days), 2019 (11 day), 2020 (27 days), 2021 (2 days)
	**Sasamat Lake - White Pine Beach South	Yes	Yes	No: 2016 (3 days), 2020 (1 day), 2021 (1 day)

a The number of days a beach is posted is obtained from information made available to Metro Vancouver from Beach Operators and Health Authority Websites, and as such Metro Vancouver cannot warrant its accuracy

b False Creek is not classified as a primary-contact recreational water body (i.e., not a swimming or bathing beach). To determine the number of days the waterbody exceeds water quality guidelines, a working guideline limit of 1,000 MPN/100mL for secondary-contact recreation is used.

c Recreational water quality monitoring started at Sandy Cove, Crab Park and Sasamat Lake – White Pine Beach South in 2014.

d Rocky Point was removed from the Recreational Water Quality Program at the end of 2014

e White Rock Beach was split into White Rock Beach West and White Rock Beach East in 2015.

The past ten years of the recreational water monitoring program has seen excellent primary-contact recreational water quality throughout Greater Vancouver, particularly in 2012 and 2017 when no beaches were posted. Periods of guideline exceedances in 2014 and from 2018 to 2021 did result in swimming advisories being posted at multiple beaches. However, when compared with the past ten years, 2014 season still remains an outlier for water quality due to the severity and duration of guideline exceedances and posted swimming advisories.

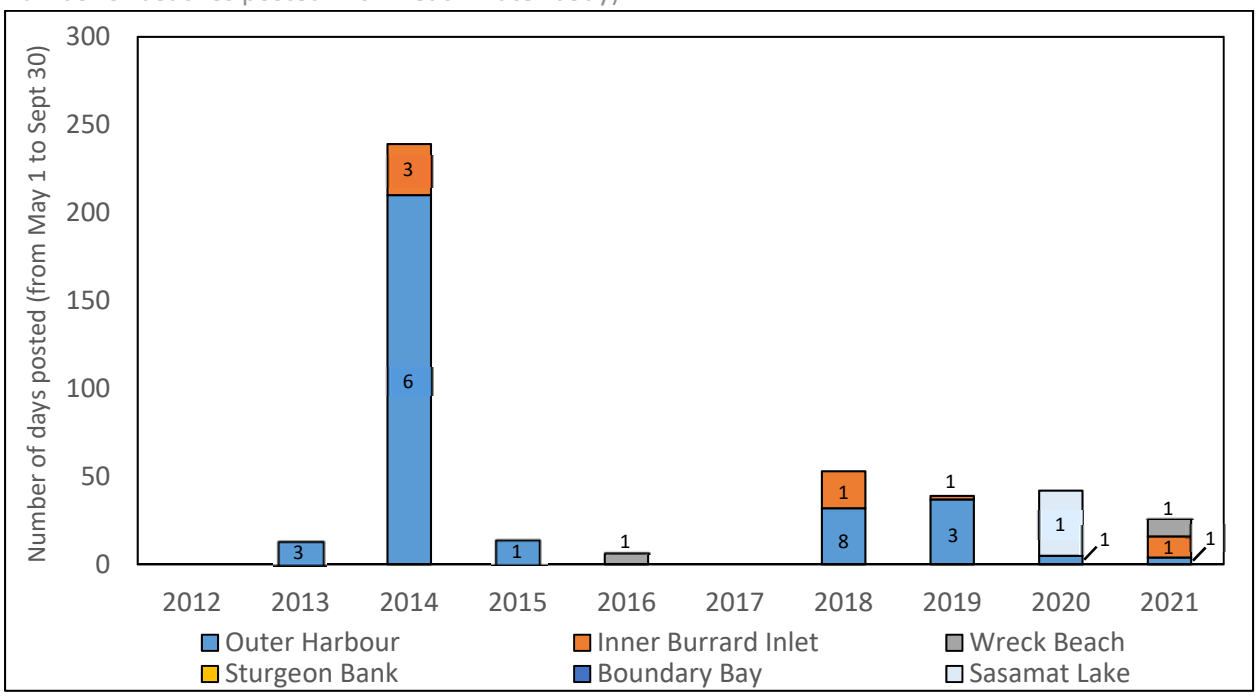
Since 2011, the cumulative number of beach days in a year that exceeded the 30-day geometric mean guideline for all beach locations was 14 days or less except in 2014 (170 days), 2018 (24 days), 2020 (39 days), and 2021 (63 days). The total cumulative number of days the beaches were posted was 13 days or less except in 2014 (239 days)[4], 2018 (53 days), 2019 (39 days), 2020 (42 days), and 2021 (26 days). Overall, the percentage of time that primary-contact recreational waters met the 30-day geometric mean guideline for primary-contact recreation ranged from 100% (2012 and 2017) to 97% (2014) and the percentage of time that these beaches were open for primary-contact recreation ranged from 100% (2012 and 2017) to 95.8% (2014).

Figure 12.15 shows the number of days between May and September that bacterial counts at the primary-contact recreational waters were above the guideline and posted for the past ten years (from 2012 – 2021). False Creek has been excluded from this chart as it is not classified as a primary-contact recreational water body.

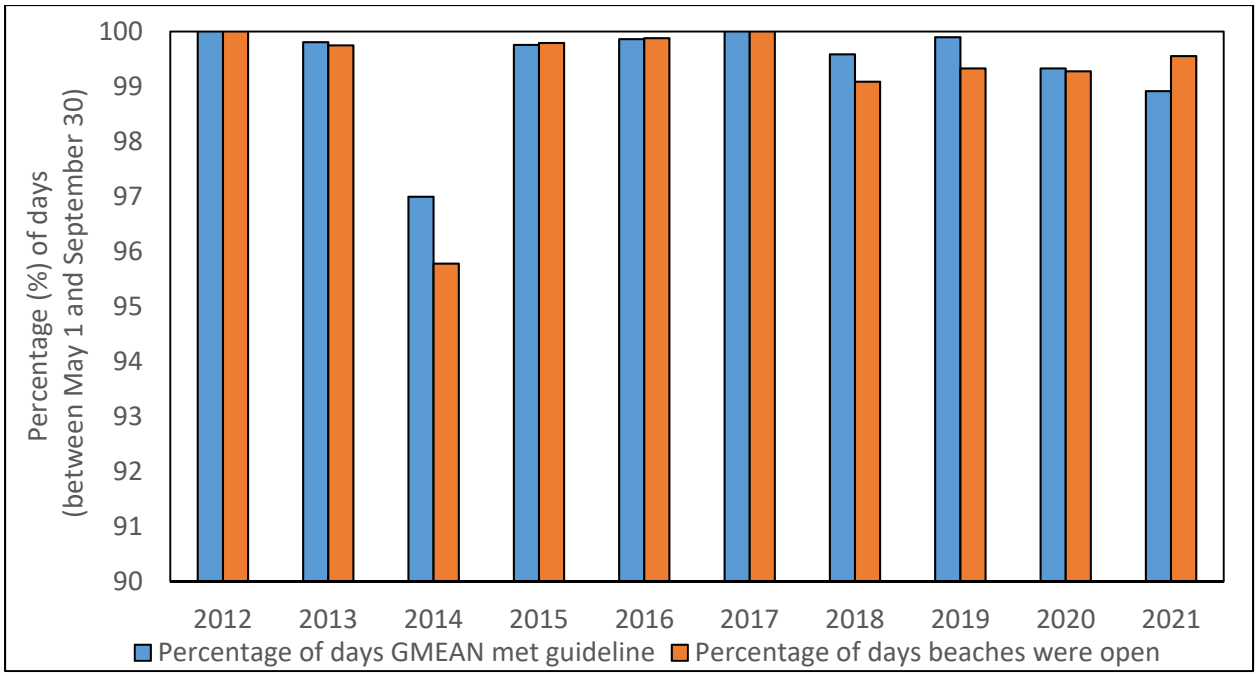
[4] The total number of days is calculated as the days each beach location exceeds the guideline/is posted. As a result, the total number of days may exceed the number of days in the beach season because the days at each beach location are summed (e.g., in 2014 several beaches were above the guideline for a total of 170 days).

FIGURE 12.15 2012–2021 PRIMARY CONTACT RECREATIONAL WATER STATUS

(A) Number of days the beaches were posted for the particular water body (the number indicates the number of beaches posted within each water body)



(B) Percentage of days the guideline was met and beaches were open for recreation



12.4.5 STATUS AND TRENDS

E. coli geometric means are useful in assessing the bacteriological quality of recreational waters over time. Graphs of the 30-day geometric means of *E. coli* results for the 2021 beach season are provided in Appendix B. Included with the 2021 results are the geometric means of *E. coli* for the years 2017 to 2020.

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13.0 LWS ENVIRONMENTAL MANAGEMENT SYSTEM

13.1 OVERVIEW

Metro Vancouver continues to develop the Environmental Management System (EMS) for LWS. An EMS is a management framework for identifying and addressing how a business is interacting with the environment, complying with environmental regulations, ensuring due diligence, and continuously improving environmental performance in operations. It is a systematic and iterative approach to planning, doing, reviewing, and taking preventative and corrective action. It involves evaluating environmental risks and compliance obligations, then developing policies, programs, procedures, protocols, training, communications, and performance measures around those environmental risks and compliance obligations. International standards, the most widely followed being International Organization for Standardization (ISO), define these essential components.

Metro Vancouver is incorporating the principles of the standard ISO EMS 14001:2015 into its LWS practices, including:

1. Evaluating environmental risks and compliance obligations as a basis for setting priorities for action and improvement;
2. Measurable targets that motivate continuous improvement and are consistent with other departmental and corporate objectives;
3. Regular monitoring and reporting on progress toward meeting these targets;
4. Procedures and processes that continuously improve environmental performance in operating the Liquid Waste utility; and
5. Environmental training for staff.

13.2 EMS WORK 2021

In 2021, work focused on development and LWS-wide roll-out of the following:

- EMS documentation as per the ISO 14001:2015 standard;
- Internal network site portal for environmental risk awareness and management tools;
- Operational standards and awareness training resources for solid and hazardous waste management;
- Hazardous waste storage site set up guide and a waste management handbook; and,
- Facility assessments and recommendations for hazardous waste storage and handling improvements.

Work on these fronts is ongoing with annual review and iterative modifications, providing opportunity for continuous improvement and alignment with other LWS related objectives, processes, and systems (e.g., environmental monitoring and risk assessments and management systems for safety, assets, energy, budget prioritization and performance evaluation).

APPENDIX A:
CSO Water Quality Monitoring Results

This appendix summarizes results for laboratory analyses that were completed in 2021 for samples collected in 2020 and 2021.

Analyte	Detection Limit	Units	Descriptive Statistics [1]																	
			Grab						Composite						Total [4]					
			Range		Mean	Stdev	N	%ND[3]	Range		Mean	Stdev	N	%ND[3]	Range		Mean	Stdev	N	%ND[3]
Microbiology [2]																				
Ecoli	18000	MPN/100mls	511,000	511,000	511,000	**	1	0%	275,000	426,000	343,000	107,000	2	0%	275,000	511,000	391,000	119,000	3	0%
Enterococci	100	MPN/100mls	67,000	67,000	67,000	**	1	0%	21,000	21,000	21,000	**	1	0%	21,000	67,000	37,000	33,000	2	0%
Fecal Coliform	18000	MPN/100mls	511,000	511,000	511,000	**	1	0%	330,000	511,000	410,000	128,000	2	0%	330,000	511,000	441,000	104,000	3	0%
Inorganic Chemistry and Physical																				
Biochemical Oxygen Demand	10	mg/L	-	-	-	**	-	-	<10	13	<12	<2	2	50%	<10	13	<12	<2	2	50%
Chemical Oxygen Demand	20	mg/L	47	47	47	**	1	0%	60	65	63	4	2	0%	47	65	57	9	3	0%
Conductivity	1	µmho/cm	42	42	42	**	1	0%	62	80	71	13	2	0%	42	80	61	19	3	0%
Hardness as CACO3	0.2	mg/L	15.5	15.5	15.5	**	1	0%	20.4	26.4	23.4	4.2	2	0%	15.5	26.4	20.8	5.5	3	0%
Nitrogen - Ammonia as N	0.2	mg/L	0.4	0.4	0.40	**	1	0%	0.3	0.4	0.40	0.1	2	0%	0.3	0.4	0.40	0.1	3	0%
Nitrogen - Nitrate as N	0.01	mg/L	0.3	0.3	0.30	**	1	0%	0.28	0.36	0.32	0.06	2	0%	0.28	0.36	0.31	0.04	3	0%
Nitrogen - Nitrite as N	0.01	mg/L	0.01	0.01	0.01	**	1	0%	0.01	0.01	0.01	0.00	2	0%	0.01	0.01	0.01	0.00	3	0%
pH	0.1	PH	6.9	6.9	6.9	**	1	0%	7.2	7.2	7.2	0.0	2	0%	6.9	7.2	7.1	0.2	3	0%
Total Suspended Solids	4	mg/L	37	37	37	**	1	0%	52	55	54	2	2	0%	37	55	48	10	3	0%
Volatile Suspended Solids	4	mg/L	21	21	21	**	1	0%	34	35	35	1	2	0%	21	35	30	8	3	0%
Toxicity [5]																				
LC50 Rainbow Trout 96-h	**	%vol/vol	100	100	100	**	1	**	**	**	**	**	**	**	**	**	**	**	**	**
Total Metals																				
Aluminum Total	5	µg/L	805	805	805	**	1	0%	750	929	840	127	2	0%	750	929	828	92	3	0%
Arsenic Total	0.5	µg/L	3.4	3.4	3.4	**	1	0%	5.7	5.8	5.8	0.1	2	0%	3.4	5.8	5.0	1.4	3	0%
Barium Total	0.5	µg/L	12.1	12.1	12.1	**	1	0%	12.3	15.3	13.8	2.1	2	0%	12.1	15.3	13.2	1.8	3	0%
Boron Total	10	µg/L	11	11	11.00	**	1	0%	<10	<10	<10	<0	2	100%	<10	11	<10	<1	3	67%
Cadmium Total	0.2	µg/L	<0.2	<0.2	<0.2	**	1	100%	<0.2	<0.2	<0.2	<0.0	2	100%	<0.2	<0.2	<0.2	<0.0	3	100%
Calcium Total	20	µg/L	5200	5200	5200	**	1	0%	6660	8630	7645	1393	2	0%	5200	8630	6830	1721	3	0%
Chromium Total	0.5	µg/L	3.2	3.2	3.2	**	1	0%	3.1	3.2	3.2	0.1	2	0%	3.1	3.2	3.2	0.1	3	0%
Cobalt Total	0.5	µg/L	<0.5	<0.5	<0.5	**	1	100%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	3	100%
Copper Total	0.5	µg/L	19.9	19.9	19.9	**	1	0%	24.3	24.6	24.5	0.2	2	0%	19.9	24.6	22.9	2.6	3	0%
Iron Total	5	µg/L	791	791	791	**	1	0%	769	938	854	120	2	0%	769	938	833	92	3	0%
Lead Total	0.5	µg/L	3.2	3.2	3.2	**	1	0%	3.1	3.9	3.5	0.6	2	0%	3.1	3.9	3.4	0.4	3	0%
Magnesium Total	10	µg/L	614	614	614	**	1	0%	909	1170	1040	185	2	0%	614	1170	898	278	3	0%
Manganese Total	0.5	µg/L	28	28	28.0	**	1	0%	24.1	31	27.6	4.9	2	0%	24.1	31	27.7	3.5	3	0%
Mercury Total	0.05	µg/L	<0.05	<0.05	<0.05	**	1	100%	<0.05	<0.05	<0.05	<0.00	2	100%	<0.05	<0.05	<0.05	<0.00	3	100%
Molybdenum Total	0.5	µg/L	<0.5	<0.5	<0.5	**	1	100%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	3	100%
Nickel Total	0.5	µg/L	1.1	1.1	1.1	**	1	0%	0.9	1.2	1.1	0.2	2	0%	0.9	1.2	1.1	0.2	3	0%
Phosphorus Total	20	µg/L	272	272	272	**	1	0%	263	296	280	23	2	0%	263	296	277	17	3	0%
Selenium Total	0.5	µg/L	<0.5	<0.5	<0.5	**	1	100%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	3	100%
Silver Total	0.5	µg/L	<0.5	<0.5	<0.5	**	1	100%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	3	100%
Sodium Total	50	µg/L	2010	2010	2010	**	1	0%	3530	5050	4290	1075	2	0%	2010	5050	3530	1520	3	0%
Zinc Total	3	µg/L	36	36	36	**	1	0%	31	43	37	8	2	0%	31	43	37	6	3	0%
Dissolved Metals																				
Aluminium Dissolved	5	µg/L	30	30	30	**	1	0%	14	22	18	6	2	0%	14	30	22	8	3	0%
Arsenic Dissolved	0.5	µg/L	3	3	3.0	**	1	0%	5.1	5.2	5.2	0.1	2	0%	3	5.2	4.4	1.2	3	0%
Barium Dissolved	0.5	µg/L	4.2	4.2	4.2	**	1	0%	5.2	6.6	5.9	1.0	2	0%	4.2	6.6	5.3	1.2	3	0%
Boron Dissolved	10	µg/L	<10	<10	<10	**	1	100%	<10	<10	<10	<0	2	100%	<10	<10	<10	<0	3	100%
Cadmium Dissolved	0.2	µg/L	<0.2	<0.2	<0.2	**	1	100%	<0.2	<0.2	<0.2	<0.0	2	100%	<0.2	<0.2	<0.2	<0.0	3	100%
Calcium Dissolved	20	µg/L	4330	4330	4330	**	1	0%	5990	7760	6875	1252	2	0%	4330	7760	6027	1715	3	0%
Chromium Dissolved	0.5	µg/L	1.7	1.7	1.7	**	1	0%	1.5	1.6	1.6	0.1	2	0%	1.5	1.7	1.6	0.1	3	0%
Cobalt Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	**	1	100%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	3	100%
Copper Dissolved	0.5	µg/L	7.4	7.4	7.4	**	1	0%	8.3	9.5	8.9	0.8	2	0%	7.4	9.5	8.4	1.1	3	0%
Iron Dissolved	5	µg/L	32	32	32	**	1	0%	19	26	23	5	2	0%	19	32	26	7	3	0%
Lead Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	**	1	100%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	3	100%
Magnesium Dissolved	10	µg/L	399	399	399	**	1	0%	718	908	813	134	2	0%	399	908	675	257	3	0%
Manganese Dissolved	0.5	µg/L	5.4	5.4	5.4	**	1	0%	5.6	6.3	6.0	0.5	2	0%	5.4	6.3	5.8	0.5	3	0%
Molybdenum Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	**	1	100%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	3	100%
Nickel Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	**	1	100%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	3	100%
Phosphorus Dissolved	20	µg/L	103	103	103	**	1	0%	97	171	134	52	2	0%	97	171	124	41	3	0%
Selenium Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	**	1	100%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	3	100%
Silver Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	**	1	100%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	3	100%
Sodium Dissolved	50	µg/L	1970	1970	1970	**	1	0%	3530	4980	4255	1025	2	0%	1970	4980	3493	1505	3	0%
Zinc Dissolved	3	µg/L	15	15	15	**	1	0%	12	18	15	4	2	0%	12	18	15	3	3	0%

** Not applicable

< Results reported less than detection limit

1 Range, mean (geomean for microbiology), standard deviation, and number of samples (N) are provided. When results are less than (greater than for microbiology) the detection limit, the detection limit was used to calculate each statistical value

2 Every sample for microbiology was collected with a duplicate, the result reported is the geomean of duplicates

3 Percent of samples with result less than detection limit

4 Total includes both grab and composite

5 LC50 results represent % survival, results show 0% mortality throughout test

Analyte	Detection Limit	Units	Descriptive Statistics [1]					
			Grab					
			Range		Mean	Stdev	N	%ND [2]
Volatile petroleum hydrocarbons								
1,1,1,2-Tetrachloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,1,1-Trichloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,1,2,2-Tetrachloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,1,2-Trichloro/1,2,2-Trifluoroethane	2.0	µg/L	<2.0	<2.0	<2.0	**	1	100%
1,1,2-Trichloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,1-Dichloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,1-Dichloroethylene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,2,3-Trichlorobenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	1	100%
1,2,4-Trichlorobenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	1	100%
1,2-Dibromoethane	0.20	µg/L	<0.20	<0.20	<0.20	**	1	100%
1,2-Dichlorobenzene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,2-Dichloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,2-Dichloropropane	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,3,5-Trimethylbenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	1	100%
1,3-Butadiene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,3-Dichlorobenzene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,3-Dichloropropane	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
1,4-Dichlorobenzene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
Benzene	0.40	µg/L	<0.40	<0.40	<0.40	**	1	100%
Bromobenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	1	100%
Bromodichloromethane	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
Bromoform	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
Bromomethane	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
Carbon Tetrachloride	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
Chlorobenzene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
Chloroethane	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
Chloroform	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
Chloromethane	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
cis-1,2-Dichloroethylene	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
cis-1,3-Dichloropropylene	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
Dibromochloromethane	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
Dichlorodifluoromethane	2.0	µg/L	<2.0	<2.0	<2.0	**	1	100%
Dichloromethane	2.0	µg/L	<2.0	<2.0	<2.0	**	1	100%
Ethylbenzene	0.40	µg/L	<0.40	<0.40	<0.40	**	1	100%
Hexachlorobutadiene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
Isopropylbenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	1	100%
m- & p-Xylene	0.40	µg/L	<0.40	<0.40	<0.40	**	1	100%
Methyl t-butyl ether (MTBE)	4.0	µg/L	<4.0	<4.0	<4.0	**	1	100%
o-Xylene	0.40	µg/L	<0.40	<0.40	<0.40	**	1	100%
Styrene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
Tetrachloroethylene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
Toluene	0.40	µg/L	<0.40	<0.40	<0.40	**	1	100%
trans-1,2-Dichloroethylene	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
trans-1,3-Dichloropropylene	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
Trichloroethylene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
Trichlorofluoromethane	4.0	µg/L	<4.0	<4.0	<4.0	**	1	100%
VH (C6-C10) [3]	300	µg/L	<300	<300	<300	**	1	100%
Vinyl Chloride	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
VPH (C6-10) - BTEX [4]	300	µg/L	<300	<300	<300	**	1	100%
Xylenes	0.40	µg/L	<0.40	<0.40	<0.40	**	1	100%

Analyte		Detection Limit	Units	Descriptive Statistics [1]					
				Grab					
				Range		Mean	Stdev	N	%ND [2]
Extractable petroleum hydrocarbons									
LEPH (C10-C19 less PAH) [5]		0.20	mg/L	<0.20	<0.20	<0.20	**	1	100%
HEPH (C19-C32 less PAH) [6]		0.20	mg/L	0.27	0.27	0.27	**	1	0%
EPH (C10-C19)		0.20	mg/L	<0.20	<0.20	<0.20	**	1	100%
EPH (C19-C32)		0.20	mg/L	0.27	0.27	0.27	**	1	0%
Polycyclic aromatic hydrocarbons (PAH)									
Low molecular weight PAHs (LPAH)	2-Methylnaphthalene [7]	0.10	µg/L	0.013	0.013	0.013	**	1	0%
	Phenanthrene	0.020	µg/L	0.013	0.013	0.013	**	1	0%
	Acenaphthene	0.050	µg/L	<0.030	<0.030	<0.030	**	1	100%
	Acenaphthylene	0.050	µg/L	<0.050	<0.050	<0.050	**	1	100%
	Anthracene	0.010	µg/L	<0.050	<0.050	<0.050	**	1	100%
	Acridine [8]	0.050	µg/L	<0.020	<0.020	<0.020	**	1	100%
	Fluorene	0.050	µg/L	<0.0030	<0.0030	<0.0030	**	1	100%
	Naphthalene	0.10	µg/L	<0.020	<0.020	<0.020	**	1	100%
	Quinoline [8]	0.050	µg/L	<0.050	<0.050	<0.050	**	1	100%
	Total LPAHs	0.10	µg/L	<0.020	<0.020	<0.020	**	1	100%
High molecular weight PAHs (HPAH)	Benz[a]anthracene	0.010	µg/L	<0.050	<0.050	<0.050	**	1	100%
	Benzo[a]pyrene	0.0050	µg/L	<0.10	<0.10	<0.10	**	1	100%
	Benzo[b+j]fluoranthene	0.030	µg/L	0.028	0.028	0.028	**	1	0%
	Benzo[g,h,i]perylene	0.050	µg/L	<0.050	<0.050	<0.050	**	1	100%
	Benzo[k]fluoranthene	0.050	µg/L	<0.050	<0.050	<0.050	**	1	100%
	Chrysene	0.020	µg/L	<0.010	<0.010	<0.010	**	1	100%
	Dibenz[a,h]anthracene	0.0030	µg/L	<0.050	<0.050	<0.050	**	1	100%
	Fluoranthene	0.020	µg/L	<0.050	<0.050	<0.050	**	1	100%
	Indeno[1,2,3-c,d]pyrene	0.050	µg/L	<0.10	<0.10	<0.10	**	1	100%
	Pyrene	0.020	µg/L	<0.050	<0.050	<0.050	**	1	100%
	Total HPAHs	0.050	µg/L	<0.10	<0.10	<0.10	**	1	100%
Total PAH = LPAH + HPAH		0.10	µg/L	<0.10	<0.10	<0.10	**	1	100%

** Not applicable
< Results reported less than detection limit
1 Range, mean (geomean for microbiology), standard deviation, and number of samples (N) are provided. When results are less than (greater than for microbiology) the detection limit, the detection limit was used to caculate each statistical value
2 Percent of samples with result less than detection limit
3 Volatile Hydrocarbons containing all petroleum hydrocarbons in the carbon range of C6-C10, including BTEX and Styrene
4 Volatile Petroleum Hydrocarbons containing all pretroleum hydrocarbons in the carbon range of C6-C10 minus BTEX
5 LEPH = Light Extractable Petroleum Hydrocarbons
6 HEPH = Heavy Extractable Petroleum Hydrocarbons
7 Alkylated Low Molecular Weight PAHs
8 N-Heterocycle Low Molecular Weight PAHs

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]																	
					Combined Fractions [2]																	
					Grab						Composite						Total					
					Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]
Polybrominated diphenyl ethers (PBDEs)																						
Di	PBDE 7	1.03	1.06	pg/L	<1.03	<1.03	<1.03	<0.00	1	100%	<1.06	<1.06	<1.06	<0.00	1	100%	<1.03	<1.06	<1.05	<0.02	2	100%
Di	PBDE 8/11	1.03	1.06	pg/L	<1.03	<1.03	<1.03	<0.00	1	100%	<1.06	<1.06	<1.06	<0.00	1	100%	<1.03	<1.06	<1.05	<0.02	2	100%
Di	PBDE 10	1.03	1.06	pg/L	<1.03	<1.03	<1.03	<0.00	1	100%	<1.06	<1.06	<1.06	<0.00	1	100%	<1.03	<1.06	<1.05	<0.02	2	100%
Di	PBDE 12/13	1.03	1.06	pg/L	<1.03	<1.03	<1.03	<0.00	1	100%	<1.06	<1.06	<1.06	<0.00	1	100%	<1.03	<1.06	<1.05	<0.02	2	100%
Di	PBDE 15	1.03	1.06	pg/L	2.12	2.12	2.12	0	1	0%	1.32	1.32	1.32	0	1	0%	1.32	2.12	1.72	0.57	2	0%
Tri	PBDE 17/25	1.03	1.06	pg/L	9.80	9.80	9.80	0.00	1	0%	6.16	6.16	6.16	0.00	1	0%	6.16	9.80	7.98	2.57	2	0%
Tri	PBDE 28/33	1.03	1.06	pg/L	20.40	20.40	20.40	0.00	1	0%	14.60	14.60	14.60	0.00	1	0%	14.60	20.40	17.50	4.10	2	0%
Tri	PBDE 30	1.03	1.06	pg/L	<1.03	<1.03	<1.03	<0.00	1	100%	<1.06	<1.06	<1.06	<0.00	1	100%	<1.03	<1.06	<1.05	<0.02	2	100%
Tri	PBDE 32	1.03	1.06	pg/L	<1.03	<1.03	<1.03	<0.00	1	100%	<1.06	<1.06	<1.06	<0.00	1	100%	<1.03	<1.06	<1.05	<0.02	2	100%
Tri	PBDE 35	1.03	1.06	pg/L	2.07	2.07	2.07	0	1	0%	3.74	3.74	3.74	0	1	0%	2.07	3.74	2.91	1.18	2	0%
Tri	PBDE 37	1.03	1.06	pg/L	5.24	5.24	5.24	0	1	0%	3.12	3.12	3.12	0	1	0%	3.12	5.24	4.18	1.5	2	0%
Tetra	PBDE 47	1.06	1.45	pg/L	594.00	594.00	594.00	0.00	1	0%	718.00	718.00	718.00	0.00	1	0%	594.00	718.00	656.00	88.00	2	0%
Tetra	PBDE 49	1.06	2.2	pg/L	24.90	24.90	24.90	0.00	1	0%	22.70	22.70	22.70	0.00	1	0%	22.70	24.90	23.80	1.60	2	0%
Tetra	PBDE 51	1.06	1.61	pg/L	3.03	3.03	3.03	0	1	0%	2.16	2.16	2.16	0	1	0%	2.16	3.03	2.6	0.62	2	0%
Tetra	PBDE 66	1.06	2.71	pg/L	19.6	19.6	19.6	0	1	0%	15.4	15.4	15.4	0	1	0%	15.4	19.6	17.5	3	2	0%
Tetra	PBDE 71	1.06	2.1	pg/L	5.92	5.92	5.92	0	1	0%	3.59	3.59	3.59	0	1	0%	3.59	5.92	4.76	1.65	2	0%
Tetra	PBDE 75	1.06	1.65	pg/L	3.04	3.04	3.04	0	1	0%	<1.06	<1.06	<1.06	<0.00	1	100%	<1.06	3.04	<2.05	<1.40	2	50%
Tetra	PBDE 77	1.06	1.42	pg/L	<1.42	<1.42	<1.42	<0.00	1	100%	<1.06	<1.06	<1.06	<0.00	1	100%	<1.06	<1.42	<1.24	<0.25	2	100%
Tetra	PBDE 79	1.06	1.67	pg/L	1.86	1.86	1.86	0	1	0%	<1.06	<1.06	<1.06	<0.00	1	100%	<1.06	1.86	<1.46	<0.57	2	50%
Penta	PBDE 85	1.93	2.34	pg/L	25.40	25.40	25.40	0.00	1	0%	32.30	32.30	32.30	0.00	1	0%	25.40	32.30	28.90	4.90	2	0%
Penta	PBDE 99	1.42	1.78	pg/L	573	573	573	0	1	0%	696	696	696	0	1	0%	573	696	635	87	2	0%
Penta	PBDE 100	1.06	1.23	pg/L	122	122	122	0	1	0%	148	148	148	0	1	0%	122	148	135	18	2	0%
Penta	PBDE 105	2.56	3.15	pg/L	<3.15	<3.15	<3.15	<0.00	1	100%	<2.56	<2.56	<2.56	<0.00	1	100%	<2.56	<3.15	<2.86	<0.42	2	100%
Penta	PBDE 116	3.06	4.06	pg/L	<4.06	<4.06	<4.06	<0.00	1	100%	<3.06	<3.06	<3.06	<0.00	1	100%	<3.06	<4.06	<3.56	<0.71	2	100%
Penta	PBDE 119/120	2.11	2.7	pg/L	<2.7	<2.7	<2.7	<0.0	1	100%	<2.11	<2.11	<2.11	<0.00	1	100%	<2.11	<2.7	<2.41	<0.42	2	100%
Penta	PBDE 126	1.16	1.39	pg/L	<1.39	<1.39	<1.39	<0.00	1	100%	<1.16	<1.16	<1.16	<0.00	1	100%	<1.16	<1.39	<1.28	<0.16	2	100%
Hexa	PBDE 128	13.8	34	pg/L	<34	<34	<34	<0	1	100%	<13.8	<13.8	<13.8	<0.0	1	100%	<13.8	<34	<23.9	<14.3	2	100%
Hexa	PBDE 138/166	3.17	5.38	pg/L	8.76	8.76	8.76	0	1	0%	9.37	9.37	9.37	0	1	0%	8.76	9.37	9.07	0.43	2	0%
Hexa	PBDE 140	2.18	3.93	pg/L	5.45	5.45	5.45	0	1	0%	4.09	4.09	4.09	0	1	0%	4.09	5.45	4.77	0.96	2	0%
Hexa	PBDE 153	2.29	3.6	pg/L	55.80	55.80	55.80	0.00	1	0%	62.30	62.30	62.30	0.00	1	0%	55.80	62.30	59.10	4.60	2	0%
Hexa	PBDE 154	2.53	2.69	pg/L	37.70	37.70	37.70	0.00	1	0%	46.30	46.30	46.30	0.00	1	0%	37.70	46.30	42.00	6.10	2	0%
Hexa	PBDE 155	1.48	2.83	pg/L	5.20	5.20	5.20	0.00	1	0%	3.86	3.86	3.86	0.00	1	0%	3.86	5.20	4.53	0.95	2	0%
Hepta	PBDE 181	2.61	5.27	pg/L	<5.27	<5.27	<5.27	<0.00	1	100%	<2.61	<2.61	<2.61	<0.00	1	100%	<2.61	<5.27	<3.94	<1.88	2	100%
Hepta	PBDE 183	1.8	3.48	pg/L	30.90	30.90	30.90	0.00	1	0%	33.10	33.10	33.10	0.00	1	0%	30.90	33.10	32.00	1.60	2	0%
Hepta	PBDE 190	4.41	9.08	pg/L	<9.08	<9.08	<9.08	<0.00	1	100%	5.34	5.34	5.34	0	1	0%	5.34	<9.08	<7.21	<2.64	2	50%
Octa	PBDE 203	9.64	12	pg/L	40.90	40.90	40.90	0.00	1	0%	25.90	25.90	25.90	0.00	1	0%	25.90	40.90	33.40	10.60	2	0%
Nona	PBDE 206	7.14	8.07	pg/L	283.00	283.00	283.00	0.00	1	0%	222.00	222.00	222.00	0.00	1	0%	222.00	283.00	253.00	43.00	2	0%
Nona	PBDE 207	10.7	13.3	pg/L	506.00	506.00	506.00	0.00	1	0%	317.00	317.00	317.00	0.00	1	0%	317.00	506.00	412.00	134.00	2	0%
Nona	PBDE 208	9.73	14.1	pg/L	330.00	330.00	330.00	0.00	1	0%	153.00	153.00	153.00	0.00	1	0%	153.00	330.00	242.00	125.00	2	0%
Deca	PBDE 209	29.6	69.4	pg/L	4680.0	4680.0	4680.0	0.0	1	0%	3920.0	3920.0	3920.0	0.0	1	0%	3920.0	4680.0	4300.0	537.0	2	0%

< Results reported less than detection limit

1 Range, mean, standard deviation, and number of samples (N) are provided. When results are less than the detection limit, the detection limit was used to calculate each statistical value

2 Solid and aqueous fractions of the samples were analyzed separately, results are presented as a total of both solid and aqueous fractions

3 Percent of samples with result less than detection limit

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]																	
					Combined Fractions [2]																	
					Grab						Composite						Total					
					Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]
Polychlorinated biphenyls (PCBs)																						
Mono	PCB 1	0.514	0.529	pg/L	5.23	5.23	5.23	0	1	0%	3.32	3.32	3.32	0	1	0%	3.32	5.23	4.28	1.35	2	0%
Mono	PCB 2	0.514	0.529	pg/L	5.01	5.01	5.01	0	1	0%	1.98	1.98	1.98	0	1	0%	1.98	5.01	3.5	2.14	2	0%
Mono	PCB 3	0.514	0.529	pg/L	4.68	4.68	4.68	0	1	0%	3.63	3.63	3.63	0	1	0%	3.63	4.68	4.16	0.74	2	0%
Di	PCB 4	2.28	2.59	pg/L	5.64	5.64	5.64	0	1	0%	11.4	11.4	11.4	0	1	0%	5.64	11.4	8.52	4.07	2	0%
Di	PCB 5	1.35	1.62	pg/L	<1.62	<1.62	<1.62	<0.00	1	100%	<1.35	<1.35	<1.35	<0.00	1	100%	<1.35	<1.62	<1.49	<0.19	2	100%
Di	PCB 6	1.18	1.41	pg/L	2.36	2.36	2.36	0.00	1	0%	2.96	2.96	2.96	0.00	1	0%	2.36	2.96	2.66	0.42	2	0%
Di	PCB 7	1.24	1.44	pg/L	<1.44	<1.44	<1.44	<0.00	1	100%	<1.24	<1.24	<1.24	<0.00	1	100%	<1.24	<1.44	<1.34	<0.14	2	100%
Di	PCB 8	1.11	1.26	pg/L	7.11	7.11	7.11	0	1	0%	9.07	9.07	9.07	0	1	0%	7.11	9.07	8.09	1.39	2	0%
Di	PCB 9	1.21	1.34	pg/L	<1.34	<1.34	<1.34	<0.00	1	100%	<1.21	<1.21	<1.21	<0.00	1	100%	<1.21	<1.34	<1.28	<0.09	2	100%
Di	PCB 10	1.23	1.37	pg/L	<1.37	<1.37	<1.37	<0.00	1	100%	<1.23	<1.23	<1.23	<0.00	1	100%	<1.23	<1.37	<1.30	<0.10	2	100%
Di	PCB 11	1.32	1.52	pg/L	75.4	75.4	75.4	0	1	0%	40.8	40.8	40.8	0	1	0%	40.8	75.4	58.1	24.5	2	0%
Di	PCB 12/13	1.32	1.48	pg/L	3.21	3.21	3.21	0.00	1	0%	2.03	2.03	2.03	0.00	1	0%	2.03	3.21	2.62	0.83	2	0%
Di	PCB 14	1.22	1.47	pg/L	<1.47	<1.47	<1.47	<0.00	1	100%	<1.22	<1.22	<1.22	<0.00	1	100%	<1.22	<1.47	<1.35	<0.18	2	100%
Di	PCB 15	1.48	1.61	pg/L	7.82	7.82	7.82	0	1	0%	8.85	8.85	8.85	0	1	0%	7.82	8.85	8.34	0.73	2	0%
Tri	PCB 16	0.514	0.955	pg/L	4.89	4.89	4.89	0	1	0%	8.44	8.44	8.44	0	1	0%	4.89	8.44	6.67	2.51	2	0%
Tri	PCB 17	0.514	0.822	pg/L	4.58	4.58	4.58	0	1	0%	8.11	8.11	8.11	0	1	0%	4.58	8.11	6.35	2.5	2	0%
Tri	PCB 18/30	0.514	0.701	pg/L	9.81	9.81	9.81	0	1	0%	14	14	14	0	1	0%	9.81	14	11.91	2.96	2	0%
Tri	PCB 19	0.569	1.27	pg/L	3.18	3.18	3.18	0	1	0%	6.49	6.49	6.49	0	1	0%	3.18	6.49	4.84	2.34	2	0%
Tri	PCB 20/28	0.514	0.571	pg/L	18	18	18	0	1	0%	23.4	23.4	23.4	0	1	0%	18	23.4	20.7	3.8	2	0%
Tri	PCB 21/33	0.514	0.555	pg/L	10.30	10.30	10.30	0.00	1	0%	8.28	8.28	8.28	0.00	1	0%	8.28	10.30	9.29	1.43	2	0%
Tri	PCB 22	0.514	0.612	pg/L	7.83	7.83	7.83	0	1	0%	6.91	6.91	6.91	0	1	0%	6.91	7.83	7.37	0.65	2	0%
Tri	PCB 23	0.514	0.6	pg/L	0.695	0.695	0.695	0	1	0%	<0.6	<0.6	<0.6	<0.0	1	100%	<0.6	0.695	<0.648	<0.067	2	50%
Tri	PCB 24	0.514	0.621	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.621	<0.621	<0.621	<0.000	1	100%	<0.514	<0.621	<0.568	<0.076	2	100%
Tri	PCB 25	0.514	0.529	pg/L	1.24	1.24	1.24	0	1	0%	1.94	1.94	1.94	0	1	0%	1.24	1.94	1.59	0.49	2	0%
Tri	PCB 26/29	0.514	0.572	pg/L	2.92	2.92	2.92	0.00	1	0%	4.61	4.61	4.61	0.00	1	0%	2.92	4.61	3.77	1.20	2	0%
Tri	PCB 27	0.514	0.59	pg/L	1.26	1.26	1.26	0.00	1	0%	1.81	1.81	1.81	0.00	1	0%	1.26	1.81	1.54	0.39	2	0%
Tri	PCB 31	0.514	0.544	pg/L	14.7	14.7	14.7	0	1	0%	17.8	17.8	17.8	0	1	0%	14.7	17.8	16.3	2.2	2	0%
Tri	PCB 32	0.514	0.567	pg/L	3.49	3.49	3.49	0	1	0%	4.22	4.22	4.22	0	1	0%	3.49	4.22	3.86	0.52	2	0%
Tri	PCB 34	0.514	0.59	pg/L	0.538	0.538	0.538	0	1	0%	<0.59	<0.59	<0.59	<0.00	1	100%	0.538	<0.59	<0.564	<0.037	2	50%
Tri	PCB 35	0.55	0.608	pg/L	2.96	2.96	2.96	0.00	1	0%	1.95	1.95	1.95	0.00	1	0%	1.95	2.96	2.46	0.71	2	0%
Tri	PCB 36	0.514	0.572	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.572	<0.572	<0.572	<0.000	1	100%	<0.514	<0.572	<0.543	<0.041	2	100%
Tri	PCB 37	0.518	0.682	pg/L	9.47	9.47	9.47	0.00	1	0%	9.58	9.58	9.58	0.00	1	0%	9.47	9.58	9.53	0.08	2	0%
Tri	PCB 38	0.514	0.58	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.58	<0.58	<0.58	<0.00	1	100%	<0.514	<0.58	<0.547	<0.047	2	100%
Tri	PCB 39	0.514	0.55	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.55	<0.55	<0.55	<0.00	1	100%	<0.514	<0.55	<0.532	<0.025	2	100%
Tetra	PCB 40/41/71	0.514	0.809	pg/L	8.89	8.89	8.89	0	1	0%	14.7	14.70	14.7	0	1	0%	8.89	14.70	11.8	4.11	2	0%
Tetra	PCB 42	0.514	0.845	pg/L	3.83	3.83	3.83	0	1	0%	5.84	5.84	5.84	0	1	0%	3.83	5.84	4.84	1.42	2	0%
Tetra	PCB 43	0.514	0.92	pg/L	1.27	1.27	1.27	0	1	0%	<0.92	<0.92	<0.92	<0.00	1	100%	<0.92	1.27	<1.10	<0.25	2	50%
Tetra	PCB 44/47/65	0.514	0.751	pg/L	29.1	29.1	29.1	0	1	0%	56.6	56.6	56.6	0	1	0%	29.1	56.6	42.9	19.4	2	0%
Tetra	PCB 45/51	0.514	0.832	pg/L	5.54	5.54	5.54	0	1	0%	7.59	7.59	7.59	0	1	0%	5.54	7.59	6.57	1.45	2	0%
Tetra	PCB 46	0.514	0.947	pg/L	1.28	1.28	1.28	0	1	0%	1.54	1.54	1.54	0	1	0%	1.28	1.54	1.41	0.18	2	0%
Tetra	PCB 48	0.514	0.817	pg/L	3.12	3.12	3.12	0.00	1	0%	5.18	5.18	5.18	0.00	1	0%	3.12	5.18	4.15	1.46	2	0%
Tetra	PCB 49/69	0.514	0.692	pg/L	9.01	9.01	9.01	0	1	0%	16.9	16.9	16.9	0	1	0%	9.01	16.9	12.96	5.58	2	0%

< Results reported less than detection limit

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3 Percent of samples with result less than detection limit

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]																	
					Combined Fractions [2]																	
					Grab						Composite						Total					
					Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]
Polychlorinated biphenyls (PCBs)																						
Tetra	PCB 57	0.567	0.792	pg/L	<0.567	<0.567	<0.567	<0.000	1	100%	<0.792	<0.792	<0.792	<0.000	1	100%	<0.567	<0.792	<0.680	<0.159	2	100%
Tetra	PCB 58	0.597	0.831	pg/L	<0.597	<0.597	<0.597	<0.000	1	100%	<0.831	<0.831	<0.831	<0.000	1	100%	<0.597	<0.831	<0.714	<0.165	2	100%
Tetra	PCB 59/62/75	0.514	0.611	pg/L	2.07	2.07	2.07	0	1	0%	2.42	2.42	2.42	0	1	0%	2.07	2.42	2.25	0.25	2	0%
Tetra	PCB 60	0.626	0.852	pg/L	4.47	4.47	4.47	0.00	1	0%	6.01	6.01	6.01	0.00	1	0%	4.47	6.01	5.24	1.09	2	0%
Tetra	PCB 61/70/74/76	0.536	0.807	pg/L	30.80	30.80	30.80	0.00	1	0%	46.80	46.80	46.80	0.00	1	0%	30.80	46.80	38.80	11.30	2	0%
Tetra	PCB 63	0.588	0.788	pg/L	0.70	0.70	0.70	0.00	1	0%	0.88	0.88	0.88	0.00	1	0%	0.70	0.88	0.79	0.13	2	0%
Tetra	PCB 64	0.514	0.585	pg/L	7.32	7.32	7.32	0	1	0%	14.1	14.1	14.1	0	1	0%	7.32	14.1	10.71	4.79	2	0%
Tetra	PCB 66	0.587	0.801	pg/L	15.10	15.10	15.10	0.00	1	0%	20.60	20.60	20.60	0.00	1	0%	15.10	20.60	17.90	3.90	2	0%
Tetra	PCB 67	0.514	0.702	pg/L	0.654	0.654	0.654	0	1	0%	0.925	0.925	0.925	0	1	0%	0.654	0.925	0.79	0.192	2	0%
Tetra	PCB 68	0.561	0.776	pg/L	1.93	1.93	1.93	0.00	1	0%	2.47	2.47	2.47	0.00	1	0%	1.93	2.47	2.20	0.38	2	0%
Tetra	PCB 72	0.555	0.777	pg/L	<0.555	<0.555	<0.555	<0.000	1	100%	<0.777	<0.777	<0.777	<0.000	1	100%	<0.555	<0.777	<0.666	<0.157	2	100%
Tetra	PCB 73	0.514	0.647	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.647	<0.647	<0.647	<0.000	1	100%	<0.514	<0.647	<0.581	<0.094	2	100%
Tetra	PCB 77	0.56	0.873	pg/L	3.82	3.82	3.82	0.00	1	0%	3.76	3.76	3.76	0.00	1	0%	3.76	3.82	3.79	0.04	2	0%
Tetra	PCB 78	0.593	0.846	pg/L	<0.593	<0.593	<0.593	<0.000	1	100%	<0.846	<0.846	<0.846	<0.000	1	100%	<0.593	<0.846	<0.720	<0.179	2	100%
Tetra	PCB 79	0.514	0.709	pg/L	0.796	0.796	0.796	0	1	0%	<0.709	<0.709	<0.709	<0.000	1	100%	<0.709	0.796	<0.753	<0.062	2	50%
Tetra	PCB 80	0.54	0.754	pg/L	<0.54	<0.54	<0.54	<0.00	1	100%	<0.754	<0.754	<0.754	<0.000	1	100%	<0.54	<0.754	<0.647	<0.151	2	100%
Tetra	PCB 81	0.577	0.894	pg/L	<0.577	<0.577	<0.577	<0.000	1	100%	<0.894	<0.894	<0.894	<0.000	1	100%	<0.577	<0.894	<0.736	<0.224	2	100%
Penta	PCB 82	0.613	0.761	pg/L	5.11	5.11	5.11	0.00	1	0%	8.78	8.78	8.78	0.00	1	0%	5.11	8.78	6.95	2.60	2	0%
Penta	PCB 83/99	0.584	0.708	pg/L	25.60	25.60	25.60	0.00	1	0%	36.60	36.60	36.60	0.00	1	0%	25.60	36.60	31.10	7.80	2	0%
Penta	PCB 84	0.648	0.773	pg/L	11	11	11	0	1	0%	14.6	14.6	14.6	0	1	0%	11	14.6	12.8	2.5	2	0%
Penta	PCB 85/116/117	0.514	0.563	pg/L	9.43	9.43	9.43	0	1	0%	11.8	11.8	11.8	0	1	0%	9.43	11.8	10.62	1.68	2	0%
Penta	PCB 86/87/97/109/119/125	0.514	0.604	pg/L	36.7	36.7	36.7	0	1	0%	45.8	45.8	45.8	0	1	0%	36.7	45.8	41.3	6.4	2	0%
Penta	PCB 88/91	0.554	0.693	pg/L	4.39	4.39	4.39	0	1	0%	8.48	8.48	8.48	0	1	0%	4.39	8.48	6.44	2.89	2	0%
Penta	PCB 89	0.598	0.713	pg/L	<0.598	<0.598	<0.598	<0.000	1	100%	<0.713	<0.713	<0.713	<0.000	1	100%	<0.598	<0.713	<0.656	<0.081	2	100%
Penta	PCB 90/101/113	0.514	0.598	pg/L	43.40	43.40	43.40	0.00	1	0%	60.80	60.80	60.80	0.00	1	0%	43.40	60.80	52.10	12.30	2	0%
Penta	PCB 92	0.58	0.678	pg/L	8.35	8.35	8.35	0.00	1	0%	11.50	11.50	11.50	0.00	1	0%	8.35	11.50	9.93	2.23	2	0%
Penta	PCB 93/95/98/100/102	0.551	0.674	pg/L	34.8	34.8	34.8	0	1	0%	45.8	45.8	45.8	0	1	0%	34.8	45.8	40.3	7.8	2	0%
Penta	PCB 94	0.617	0.749	pg/L	<0.617	<0.617	<0.617	<0.000	1	100%	<0.749	<0.749	<0.749	<0.000	1	100%	<0.617	<0.749	<0.683	<0.093	2	100%
Penta	PCB 96	0.514	0.63	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.63	<0.63	<0.63	<0.00	1	100%	<0.514	<0.63	<0.572	<0.082	2	100%
Penta	PCB 103	0.514	0.601	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.601	<0.601	<0.601	<0.000	1	100%	<0.514	<0.601	<0.558	<0.062	2	100%
Penta	PCB 104	0.514	0.79	pg/L	0.84	0.84	0.84	0.00	1	0%	<0.79	<0.79	<0.79	<0.00	1	100%	<0.79	0.84	<0.817	<0.038	2	50%
Penta	PCB 105	0.717	1	pg/L	21.40	21.40	21.40	0.00	1	0%	29.00	29.00	29.00	0.00	1	0%	21.40	29.00	25.20	5.40	2	0%
Penta	PCB 106	0.662	0.919	pg/L	<0.662	<0.662	<0.662	<0.000	1	100%	<0.919	<0.919	<0.919	<0.000	1	100%	<0.662	<0.919	<0.791	<0.182	2	100%
Penta	PCB 107	0.648	0.818	pg/L	2.98	2.98	2.98	0	1	0%	4.48	4.48	4.48	0	1	0%	2.98	4.48	3.73	1.06	2	0%
Penta	PCB 108/124	0.716	0.961	pg/L	2.27	2.27	2.27	0	1	0%	2.8	2.8	2.8	0	1	0%	2.27	2.8	2.54	0.37	2	0%
Penta	PCB 110/115	0.514	0.529	pg/L	56.6	56.6	56.6	0	1	0%	83.8	83.8	83.8	0	1	0%	56.6	83.8	70.2	19.2	2	0%
Penta	PCB 111	0.514	0.529	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.529	<0.529	<0.529	<0.000	1	100%	<0.514	<0.529	<0.522	<0.011	2	100%
Penta	PCB 112	0.514	0.529	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.529	<0.529	<0.529	<0.000	1	100%	<0.514	<0.529	<0.522	<0.011	2	100%
Penta	PCB 114	0.707	1.03	pg/L	1.15	1.15	1.15	0.00	1	0%	1.47	1.47	1.47	0.00	1	0%	1.15	1.47	1.31	0.23	2	0%
Penta	PCB 118	0.702	1	pg/L	45.6	45.6	45.6	0	1	0%	65.1	65.1	65.1	0	1	0%	45.6	65.1	55.4	13.8	2	0%
Penta	PCB 120	0.514	0.529	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.529	<0.529	<0.529	<0.000	1	100%	<0.514	<0.529	<0.522	<0.011	2	100%
Penta	PCB 121	0.514	0.529	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.529	<0.529	<0.529	<0.000	1	100%	<0.514	<0.529	<0.522	<0.011	2	100%
Penta	PCB 122	0.737	0.992	pg/L	<0.737	<0.737	<0.737	<0.000	1	100%	<0.992	<0.992	<0.992	<0.000	1	100%	<0.737	<0.992	<0.865	<0.180	2	100%

< Results reported less than detection limit

1 Range, mean, standard deviation, and number of samples (N) are provided. When results are less than the detection limit, the detection limit was used to calculate each statistical value

2 Solid and aqueous fractions of the samples were analyzed separately, results are presented as a total of both solid and aqueous fractions

3 Percent of samples with result less than detection limit

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]																	
					Combined Fractions [2]																	
					Grab						Composite						Total					
					Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]
Polychlorinated biphenyls (PCBs)																						
Penta	PCB 123	0.758	1.09	pg/L	1.67	1.67	1.67	0.00	1	0%	2.02	2.02	2.02	0.00	1	0%	1.67	2.02	1.85	0.25	2	0%
Penta	PCB 126	0.724	1	pg/L	<0.724	<0.724	<0.724	<0.000	1	100%	<1	<1	<1	<0	1	100%	<0.724	<1	<0.862	<0.195	2	100%
Penta	PCB 127	0.667	0.952	pg/L	<0.667	<0.667	<0.667	<0.000	1	100%	<0.952	<0.952	<0.952	<0.000	1	100%	<0.667	<0.952	<0.810	<0.202	2	100%
Hexa	PCB 128/166	0.514	0.815	pg/L	11.4	11.4	11.4	0	1	0%	15.6	15.6	15.6	0	1	0%	11.4	15.6	13.5	3	2	0%
Hexa	PCB 129/138/160/163	0.519	0.808	pg/L	71.6	71.6	71.6	0	1	0%	95.1	95.1	95.1	0	1	0%	71.6	95.1	83.4	16.6	2	0%
Hexa	PCB 130	0.672	1.01	pg/L	4.29	4.29	4.29	0	1	0%	5.48	5.48	5.48	0	1	0%	4.29	5.48	4.89	0.84	2	0%
Hexa	PCB 131	0.666	1	pg/L	0.796	0.796	0.796	0	1	0%	1.36	1.36	1.36	0	1	0%	0.796	1.36	1.078	0.399	2	0%
Hexa	PCB 132	0.706	1.02	pg/L	20.20	20.20	20.20	0.00	1	0%	28.70	28.70	28.70	0.00	1	0%	20.20	28.70	24.50	6.00	2	0%
Hexa	PCB 133	0.598	0.956	pg/L	0.88	0.88	0.88	0.00	1	0%	1.03	1.03	1.03	0.00	1	0%	0.88	1.03	0.95	0.11	2	0%
Hexa	PCB 134/143	0.661	0.975	pg/L	2.63	2.63	2.63	0	1	0%	3.58	3.58	3.58	0	1	0%	2.63	3.58	3.11	0.67	2	0%
Hexa	PCB 135/151/154	0.514	0.668	pg/L	18.2	18.2	18.2	0	1	0%	24	24	24	0	1	0%	18.2	24	21.1	4.1	2	0%
Hexa	PCB 136	0.514	0.529	pg/L	5.67	5.67	5.67	0	1	0%	8.94	8.94	8.94	0	1	0%	5.67	8.94	7.31	2.31	2	0%
Hexa	PCB 137	0.662	0.994	pg/L	3.69	3.69	3.69	0	1	0%	5.97	5.97	5.97	0	1	0%	3.69	5.97	4.83	1.61	2	0%
Hexa	PCB 139/140	0.607	0.874	pg/L	1.56	1.56	1.56	0.00	1	0%	1.11	1.11	1.11	0.00	1	0%	1.11	1.56	1.34	0.32	2	0%
Hexa	PCB 141	0.561	0.886	pg/L	11.10	11.10	11.10	0.00	1	0%	14.70	14.70	14.70	0.00	1	0%	11.10	14.70	12.90	2.50	2	0%
Hexa	PCB 142	0.69	1	pg/L	<0.69	<0.69	<0.69	<0.00	1	100%	<1	<1	<1	<0	1	100%	<0.69	<1	<0.85	<0.22	2	100%
Hexa	PCB 144	0.514	0.675	pg/L	2.24	2.24	2.24	0	1	0%	2.82	2.82	2.82	0	1	0%	2.24	2.82	2.53	0.41	2	0%
Hexa	PCB 145	0.514	0.553	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.553	<0.553	<0.553	<0.000	1	100%	<0.514	<0.553	<0.534	<0.028	2	100%
Hexa	PCB 146	0.53	0.82	pg/L	10.1	10.1	10.1	0	1	0%	10.5	10.5	10.5	0	1	0%	10.1	10.5	10.3	0.3	2	0%
Hexa	PCB 147/149	0.608	0.869	pg/L	38.7	38.7	38.7	0	1	0%	61.9	61.9	61.9	0	1	0%	38.7	61.9	50.3	16.4	2	0%
Hexa	PCB 148	0.514	0.692	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.692	<0.692	<0.692	<0.000	1	100%	<0.514	<0.692	<0.603	<0.126	2	100%
Hexa	PCB 150	0.514	0.529	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.529	<0.529	<0.529	<0.000	1	100%	<0.514	<0.529	<0.522	<0.011	2	100%
Hexa	PCB 152	0.514	0.529	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.529	<0.529	<0.529	<0.000	1	100%	<0.514	<0.529	<0.522	<0.011	2	100%
Hexa	PCB 153/168	0.514	0.732	pg/L	53.8	53.8	53.8	0	1	0%	73.2	73.2	73.2	0	1	0%	53.8	73.2	63.5	13.7	2	0%
Hexa	PCB 155	0.514	0.555	pg/L	1.63	1.63	1.63	0	1	0%	0.993	0.993	0.993	0	1	0%	0.993	1.63	1.312	0.45	2	0%
Hexa	PCB 156/157	0.524	0.911	pg/L	8.7	8.7	8.7	0	1	0%	11.9	11.9	11.9	0	1	0%	8.7	11.9	10.3	2.3	2	0%
Hexa	PCB 158	0.514	0.631	pg/L	7.82	7.82	7.82	0.00	1	0%	8.01	8.01	8.01	0.00	1	0%	7.82	8.01	7.92	0.13	2	0%
Hexa	PCB 159	0.514	0.661	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.661	<0.661	<0.661	<0.000	1	100%	<0.514	<0.661	<0.588	<0.104	2	100%
Hexa	PCB 161	0.514	0.678	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.678	<0.678	<0.678	<0.000	1	100%	<0.514	<0.678	<0.596	<0.116	2	100%
Hexa	PCB 162	0.514	0.668	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.668	<0.668	<0.668	<0.000	1	100%	<0.514	<0.668	<0.591	<0.109	2	100%
Hexa	PCB 164	0.514	0.651	pg/L	5.14	5.14	5.14	0	1	0%	5.82	5.82	5.82	0	1	0%	5.14	5.82	5.48	0.48	2	0%
Hexa	PCB 165	0.514	0.762	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.762	<0.762	<0.762	<0.000	1	100%	<0.514	<0.762	<0.638	<0.175	2	100%
Hexa	PCB 167	0.514	0.714	pg/L	3.21	3.21	3.21	0.00	1	0%	4.06	4.06	4.06	0.00	1	0%	3.21	4.06	3.64	0.60	2	0%
Hexa	PCB 169	0.514	0.734	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.734	<0.734	<0.734	<0.000	1	100%	<0.514	<0.734	<0.624	<0.156	2	100%
Hepta	PCB 170	0.514	0.795	pg/L	11.90	11.90	11.90	0.00	1	0%	16.40	16.40	16.40	0.00	1	0%	11.90	16.40	14.20	3.20	2	0%
Hepta	PCB 171/173	0.514	0.852	pg/L	4.36	4.36	4.36	0.00	1	0%	6.82	6.82	6.82	0.00	1	0%	4.36	6.82	5.59	1.74	2	0%
Hepta	PCB 172	0.514	0.842	pg/L	2.65	2.65	2.65	0	1	0%	2.99	2.99	2.99	0	1	0%	2.65	2.99	2.82	0.24	2	0%
Hepta	PCB 174	0.514	0.762	pg/L	11.1	11.1	11.1	0	1	0%	16.7	16.7	16.7	0	1	0%	11.1	16.7	13.9	4	2	0%
Hepta	PCB 175	0.514	0.752	pg/L	0.699	0.699	0.699	0	1	0%	<0.752	<0.752	<0.752	<0.000	1	100%	0.699	<0.752	<0.726	<0.037	2	50%
Hepta	PCB 176	0.514	0.578	pg/L	1.76	1.76	1.76	0	1	0%	2.1	2.1	2.1	0	1	0%	1.76	2.1	1.93	0.24	2	0%
Hepta	PCB 177	0.514	0.824	pg/L	6.84	6.84	6.84	0	1	0%	12.6	12.6	12.6	0	1	0%	6.84	12.6	9.72	4.07	2	0%

< Results reported less than detection limit

1 Range, mean, standard deviation, and number of samples (N) are provided. When results are less than the detection limit, the detection limit was used to calculate each statistical value

2 Solid and aqueous fractions of the samples were analyzed separately, results are presented as a total of both solid and aqueous fractions

3 Percent of samples with result less than detection limit

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]																	
					Combined Fractions [2]																	
					Grab						Composite						Total					
					Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]
Polychlorinated biphenyls (PCBs)																						
Hepta	PCB 178	0.514	0.807	pg/L	2.51	2.51	2.51	0	1	0%	3.88	3.88	3.88	0	1	0%	2.51	3.88	3.2	0.97	2	0%
Hepta	PCB 179	0.514	0.585	pg/L	5.63	5.63	5.63	0.00	1	0%	9.77	9.77	9.77	0.00	1	0%	5.63	9.77	7.70	2.93	2	0%
Hepta	PCB 180/193	0.514	0.836	pg/L	34.4	34.4	34.4	0	1	0%	48.4	48.4	48.4	0	1	0%	34.4	48.4	41.4	9.9	2	0%
Hepta	PCB 181	0.514	0.805	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.805	<0.805	<0.805	<0.000	1	100%	<0.514	<0.805	<0.660	<0.206	2	100%
Hepta	PCB 182	0.514	0.743	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.743	<0.743	<0.743	<0.000	1	100%	<0.514	<0.743	<0.629	<0.162	2	100%
Hepta	PCB 183/185	0.514	0.744	pg/L	8.82	8.82	8.82	0	1	0%	11	11	11	0	1	0%	8.82	11	9.91	1.54	2	0%
Hepta	PCB 184	0.514	0.57	pg/L	1.39	1.39	1.39	0.00	1	0%	1.54	1.54	1.54	0.00	1	0%	1.39	1.54	1.47	0.11	2	0%
Hepta	PCB 186	0.514	0.63	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.63	<0.63	<0.63	<0.00	1	100%	<0.514	<0.63	<0.572	<0.082	2	100%
Hepta	PCB 187	0.514	0.737	pg/L	17.5	17.5	17.5	0	1	0%	25.3	25.3	25.3	0	1	0%	17.5	25.3	21.4	5.5	2	0%
Hepta	PCB 188	0.514	0.62	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.62	<0.62	<0.62	<0.00	1	100%	<0.514	<0.62	<0.567	<0.075	2	100%
Hepta	PCB 189	0.514	0.617	pg/L	0.739	0.739	0.739	0	1	0%	1.06	1.06	1.06	0	1	0%	0.739	1.06	0.9	0.227	2	0%
Hepta	PCB 190	0.514	0.624	pg/L	2.56	2.56	2.56	0.00	1	0%	3.50	3.50	3.50	0.00	1	0%	2.56	3.50	3.03	0.66	2	0%
Hepta	PCB 191	0.514	0.599	pg/L	0.59	0.59	0.59	0.00	1	0%	1.03	1.03	1.03	0.00	1	0%	0.59	1.03	0.81	0.31	2	0%
Hepta	PCB 192	0.514	0.655	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.655	<0.655	<0.655	<0.000	1	100%	<0.514	<0.655	<0.585	<0.100	2	100%
Octa	PCB 194	0.514	0.752	pg/L	6.62	6.62	6.62	0	1	0%	8.4	8.4	8.4	0	1	0%	6.62	8.4	7.51	1.26	2	0%
Octa	PCB 195	0.514	0.782	pg/L	2.84	2.84	2.84	0.00	1	0%	3.68	3.68	3.68	0.00	1	0%	2.84	3.68	3.26	0.59	2	0%
Octa	PCB 196	0.514	0.7	pg/L	3.55	3.55	3.55	0	1	0%	6.06	6.06	6.06	0	1	0%	3.55	6.06	4.81	1.77	2	0%
Octa	PCB 197/200	0.514	0.529	pg/L	1.20	1.20	1.20	0.00	1	0%	1.53	1.53	1.53	0.00	1	0%	1.20	1.53	1.37	0.23	2	0%
Octa	PCB 198/199	0.514	0.748	pg/L	10.30	10.30	10.30	0.00	1	0%	11.50	11.50	11.50	0.00	1	0%	10.30	11.50	10.90	0.80	2	0%
Octa	PCB 201	0.514	0.529	pg/L	1.51	1.51	1.51	0.00	1	0%	1.32	1.32	1.32	0.00	1	0%	1.32	1.51	1.42	0.13	2	0%
Octa	PCB 202	0.514	0.584	pg/L	2.00	2.00	2.00	0.00	1	0%	2.53	2.53	2.53	0.00	1	0%	2.00	2.53	2.27	0.37	2	0%
Octa	PCB 203	0.514	0.674	pg/L	5.9	5.9	5.9	0.0	1	0%	5.9	5.9	5.9	0.0	1	0%	5.9	5.9	5.9	0.0	2	0%
Octa	PCB 204	0.514	0.529	pg/L	<0.514	<0.514	<0.514	<0.000	1	100%	<0.529	<0.529	<0.529	<0.000	1	100%	<0.514	<0.529	<0.522	<0.011	2	100%
Octa	PCB 205	0.514	0.656	pg/L	0.65	0.65	0.65	0.00	1	0%	<0.656	<0.656	<0.656	<0.000	1	100%	0.65	<0.656	<0.654	<0.004	2	50%
Nona	PCB 206	0.921	3.56	pg/L	4.38	4.38	4.38	0	1	0%	6.34	6.34	6.34	0	1	0%	4.38	6.34	5.36	1.39	2	0%
Nona	PCB 207	0.65	2.44	pg/L	0.75	0.75	0.75	0.00	1	0%	<2.44	<2.44	<2.44	<0.00	1	100%	0.75	<2.44	<1.594	<1.196	2	50%
Nona	PCB 208	0.683	2.55	pg/L	1.08	1.08	1.08	0.00	1	0%	<2.55	<2.55	<2.55	<0.00	1	100%	1.08	<2.55	<1.82	<1.04	2	50%
Deca	PCB 209	0.514	1.03	pg/L	3	3	3	0	1	0%	4.39	4.39	4.39	0	1	0%	3	4.39	3.7	0.98	2	0%

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2 Solid and aqueous fractions of the samples were analyzed separately, results are presented as a total of both solid and aqueous fractions

3 Percent of samples with result less than detection limit

Analyte	Detection Limit	Units	Descriptive Statistics [1]					
			Grab					
			Range		Mean	Stdev	N	%ND [2]
Pharmaceuticals								
Acetaminophen	3	ng/L	1370	1370	1370	**	1	0%
Bisphenol A	5	ng/L	44.4	44.4	44.4	**	1	0%
Caffeine	100	ng/L	3140	3140	3140	**	1	0%
Clopidogrel	5	ng/L	<5.0	<5.0	<5.0	**	1	100%
Diclofenac	1	ng/L	59.5	59.5	59.5	**	1	0%
Fluoxetine	20	ng/L	<20.0	<20.0	<20.0	**	1	100%
Gemfibrozil	2	ng/L	3.7	3.7	3.7	**	1	0%
Ibuprofen	5	ng/L	174	174	174	**	1	0%
Naproxen	5	ng/L	85.5	85.5	85.5	**	1	0%
Primidone	2	ng/L	<2.0	<2.0	<2.0	**	1	100%
Sulfamethoxazole	1	ng/L	<1.0	<1.0	<1.0	**	1	100%
Triclosan	20	ng/L	<20.0	<20.0	<20.0	**	1	100%
Trimethoprim	1	ng/L	1.6	1.6	1.6	**	1	0%

** Not applicable

< Results reported less than detection limit

1 Range, mean, standard deviation, and number of samples (N) are provided. When results are less than the detection limit, the detection limit was used to calculate each statistical value

2 Percent of samples with result less than detection limit

Analyte	Detection Limit	Units	Descriptive Statistics [1]																	
			Grab						Composite						Total [4]					
			Range		Mean	Stdev	N	%ND[3]	Range		Mean	Stdev	N	%ND[3]	Range		Mean	Stdev	N	%ND[3]
Microbiology [2]																				
Ecoli	1800-18000	MPN/100mls	990,000	1,013,000	1,002,000	17,000	2	0%	275,000	2,133,000	649,000	849,000	4	0%	275,000	2,133,000	750,000	660,000	6	0%
Enterococci	10-100	MPN/100mls	186,000	461,000	292,000	195,000	2	0%	105,000	816,000	244,000	394,000	3	0%	105,000	816,000	262,000	296,000	5	0%
Fecal Coliform	1800-18000	MPN/100mls	1,196,000	1,556,000	1,364,000	254,000	2	0%	330,000	2,898,000	893,000	1,150,000	4	0%	330,000	2,898,000	1,028,000	902,000	6	0%
Inorganic Chemistry and Physical																				
Biochemical Oxygen Demand	10	mg/L	46	46	46	0.0	1	0%	34	117	66	36	4	0%	34	117	62	32	5	0%
Chemical Oxygen Demand	20	mg/L	114	115	115	1	2	0%	111	293	183	85	4	0%	111	293	160	75	6	0%
Conductivity	1	µmho/cm	111	264	188	108	2	0%	204	420	268	103	4	0%	111	420	241	102	6	0%
Hardness as CACO3	0.2	mg/L	21.9	38	30.0	11.4	2	0%	32.1	58.1	41.1	11.6	4	0%	21.9	58.1	37.4	11.8	6	0%
Nitrogen - Ammonia as N	0.2	mg/L	3.7	4.5	4.10	0.60	2	0%	4	11.6	6.80	3.4	4	0%	3.7	11.6	5.90	3.0	6	0%
Nitrogen - Nitrate as N	0.01	mg/L	0.38	0.39	0.39	0.01	2	0%	0.05	0.55	0.36	0.22	4	0%	0.05	0.55	0.37	0.17	6	0%
Nitrogen - Nitrite as N	0.01	mg/L	0.03	0.04	0.04	0.01	2	0%	0.04	0.13	0.07	0.04	4	0%	0.03	0.13	0.06	0.04	6	0%
pH	0.1	PH	7.1	7.3	7.2	0.1	2	0%	6.8	7.5	7.3	0.3	4	0%	6.8	7.5	7.2	0.3	6	0%
Total Suspended Solids	5	mg/L	56	90	73	24	2	0%	51	153	117	48	4	0%	51	153	102	45	6	0%
Volatile Suspended Solids	5	mg/L	45	58	52	9	2	0%	40	137	88	40	4	0%	40	137	76	37	6	0%
Toxicity [5]																				
LC50 Rainbow Trout 96-h	**	%vol/vol	100	100	100	**	1	**	**	**	**	**	**	**	**	**	**	**	**	**
Total Metals																				
Aluminum Total	5	µg/L	667	1050	859	271	2	0%	364	2160	1004	803	4	0%	364	2160	956	638	6	0%
Arsenic Total	0.5	µg/L	1.8	2.6	2.2	0.6	2	0%	1.8	3.6	2.3	0.9	4	0%	1.8	3.6	2.2	0.7	6	0%
Barium Total	0.5	µg/L	17.8	18.4	18.1	0.4	2	0%	17.1	37.7	24.8	8.9	4	0%	17.1	37.7	22.6	7.7	6	0%
Boron Total	10	µg/L	20	30	25.00	7	2	0%	16	51	27.00	16	4	0%	16	51	27.00	13	6	0%
Cadmium Total	0.2	µg/L	<0.2	0.6	<0.4	<0.3	2	50%	<0.2	<0.2	<0.2	<0.0	4	75%	<0.2	0.6	<0.3	<0.2	6	67%
Calcium Total	20	µg/L	6680	9920	8300	2291	2	0%	9280	15000	11283	2635	4	0%	6680	15000	10288	2755	6	0%
Chromium Total	0.5	µg/L	1.6	3.3	2.5	1.2	2	0%	1.4	6.6	3.1	2.4	4	0%	1.4	6.6	2.9	2.0	6	0%
Cobalt Total	0.5	µg/L	<0.5	0.6	<0.6	<0.1	2	50%	<0.5	1.2	<0.7	<0.4	4	50%	<0.5	1.2	<0.6	<0.3	6	50%
Copper Total	0.5	µg/L	33.9	39.5	36.7	4.0	2	0%	29	76.9	48.6	21.2	4	0%	29	76.9	44.6	17.6	6	0%
Iron Total	5	µg/L	838	1330	1084	348	2	0%	704	3330	1689	1138	4	0%	704	3330	1487	948	6	0%
Lead Total	0.5	µg/L	3.2	4.4	3.8	0.8	2	0%	2.5	14	6.1	5.4	4	0%	2.5	14.0	5.3	4.3	6	0%
Magnesium Total	10	µg/L	1270	3220	2245	1379	2	0%	2170	5010	3138	1310	4	0%	1270	5010	2840	1274	6	0%
Manganese Total	0.5	µg/L	33.2	37.9	35.6	3.3	2	0%	29	97.7	53.6	30.2	4	0%	29	97.7	47.6	25.2	6	0%
Mercury Total	0.05	µg/L	<0.05	<0.05	<0.05	<0.00	2	100%	<0.05	0.21	<0.10	<0.08	4	50%	<0.05	0.21	<0.08	<0.06	6	67%
Molybdenum Total	0.5	µg/L	0.7	0.8	0.8	0.1	2	0%	0.9	1.4	1.10	0.2	4	0%	0.7	1.4	1.00	0.3	6	0%
Nickel Total	0.5	µg/L	1.5	2.3	1.9	0.6	2	0%	1.9	4.2	2.7	1.0	4	0%	1.5	4.2	2.4	0.9	6	0%
Phosphorus Total	20	µg/L	1000	1280	1140	198	2	0%	1100	2810	1703	763	4	0%	1000	2810	1515	664	6	0%
Selenium Total	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	4	100%	<0.5	<0.5	<0.5	<0.0	6	100%
Silver Total	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	4	100%	<0.5	<0.5	<0.5	<0.0	6	100%
Sodium Total	50-500	µg/L	8150	26400	17275	12905	2	0%	17100	40700	25675	10347	4	0%	8150	40700	22875	10787	6	0%
Zinc Total	3	µg/L	68	82	75	10	2	0%	79	181	116	45	4	0%	68	181	103	41	6	0%
Dissolved Metals																				
Aluminium Dissolved	5	µg/L	21	27	24	4	2	0%	12	25	18	6	4	0%	12	27	20	6	6	0%
Arsenic Dissolved	0.5	µg/L	1.5	2.2	1.9	0.5	2	0%	1.3	2	1.6	0.3	4	0%	1.3	2.2	1.7	0.3	6	0%
Barium Dissolved	0.5	µg/L	5.1	8.1	6.6	2.1	2	0%	7.3	10.7	9.0	1.4	4	0%	5.1	10.7	8.2	1.9	6	0%
Boron Dissolved	10	µg/L	19	30	25	8	2	0%	15	51	27	16	4	0%	15	51	26	13	6	0%
Cadmium Dissolved	0.2	µg/L	<0.2	<0.2	<0.2	<0.0	2	100%	<0.2	<0.2	<0.2	<0.0	4	100%	<0.2	<0.2	<0.2	<0.0	6	100%
Calcium Dissolved	20	µg/L	5190	8740	6965	2510	2	0%	7170	13000	9630	2577	4	0%	5190	13000	8742	2672	6	0%
Chromium Dissolved	0.5	µg/L	0.7	1.3	1.0	0.4	2	0%	<0.5	0.8	<0.7	<0.1	4	25%	<0.5	1.3	<0.8	<0.3	6	17%
Cobalt Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	4	100%	<0.5	<0.5	<0.5	<0.0	6	100%
Copper Dissolved	0.5	µg/L	9.3	12.5	10.9	2.3	2	0%	7.3	14	10.7	2.7	4	0%	7.3	14	10.7	2.4	6	0%
Iron Dissolved	5	µg/L	50	98	74	34	2	0%	80	199	128	56	4	0%	50	199	110	54	6	0%
Lead Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	4	100%	<0.5	<0.5	<0.5	<0.0	6	100%
Magnesium Dissolved	10	µg/L	879	2890	1885	1422	2	0%	1810	4510	2660	1246	4	0%	879	4510	2402	1223	6	0%
Manganese Dissolved	0.5	µg/L	9.3	14.2	11.8	3.5	2	0%	16.4	41.2	24.4	11.5	4	0%	9.3	41.2	20.2	11.2	6	0%
Molybdenum Dissolved	0.5	µg/L	<0.5	0.6	<0.6	<0.1	2	50%	0.5	0.8	0.70	0.20	4	0%	0.5	0.8	<0.6	<0.1	6	17%
Nickel Dissolved	0.5	µg/L	0.7	0.9	0.80	0.1	2	0%	0.7	1.2	1.00	0.20	4	0%	0.7	1.2	1.00	0.20	6	0%
Phosphorus Dissolved	20	µg/L	492	757	625	187	2	0%	289	1270	726	407	4	0%	289	1270	692	331	6	0%
Selenium Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	4	100%	<0.5	<0.5	<0.5	<0.0	6	100%
Silver Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	4	100%	<0.5	<0.5	<0.5	<0.0	6	100%
Sodium Dissolved	50-500	µg/L	8100	25800	16950	12516	2	0%	17100	40200	25275	10237	4	0%	8100	40200	22500	10615	6	0%
Zinc Dissolved	3	µg/L	26	34	30	6	2	0%	22	38	27	7	4	0%	22	38	28	6	6	0%

** Not applicable

< Results reported less than detection limit

1 Range, mean (geomean for microbiology), standard deviation, and number of samples (N) are provided. When results are less than (greater than for microbiology) the detection limit, the detection limit was used to calculate each statistical value

2 Every sample for microbiology was collected with a duplicate, the result reported is the geomean of duplicates

3 Percent of samples with result less than detection limit

4 Total includes both grab and composite

5 LC50 results represent % survival, results show 0% mortality throughout test

Analyte	Detection Limit	Units	Descriptive Statistics [1]				
			Grab				
			Range	Mean	Stdev	N	%ND [2]
Volatile petroleum hydrocarbons							
1,1,1,2-Tetrachloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
1,1,1-Trichloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
1,1,2,2-Tetrachloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
1,1,2-Trichloro/1,2,2-Trifluoroethane	2.0	µg/L	<2.0	<2.0	<2.0	**	2	100%
1,1,2-Trichloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
1,1-Dichloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
1,1-Dichloroethylene	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
1,2,3-Trichlorobenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	2	100%
1,2,4-Trichlorobenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	2	100%
1,2-Dibromoethane	0.20	µg/L	<0.20	<0.20	<0.20	**	2	100%
1,2-Dichlorobenzene	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
1,2-Dichloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
1,2-Dichloropropane	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
1,3,5-Trimethylbenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	2	100%
1,3-Butadiene	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
1,3-Dichlorobenzene	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
1,3-Dichloropropane	1.0	µg/L	<1.0	<1.0	<1.0	**	2	100%
1,4-Dichlorobenzene	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
Benzene	0.40	µg/L	<0.40	<0.40	<0.40	**	2	100%
Bromobenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	2	100%
Bromodichloromethane	1.0	µg/L	<1.0	<1.0	<1.0	**	2	100%
Bromoform	1.0	µg/L	<1.0	<1.0	<1.0	**	2	100%
Bromomethane	1.0	µg/L	<1.0	<1.0	<1.0	**	2	100%
Carbon Tetrachloride	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
Chlorobenzene	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
Chloroethane	1.0	µg/L	<1.0	<1.0	<1.0	**	2	100%
Chloroform	1.0	µg/L	1.1	2.2	1.7	0.8	2	0%
Chloromethane	1.0	µg/L	<1.0	<1.0	<1.0	**	2	100%
cis-1,2-Dichloroethylene	1.0	µg/L	<1.0	<1.0	<1.0	**	2	100%
cis-1,3-Dichloropropylene	1.0	µg/L	<1.0	<1.0	<1.0	**	2	100%
Dibromochloromethane	1.0	µg/L	<1.0	<1.0	<1.0	**	2	100%
Dichlorodifluoromethane	2.0	µg/L	<2.0	<2.0	<2.0	**	2	100%
Dichloromethane	2.0	µg/L	<2.0	<2.0	<2.0	**	2	100%
Ethylbenzene	0.40	µg/L	<0.40	<0.40	<0.40	**	2	100%
Hexachlorobutadiene	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
Isopropylbenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	2	100%
m- & p-Xylene	0.40	µg/L	<0.40	<0.40	<0.40	**	2	100%
Methyl t-butyl ether (MTBE)	4.0	µg/L	<4.0	<4.0	<4.0	**	2	100%
o-Xylene	0.40	µg/L	<0.40	<0.40	<0.40	**	2	100%
Styrene	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
Tetrachloroethylene	0.50	µg/L	<0.50	0.52	<0.51	<0.01	2	50%
Toluene	0.40	µg/L	<0.40	<0.40	<0.40	**	2	100%
trans-1,2-Dichloroethylene	1.0	µg/L	<1.0	<1.0	<1.0	**	2	100%
trans-1,3-Dichloropropylene	1.0	µg/L	<1.0	<1.0	<1.0	**	2	100%
Trichloroethylene	0.50	µg/L	<0.50	0.78	<0.64	<0.20	2	50%
Trichlorofluoromethane	4.0	µg/L	<4.0	<4.0	<4.0	**	2	100%
VH (C6-C10) [3]	300	µg/L	<300	<300	<300	**	2	100%
Vinyl Chloride	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
VPH (C6-10) - BTEX [4]	300	µg/L	<300	<300	<300	**	2	100%
Xylenes	0.40	µg/L	<0.40	<0.40	<0.40	**	2	100%

Analyte		Detection Limit	Units	Descriptive Statistics [1]				
				Grab				
				Range	Mean	Stdev	N	%ND [2]
Extractable petroleum hydrocarbons								
LEPH (C10-C19 less PAH) [5]		0.20	mg/L	<0.20	<0.20	<0.20	**	2	100%
HEPH (C19-C32 less PAH) [6]		0.20	mg/L	1.10	1.20	1.20	0.1	2	0%
EPH (C10-C19)		0.20	mg/L	<0.20	<0.20	<0.20	**	2	100%
EPH (C19-C32)		0.20	mg/L	1.10	1.20	1.20	0.1	2	0%
Polycyclic aromatic hydrocarbons (PAH)								
Low molecular weight PAHs (LPAH)	2-Methylnaphthalene [7]	0.10	µg/L	<0.10	<0.10	<0.10	**	2	100%
	Phenanthrene	0.020	µg/L	0.031	0.042	0.037	0.008	2	0%
	Acenaphthene	0.050	µg/L	<0.050	<0.050	<0.050	**	2	100%
	Acenaphthylene	0.050	µg/L	<0.050	<0.050	<0.050	**	2	100%
	Anthracene	0.010	µg/L	<0.010	<0.010	<0.010	**	2	100%
	Acridine [8]	0.050	µg/L	<0.050	<0.050	<0.050	**	2	100%
	Fluorene	0.050	µg/L	<0.050	<0.050	<0.050	**	2	100%
	Naphthalene	0.10	µg/L	<0.10	<0.10	<0.10	**	2	100%
	Quinoline [8]	0.050	µg/L	<0.050	0.06	<0.055	<0.007	2	50%
	Total LPAHs	0.10	µg/L	<0.10	<0.10	<0.10	**	2	100%
High molecular weight PAHs (HPAH)	Benz[a]anthracene	0.010	µg/L	0.01	0.012	0.011	0.001	2	0%
	Benzo[a]pyrene	0.0050	µg/L	0.011	0.011	0.011	0	2	0%
	Benzo[b+j]fluoranthene	0.030	µg/L	<0.030	<0.030	<0.030	**	2	100%
	Benzo[g,h,i]perylene	0.050	µg/L	<0.050	<0.050	<0.050	**	2	100%
	Benzo[k]fluoranthene	0.050	µg/L	<0.050	<0.050	<0.050	**	2	100%
	Chrysene	0.020	µg/L	0.021	0.022	0.022	0.001	2	0%
	Dibenz[a,h]anthracene	0.0030	µg/L	<0.0030	0.0033	<0.0032	<0.0002	2	50%
	Fluoranthene	0.020	µg/L	0.034	0.048	0.041	0.01	2	0%
	Indeno[1,2,3-c,d]pyrene	0.050	µg/L	<0.050	<0.050	<0.050	**	2	100%
	Pyrene	0.020	µg/L	0.037	0.054	0.046	0.012	2	0%
	Total HPAHs	0.050	µg/L	0.12	0.14	0.13	0.01	2	0%
Total PAH = LPAH + HPAH		0.10	µg/L	0.16	0.23	0.2	0.05	2	0%

** Not applicable
< Results reported less than detection limit
1 Range, mean (geomean for microbiology), standard deviation, and number of samples (N) are provided. When results are less than (greater than for microbiology) the detection limit, the detection limit was used to caculate each statistical value
2 Percent of samples with result less than detection limit
3 Volatile Hydrocarbons containing all petroleum hydrocarbons in the carbon range of C6-C10, including BTEX and Styrene
4 Volatile Petroleum Hydrocarbons containing all pretroleum hydrocarbons in the carbon range of C6-C10 minus BTEX
5 LEPH = Light Extractable Petroleum Hydrocarbons
6 HEPH = Heavy Extractable Petroleum Hydrocarbons
7 Alkylated Low Molecular Weight PAHs
8 N-Heterocycle Low Molecular Weight PAHs

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]					
					Combined Fractions [2]					
					Grab					
					Range		Mean	Stdev	N	%ND [3]
Polybrominated diphenyl ethers (PBDEs)										
Di	PBDE 7	1.04	1.04	pg/L	<1.04	<1.04	<1.04	<0.00	2	100%
Di	PBDE 8/11	1.04	1.04	pg/L	<1.04	<1.04	<1.04	<0.00	2	100%
Di	PBDE 10	1.04	1.04	pg/L	<1.04	<1.04	<1.04	<0.00	2	100%
Di	PBDE 12/13	1.04	1.04	pg/L	<1.04	1.34	<1.19	<0.21	2	50%
Di	PBDE 15	1.04	1.04	pg/L	1.46	3.14	2.3	1.19	2	0%
Tri	PBDE 17/25	1.04	1.14	pg/L	14.70	18.40	16.60	2.60	2	0%
Tri	PBDE 28/33	1.04	1.07	pg/L	38.60	52.60	45.60	9.90	2	0%
Tri	PBDE 30	1.04	1.2	pg/L	<1.04	<1.2	<1.12	<0.11	2	100%
Tri	PBDE 32	1.04	1.04	pg/L	<1.04	<1.04	<1.04	<0.00	2	100%
Tri	PBDE 35	1.04	1.04	pg/L	<1.04	1.74	<1.39	<0.49	2	50%
Tri	PBDE 37	1.04	1.04	pg/L	3.54	7.22	5.38	2.6	2	0%
Tetra	PBDE 47	1.04	1.07	pg/L	1860.00	2410.00	2135.00	389.00	2	0%
Tetra	PBDE 49	1.04	1.64	pg/L	56.20	87.60	71.90	22.20	2	0%
Tetra	PBDE 51	1.04	1.2	pg/L	5.32	12.80	9.06	5.29	2	0%
Tetra	PBDE 66	1.04	2.02	pg/L	18.8	91.2	55	51.2	2	0%
Tetra	PBDE 71	1.04	1.56	pg/L	6.86	10.4	8.63	2.5	2	0%
Tetra	PBDE 75	1.04	1.23	pg/L	1.98	4.94	3.46	2.09	2	0%
Tetra	PBDE 77	1.04	1.07	pg/L	<1.07	1.41	<1.24	<0.24	2	50%
Tetra	PBDE 79	1.04	1.24	pg/L	2.17	5.24	3.71	2.17	2	0%
Penta	PBDE 85	5.77	6.8	pg/L	72.00	135.00	104.00	45.00	2	0%
Penta	PBDE 99	4.09	4.68	pg/L	1670	2560	2115	629	2	0%
Penta	PBDE 100	2.86	3.84	pg/L	353	510	432	111	2	0%
Penta	PBDE 105	7.78	9.01	pg/L	<7.78	<9.01	<8.40	<0.87	2	100%
Penta	PBDE 116	10	10.8	pg/L	<10.8	17	<13.9	<4.4	2	50%
Penta	PBDE 119/120	6.66	7.43	pg/L	<7.43	21.70	<14.57	<10.09	2	50%
Penta	PBDE 126	3.85	4.16	pg/L	<3.85	<4.16	<4.01	<0.22	2	100%
Hexa	PBDE 128	15.4	16.4	pg/L	<15.4	<16.4	<15.9	<0.7	2	100%
Hexa	PBDE 138/166	3.38	5.79	pg/L	13.6	34.50	24.1	14.8	2	0%
Hexa	PBDE 140	2.33	4.23	pg/L	5.06	13.5	9.28	5.97	2	0%
Hexa	PBDE 153	2.45	4.37	pg/L	146.00	258.00	202.00	79.00	2	0%
Hexa	PBDE 154	2.91	3.77	pg/L	105.00	168.00	137.00	45.00	2	0%
Hexa	PBDE 155	1.58	3.04	pg/L	7.09	16.20	11.65	6.44	2	0%
Hepta	PBDE 181	3.44	7.29	pg/L	<3.44	<7.29	<5.37	<2.72	2	100%
Hepta	PBDE 183	2.38	4.83	pg/L	65.30	76.70	71.00	8.10	2	0%
Hepta	PBDE 190	5.81	12.6	pg/L	<5.81	<12.6	<9.21	<4.80	2	100%
Octa	PBDE 203	11.7	19.9	pg/L	42.50	94.70	68.60	36.90	2	0%
Nona	PBDE 206	7.28	12.5	pg/L	317.00	447.00	382.00	92.00	2	0%
Nona	PBDE 207	10.9	20.6	pg/L	383.00	546.00	465.00	115.00	2	0%
Nona	PBDE 208	9.92	21.9	pg/L	189.00	335.00	262.00	103.00	2	0%
Deca	PBDE 209	32.9	73	pg/L	5940.0	10700.0	8320.0	3366.0	2	0%

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2 Solid and aqueous fractions of the samples were analyzed separately, results are presented as a total of both solid and aqueous

3 Percent of samples with result less than detection limit

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]					
					Combined Fractions [2]					
					Grab					
					Range		Mean	Stdev	N	%ND [3]
Polychlorinated biphenyls (PCBs)										
Mono	PCB 1	0.518	0.521	pg/L	1.69	7.17	4.43	3.87	2	0%
Mono	PCB 2	0.518	0.521	pg/L	1.33	5.45	3.39	2.91	2	0%
Mono	PCB 3	0.518	0.521	pg/L	2.37	6.56	4.47	2.96	2	0%
Di	PCB 4	1.38	4.97	pg/L	8.58	11	9.79	1.71	2	0%
Di	PCB 5	0.937	3.04	pg/L	<0.937	<3.04	<1.989	<1.487	2	100%
Di	PCB 6	0.817	2.68	pg/L	<2.68	5.16	<3.92	<1.75	2	50%
Di	PCB 7	0.844	2.73	pg/L	1.45	3.72	2.59	1.61	2	0%
Di	PCB 8	0.751	2.51	pg/L	6.17	18.5	12.34	8.72	2	0%
Di	PCB 9	0.793	2.71	pg/L	1.42	<2.71	<2.07	<0.91	2	50%
Di	PCB 10	0.809	2.82	pg/L	<0.809	<2.82	<1.815	<1.422	2	100%
Di	PCB 11	0.896	2.97	pg/L	51.4	180	115.7	90.9	2	0%
Di	PCB 12/13	0.87	2.96	pg/L	<2.96	6.15	<4.56	<2.26	2	50%
Di	PCB 14	0.872	2.73	pg/L	<0.872	<2.73	<1.801	<1.314	2	100%
Di	PCB 15	0.887	3.35	pg/L	12.1	13.00	12.6	0.6	2	0%
Tri	PCB 16	0.518	0.521	pg/L	10.5	15.8	13.2	3.7	2	0%
Tri	PCB 17	0.518	0.521	pg/L	9.4	14.2	11.8	3.4	2	0%
Tri	PCB 18/30	0.518	0.521	pg/L	22	32.5	27.3	7.4	2	0%
Tri	PCB 19	0.518	0.521	pg/L	4	5.76	4.88	1.24	2	0%
Tri	PCB 20/28	0.518	0.521	pg/L	38.9	55	47	11.4	2	0%
Tri	PCB 21/33	0.518	0.521	pg/L	15.20	22.90	19.10	5.40	2	0%
Tri	PCB 22	0.518	0.521	pg/L	15.3	16.9	16.1	1.1	2	0%
Tri	PCB 23	0.518	0.521	pg/L	<0.518	<0.521	<0.520	<0.002	2	100%
Tri	PCB 24	0.518	0.521	pg/L	<0.518	<0.521	<0.520	<0.002	2	100%
Tri	PCB 25	0.518	0.521	pg/L	2.62	3.28	2.95	0.47	2	0%
Tri	PCB 26/29	0.518	0.521	pg/L	6.02	8.60	7.31	1.82	2	0%
Tri	PCB 27	0.518	0.521	pg/L	1.50	2.25	1.88	0.53	2	0%
Tri	PCB 31	0.518	0.521	pg/L	34	38.4	36.2	3.1	2	0%
Tri	PCB 32	0.518	0.521	pg/L	7.67	10.10	8.89	1.72	2	0%
Tri	PCB 34	0.518	0.521	pg/L	<0.518	<0.521	<0.520	<0.002	2	100%
Tri	PCB 35	0.518	0.521	pg/L	3.29	7.28	5.29	2.82	2	0%
Tri	PCB 36	0.518	0.521	pg/L	1.38	1.85	1.62	0.33	2	0%
Tri	PCB 37	0.518	0.521	pg/L	15.50	19.10	17.30	2.50	2	0%
Tri	PCB 38	0.518	0.521	pg/L	<0.518	<0.521	<0.520	<0.002	2	100%
Tri	PCB 39	0.518	0.521	pg/L	<0.518	<0.521	<0.520	<0.002	2	100%
Tetra	PCB 40/41/71	0.518	0.521	pg/L	23.8	27.80	25.8	2.8	2	0%
Tetra	PCB 42	0.518	0.521	pg/L	10.1	14.8	12.5	3.3	2	0%
Tetra	PCB 43	0.521	0.53	pg/L	1.24	1.68	1.46	0.31	2	0%
Tetra	PCB 44/47/65	0.518	0.521	pg/L	58	94.6	76.3	25.9	2	0%
Tetra	PCB 45/51	0.518	0.521	pg/L	6.5	14.4	10.5	5.6	2	0%
Tetra	PCB 46	0.521	0.527	pg/L	2.22	4.34	3.28	1.5	2	0%
Tetra	PCB 48	0.518	0.521	pg/L	8.18	13.40	10.79	3.69	2	0%
Tetra	PCB 49/69	0.518	0.521	pg/L	22.3	30.4	26.4	5.7	2	0%

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3 Percent of samples with result less than detection limit

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]					
					Combined Fractions [2]					
					Grab					
					Range		Mean	Stdev	N	%ND [3]
Polychlorinated biphenyls (PCBs)										
Tetra	PCB 57	0.521	0.96	pg/L	<0.521	<0.96	<0.741	<0.310	2	100%
Tetra	PCB 58	0.536	1	pg/L	<0.536	<1	<0.768	<0.328	2	100%
Tetra	PCB 59/62/75	0.518	0.521	pg/L	3.5	5.94	4.72	1.73	2	0%
Tetra	PCB 60	0.545	1.01	pg/L	7.44	11.40	9.42	2.80	2	0%
Tetra	PCB 61/70/74/76	0.521	0.961	pg/L	59.70	76.00	67.90	11.50	2	0%
Tetra	PCB 63	0.521	0.925	pg/L	<0.925	1.37	<1.148	<0.315	2	50%
Tetra	PCB 64	0.518	0.521	pg/L	18.4	23.4	20.9	3.5	2	0%
Tetra	PCB 66	0.521	0.945	pg/L	26.30	33.80	30.10	5.30	2	0%
Tetra	PCB 67	0.521	0.842	pg/L	1.15	1.35	1.25	0.14	2	0%
Tetra	PCB 68	0.521	0.916	pg/L	3.42	3.89	3.66	0.33	2	0%
Tetra	PCB 72	0.521	0.913	pg/L	<0.521	<0.913	<0.717	<0.277	2	100%
Tetra	PCB 73	0.518	0.521	pg/L	<0.521	0.63	<0.575	<0.076	2	50%
Tetra	PCB 77	0.522	1.01	pg/L	4.97	8.02	6.50	2.16	2	0%
Tetra	PCB 78	0.552	0.964	pg/L	<0.552	<0.964	<0.758	<0.291	2	100%
Tetra	PCB 79	0.521	0.812	pg/L	0.872	1.16	1.016	0.204	2	0%
Tetra	PCB 80	0.521	0.881	pg/L	<0.521	<0.881	<0.701	<0.255	2	100%
Tetra	PCB 81	0.521	1.02	pg/L	<0.521	<1.02	<0.771	<0.353	2	100%
Penta	PCB 82	0.518	0.521	pg/L	8.54	12.90	10.72	3.08	2	0%
Penta	PCB 83/99	0.518	0.521	pg/L	38.50	49.90	44.20	8.10	2	0%
Penta	PCB 84	0.518	0.521	pg/L	18.2	24.1	21.2	4.2	2	0%
Penta	PCB 85/116/117	0.518	0.521	pg/L	13.7	17.7	15.7	2.8	2	0%
Penta	PCB 86/87/97/109/119/125	0.518	0.521	pg/L	61.4	75.8	68.6	10.2	2	0%
Penta	PCB 88/91	0.518	0.521	pg/L	8.63	10.6	9.62	1.39	2	0%
Penta	PCB 89	0.518	0.521	pg/L	<0.518	1.24	<0.879	<0.511	2	50%
Penta	PCB 90/101/113	0.518	0.521	pg/L	79.30	98.60	89.00	13.60	2	0%
Penta	PCB 92	0.518	0.521	pg/L	13.20	18.30	15.80	3.60	2	0%
Penta	PCB 93/95/98/100/102	0.518	0.521	pg/L	63.6	74.8	69.2	7.9	2	0%
Penta	PCB 94	0.518	0.521	pg/L	<0.521	0.874	<0.698	<0.250	2	50%
Penta	PCB 96	0.518	0.521	pg/L	<0.518	0.595	<0.557	<0.054	2	50%
Penta	PCB 103	0.518	0.521	pg/L	<0.518	0.667	<0.593	<0.105	2	50%
Penta	PCB 104	0.518	0.521	pg/L	<0.518	<0.521	<0.520	<0.002	2	100%
Penta	PCB 105	0.595	1.32	pg/L	33.40	44.40	38.90	7.80	2	0%
Penta	PCB 106	0.552	1.18	pg/L	<0.552	<1.18	<0.866	<0.444	2	100%
Penta	PCB 107	0.569	1.22	pg/L	5.02	6.61	5.82	1.12	2	0%
Penta	PCB 108/124	0.621	1.33	pg/L	3.17	5.01	4.09	1.3	2	0%
Penta	PCB 110/115	0.518	0.521	pg/L	93.7	127	110.4	23.5	2	0%
Penta	PCB 111	0.518	0.521	pg/L	<0.518	<0.521	<0.520	<0.002	2	100%
Penta	PCB 112	0.518	0.521	pg/L	<0.518	<0.521	<0.520	<0.002	2	100%
Penta	PCB 114	0.6	1.39	pg/L	<1.39	2.65	<2.02	<0.89	2	50%
Penta	PCB 118	0.574	1.34	pg/L	75	102	89	19	2	0%
Penta	PCB 120	0.518	0.521	pg/L	<0.518	<0.521	<0.520	<0.002	2	100%
Penta	PCB 121	0.518	0.521	pg/L	0.577	0.596	0.587	0.013	2	0%
Penta	PCB 122	0.631	1.42	pg/L	1.37	<1.42	<1.40	<0.04	2	50%

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3 Percent of samples with result less than detection limit

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]					
					Combined Fractions [2]					
					Grab					
					Range		Mean	Stdev	N	%ND [3]
Polychlorinated biphenyls (PCBs)										
Penta	PCB 123	0.638	1.4	pg/L	<1.4	2.57	<1.99	<0.83	2	50%
Penta	PCB 126	0.613	1.36	pg/L	0.96	<1.36	<1.161	<0.281	2	50%
Penta	PCB 127	0.59	1.32	pg/L	<0.59	<1.32	<0.96	<0.52	2	100%
Hexa	PCB 128/166	0.699	1.07	pg/L	20.2	25.1	22.7	3.5	2	0%
Hexa	PCB 129/138/160/163	0.7	1.05	pg/L	120	161	141	29	2	0%
Hexa	PCB 130	0.963	1.33	pg/L	8.18	10.2	9.19	1.43	2	0%
Hexa	PCB 131	0.901	1.29	pg/L	<1.29	1.94	<1.62	<0.46	2	50%
Hexa	PCB 132	0.936	1.34	pg/L	38.10	47.10	42.60	6.40	2	0%
Hexa	PCB 133	0.844	1.26	pg/L	1.88	2.07	1.98	0.13	2	0%
Hexa	PCB 134/143	0.87	1.27	pg/L	4.67	7.86	6.27	2.26	2	0%
Hexa	PCB 135/151/154	0.518	0.521	pg/L	28.2	42	35.1	9.8	2	0%
Hexa	PCB 136	0.518	0.521	pg/L	10.5	14.5	12.5	2.8	2	0%
Hexa	PCB 137	0.836	1.22	pg/L	6.19	7.49	6.84	0.92	2	0%
Hexa	PCB 139/140	0.807	1.14	pg/L	1.74	2.57	2.16	0.59	2	0%
Hexa	PCB 141	0.765	1.21	pg/L	21.20	28.70	25.00	5.30	2	0%
Hexa	PCB 142	0.892	1.32	pg/L	<0.892	<1.32	<1.106	<0.303	2	100%
Hexa	PCB 144	0.518	0.521	pg/L	4.16	6.78	5.47	1.85	2	0%
Hexa	PCB 145	0.518	0.521	pg/L	<0.518	<0.521	<0.520	<0.002	2	100%
Hexa	PCB 146	0.727	1.12	pg/L	15	18.1	16.6	2.2	2	0%
Hexa	PCB 147/149	0.794	1.13	pg/L	75.3	106	90.7	21.7	2	0%
Hexa	PCB 148	0.518	0.521	pg/L	<0.518	0.65	<0.584	<0.093	2	50%
Hexa	PCB 150	0.518	0.521	pg/L	<0.518	<0.521	<0.520	<0.002	2	100%
Hexa	PCB 152	0.518	0.521	pg/L	<0.518	<0.521	<0.520	<0.002	2	100%
Hexa	PCB 153/168	0.628	0.949	pg/L	87.1	122	104.6	24.7	2	0%
Hexa	PCB 155	0.518	0.521	pg/L	2.68	3.85	3.27	0.83	2	0%
Hexa	PCB 156/157	0.731	1.07	pg/L	14.8	21.2	18	4.5	2	0%
Hexa	PCB 158	0.538	0.81	pg/L	11.10	15.40	13.30	3.00	2	0%
Hexa	PCB 159	0.61	0.87	pg/L	<0.61	1.26	<0.94	<0.46	2	50%
Hexa	PCB 161	0.59	0.878	pg/L	<0.59	<0.878	<0.734	<0.204	2	100%
Hexa	PCB 162	0.601	0.897	pg/L	0.741	<0.897	<0.819	<0.110	2	50%
Hexa	PCB 164	0.653	0.877	pg/L	7.18	11.9	9.54	3.34	2	0%
Hexa	PCB 165	0.689	1.01	pg/L	<0.689	<1.01	<0.850	<0.227	2	100%
Hexa	PCB 167	0.585	0.926	pg/L	5.79	6.94	6.37	0.81	2	0%
Hexa	PCB 169	0.629	0.991	pg/L	<0.629	<0.991	<0.810	<0.256	2	100%
Hepta	PCB 170	0.521	0.619	pg/L	30.60	39.70	35.20	6.40	2	0%
Hepta	PCB 171/173	0.521	0.582	pg/L	7.86	14.20	11.03	4.48	2	0%
Hepta	PCB 172	0.521	0.583	pg/L	5.31	8.90	7.11	2.54	2	0%
Hepta	PCB 174	0.521	0.528	pg/L	26.1	54.3	40.2	19.9	2	0%
Hepta	PCB 175	0.521	0.526	pg/L	1.76	2.41	2.09	0.46	2	0%
Hepta	PCB 176	0.518	0.521	pg/L	2.51	5.79	4.15	2.32	2	0%
Hepta	PCB 177	0.521	0.578	pg/L	17	26.7	21.9	6.9	2	0%

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3 Percent of samples with result less than detection limit

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]					
					Combined Fractions [2]					
					Grab					
					Range		Mean	Stdev	N	%ND [3]
Polychlorinated biphenyls (PCBs)										
Hepta	PCB 183/185	0.521	0.524	pg/L	17.3	35.4	26.4	12.8	2	0%
Hepta	PCB 184	0.518	0.521	pg/L	3.93	8.23	6.08	3.04	2	0%
Hepta	PCB 186	0.518	0.521	pg/L	<0.518	<0.521	<0.520	<0.002	2	100%
Hepta	PCB 187	0.518	0.521	pg/L	31.7	64.9	48.3	23.5	2	0%
Hepta	PCB 188	0.518	0.521	pg/L	<0.518	<0.521	<0.520	<0.002	2	100%
Hepta	PCB 189	0.518	0.521	pg/L	0.962	1.35	1.156	0.274	2	0%
Hepta	PCB 190	0.518	0.521	pg/L	5.77	9.76	7.77	2.82	2	0%
Hepta	PCB 191	0.518	0.521	pg/L	<0.518	2.69	<1.604	<1.536	2	50%
Hepta	PCB 192	0.518	0.521	pg/L	<0.518	<0.521	<0.520	<0.002	2	100%
Octa	PCB 194	0.521	0.61	pg/L	20.1	20.5	20.3	0.3	2	0%
Octa	PCB 195	0.521	0.666	pg/L	6.01	8.22	7.12	1.56	2	0%
Octa	PCB 196	0.521	0.529	pg/L	6.08	12	9.04	4.19	2	0%
Octa	PCB 197/200	0.518	0.521	pg/L	2.10	3.43	2.77	0.94	2	0%
Octa	PCB 198/199	0.521	0.558	pg/L	17.20	33.60	25.40	11.60	2	0%
Octa	PCB 201	0.518	0.521	pg/L	0.68	3.80	2.24	2.20	2	0%
Octa	PCB 202	0.521	0.569	pg/L	4.28	5.86	5.07	1.12	2	0%
Octa	PCB 203	0.518	0.521	pg/L	8.4	18.9	13.7	7.4	2	0%
Octa	PCB 204	0.518	0.521	pg/L	<0.518	<0.521	<0.520	<0.002	2	100%
Octa	PCB 205	0.518	0.521	pg/L	0.77	1.21	0.99	0.31	2	0%
Nona	PCB 206	0.89	3.5	pg/L	8.88	11.3	10.09	1.71	2	0%
Nona	PCB 207	0.67	2.43	pg/L	<2.43	4.68	<3.56	<1.59	2	50%
Nona	PCB 208	0.633	2.56	pg/L	<2.56	3.46	<3.01	<0.64	2	50%
Deca	PCB 209	0.521	0.694	pg/L	5.54	6.21	5.88	0.47	2	0%

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Analyte	Detection Limit	Units	Descriptive Statistics [1]					
			Grab					
			Range		Mean	Stdev	N	%ND [2]
Pharmaceuticals								
Acetaminophen	3	ng/L	16200	16200	16200	**	1	0%
Bisphenol A	5	ng/L	120	120	120	**	1	0%
Caffeine	100	ng/L	17000	17000	17000	**	1	0%
Clopidogrel	5	ng/L	272	272	272	**	1	0%
Diclofenac	1	ng/L	343	343	343	**	1	0%
Fluoxetine	20	ng/L	<20.0	<20.0	<20.0	**	1	100%
Gemfibrozil	2	ng/L	4	4	4	**	1	0%
Ibuprofen	5	ng/L	1730	1730	1730	**	1	0%
Naproxen	5	ng/L	1540	1540	1540	**	1	0%
Primidone	2	ng/L	2.2	2.2	2.2	**	1	0%
Sulfamethoxazole	1	ng/L	67.5	67.5	67.5	**	1	0%
Triclosan	20	ng/L	<20.0	<20.0	<20.0	**	1	100%
Trimethoprim	1	ng/L	42.9	42.9	42.9	**	1	0%

** Not applicable

< Results reported less than detection limit

1 Range, mean, standard deviation, and number of samples (N) are provided. When results are less than the detection limit, the detection limit was used to calculate each statistical value

2 Percent of samples with result less than detection limit

Analyte	Detection Limit	Units	Descriptive Statistics [1]																	
			Grab						Composite						Total [4]					
			Range		Mean	Stdev	N	%ND[3]	Range		Mean	Stdev	N	%ND[3]	Range		Mean	Stdev	N	%ND[3]
Microbiology [2]																				
Ecoli	1800-18000	MPN/100mls	30,000	51,000	39,000	15,000	2	0%	7,000	13,000	10,000	4,000	2	0%	7,000	51,000	19,000	20,000	4	0%
Enterococci	10-100	MPN/100mls	24,000	24,000	24,000	1,000	2	0%	2,800	3,400	3,100	400	2	0%	2,800	24,000	9,000	12,000	4	0%
Fecal Coliform	1800-18000	MPN/100mls	79,000	80,000	79,000	1,000	2	0%	9,000	22,000	14,000	9,000	2	0%	9,000	80,000	34,000	37,000	4	0%
Inorganic Chemistry and Physical																				
Biochemical Oxygen Demand	10	mg/L	10	43	27	23.0	2	0%	<10	<10	<10	<0	1	100%	<10	43	<21	<19	3	33%
Chemical Oxygen Demand	20	mg/L	75	274	175	141	2	0%	31	112	72	57	2	0%	31	274	123	106	4	0%
Conductivity	1	µmho/cm	48	102	75	38	2	0%	100	8090	4095	5650	2	0%	48	8090	2085	4003	4	0%
Hardness as CACO3	0.2	mg/L	36.4	38.6	37.5	1.6	2	0%	34.7	909.0	471.9	618.2	2	0%	34.7	909	254.7	436.2	4	0%
Nitrogen - Ammonia as N	0.2	mg/L	<0.2	0.7	<0.5	<0.4	2	50%	<0.2	<0.2	<0.2	<0.0	2	100%	<0.2	0.7	<0.3	<0.3	4	75%
Nitrogen - Nitrate as N	0.01	mg/L	0.2	0.71	0.46	0.36	2	0%	0.22	0.59	0.41	0.26	2	0%	0.2	0.71	0.43	0.26	4	0%
Nitrogen - Nitrite as N	0.01	mg/L	0.01	0.03	0.02	0.01	2	0%	<0.01	<0.01	<0.01	<0.00	2	50%	<0.01	0.03	<0.02	<0.01	4	25%
pH	0.1	PH	6.5	7	6.8	0.4	2	0%	7.3	7.6	7.5	0.2	2	0%	6.5	7.6	7.1	0.5	4	0%
Total Suspended Solids	2-10	mg/L	68	343	206	194	2	0%	30	46	38	11	2	0%	30	343	122	148	4	0%
Volatile Suspended Solids	2-10	mg/L	33	146	90	80	2	0%	17	20	19	2	2	0%	17	146	54	62	4	0%
Toxicity [5]																				
LC50 Rainbow Trout 96-h	**	%vol/vol	100	100	100	**	1	**	**	**	**	**	**	**	**	**	**	**	**	**
Total Metals																				
Aluminum Total	5	µg/L	1360	8310	4835	4914	2	0%	477	825	651	246	2	0%	477	8310	2743	3729	4	0%
Arsenic Total	0.5	µg/L	3.2	10.5	6.9	5.2	2	0%	1.1	1.6	1.4	0.4	2	0%	1.1	10.5	4.1	4.4	4	0%
Barium Total	0.5	µg/L	22.5	81	51.8	41.4	2	0%	14.5	30.5	22.5	11.3	2	0%	14.5	81	37.1	30.0	4	0%
Boron Total	10	µg/L	11	15	13.00	3	2	0%	11	613	312.00	426	2	0%	11	613	163.00	300	4	0%
Cadmium Total	0.2	µg/L	<0.2	0.4	<0.3	<0.1	2	50%	<0.2	<0.2	<0.2	<0.0	2	100%	<0.2	0.4	<0.3	<0.1	4	75%
Calcium Total	20	µg/L	10000	12900	11450	2051	2	0%	11700	67700	39700	39598	2	0%	10000	67700	25575	28109	4	0%
Chromium Total	0.5	µg/L	3.2	19.4	11.3	11.5	2	0%	1.2	1.6	1.4	0.3	2	0%	1.2	19.4	6.4	8.7	4	0%
Cobalt Total	0.5	µg/L	0.7	3.9	2.30	2.3	2	0%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	3.9	<1.4	<1.7	4	50%
Copper Total	0.5	µg/L	14.3	134	74.2	84.6	2	0%	8.7	8.9	8.8	0.1	2	0%	8.7	134	41.5	61.7	4	0%
Iron Total	5	µg/L	1350	8100	4725	4773	2	0%	501	1050	776	388	2	0%	501	8100	2750	3584	4	0%
Lead Total	0.5	µg/L	4.2	38.3	21.3	24.1	2	0%	1.9	2.3	2.1	0.3	2	0%	1.9	38.3	11.7	17.8	4	0%
Magnesium Total	10	µg/L	1580	2740	2160	820	2	0%	1310	180000	90655	126353	2	0%	1310	180000	46408	89064	4	0%
Manganese Total	0.5	µg/L	48.5	218	133.3	119.9	2	0%	27.5	45.2	36.4	12.5	2	0%	27.5	218	84.8	89.3	4	0%
Mercury Total	0.05	µg/L	<0.05	0.14	<0.10	<0.06	2	50%	<0.05	<0.05	<0.05	<0.00	2	100%	<0.05	0.14	<0.07	<0.05	4	75%
Molybdenum Total	0.5	µg/L	0.6	1.5	1.1	0.6	2	0%	<0.5	2.1	<1.3	<1.1	2	50%	<0.5	2.1	<1.2	<0.8	4	25%
Nickel Total	0.5	µg/L	1.8	10	5.9	5.8	2	0%	0.9	1.9	1.4	0.7	2	0%	0.9	10	3.7	4.3	4	0%
Phosphorus Total	20	µg/L	248	1100	674	602	2	0%	146	277	212	93	2	0%	146	1100	443	442	4	0%
Selenium Total	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	4	100%
Silver Total	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	4	100%
Sodium Total	50	µg/L	3670	5740	4705	1464	2	0%	5490	1480000	742745	1042636	2	0%	3670	1480000	373725	737517	4	0%
Zinc Total	3-20	µg/L	36	266	151	163	2	0%	19	20	20	1	2	0%	19	266	85	121	4	0%
Dissolved Metals																				
Aluminium Dissolved	5	µg/L	33	51	42	13	2	0%	19	34	27	11	2	0%	19	51	34	13	4	0%
Arsenic Dissolved	0.5	µg/L	2.3	4.3	3.3	1.4	2	0%	<0.5	1.3	<0.9	<0.6	2	50%	<0.5	4.3	<2.1	<1.6	4	25%
Barium Dissolved	0.5	µg/L	6	10.2	8.1	3.0	2	0%	9.9	23.9	16.9	9.9	2	0%	6.0	23.9	12.5	7.8	4	0%
Boron Dissolved	10	µg/L	<10	14	<12	<3	2	50%	11	589	300	409	2	0%	<10	589	<156	<289	4	25%
Cadmium Dissolved	0.2	µg/L	<0.2	<0.2	<0.2	<0.0	2	100%	<0.2	<0.2	<0.2	<0.0	2	100%	<0.2	<0.2	<0.2	<0.0	4	100%
Calcium Dissolved	20	µg/L	4300	11300	7800	4950	2	0%	10900	65000	37950	38254	2	0%	4300	65000	22875	28266	4	0%
Chromium Dissolved	0.5	µg/L	1.1	2.1	1.6	0.7	2	0%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	2.1	<1.1	<0.8	4	50%
Cobalt Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	4	100%
Copper Dissolved	0.5	µg/L	3.9	10.7	7.3	4.8	2	0%	1.7	4.4	3.1	1.9	2	0%	1.7	10.7	5.2	3.9	4	0%
Iron Dissolved	5	µg/L	30	112	71	58	2	0%	39	56	48	12	2	0%	30	112	59	37	4	0%
Lead Dissolved	0.5	µg/L	<0.5	0.8	<0.7	<0.2	2	50%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	0.8	<0.6	<0.2	4	75%
Magnesium Dissolved	10-5000	µg/L	426	1180	803	533	2	0%	1200	170000	85600	119360	2	0%	426	170000	43202	84533	4	0%
Manganese Dissolved	0.5	µg/L	7.4	13.7	10.6	4.5	2	0%	11.4	23.7	17.6	8.7	2	0%	7.4	23.7	14.1	6.9	4	0%
Molybdenum Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	1.9	<1.2	<1.0	2	50%	<0.5	1.9	<0.9	<0.7	4	75%
Nickel Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	0.7	<0.6	<0.1	2	50%	<0.5	0.7	<0.6	<0.1	4	50%
Phosphorus Dissolved	20	µg/L	102	104	103	1	2	0%	23	79	51	40	2	0%	23	104	77	38	4	0%
Selenium Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	4	100%
Silver Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	4	100%
Sodium Dissolved	50-30000	µg/L	2640	5610	4125	2100	2	0%	5440	1410000	707720	993174	2	0%	2640	1410000	355923	702720	4	0%
Zinc Dissolved	3	µg/L	12	17	15	4	2	0%	7	11	9	3	2	0%	7	17	12	4	4	0%

** Not applicable

< Results reported less than detection limit

1 Range, mean (geomean for microbiology), standard deviation, and number of samples (N) are provided. When results are less than (greater than for microbiology) the detection limit, the detection limit was used to calculate each statistical value

2 Every sample for microbiology was collected with a duplicate, the result reported is the geomean of duplicates

3 Percent of samples with result less than detection limit

4 Total includes both grab and composite

5 LC50 results represent % survival, results show 0% mortality throughout test

Analyte	Detection Limit	Units	Descriptive Statistics [1] Grab					
			Range		Mean	Stdev	N	%ND [2]
Volatile petroleum hydrocarbons								
1,1,1,2-Tetrachloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,1,1-Trichloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,1,2,2-Tetrachloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,1,2-Trichloro/1,2,2-Trifluoroethane	2.0	µg/L	<2.0	<2.0	<2.0	**	1	100%
1,1,2-Trichloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,1-Dichloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,1-Dichloroethylene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,2,3-Trichlorobenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	1	100%
1,2,4-Trichlorobenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	1	100%
1,2-Dibromoethane	0.20	µg/L	<0.20	<0.20	<0.20	**	1	100%
1,2-Dichlorobenzene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,2-Dichloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,2-Dichloropropane	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,3,5-Trimethylbenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	1	100%
1,3-Butadiene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,3-Dichlorobenzene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,3-Dichloropropane	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
1,4-Dichlorobenzene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
Benzene	0.40	µg/L	<0.40	<0.40	<0.40	**	1	100%
Bromobenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	1	100%
Bromodichloromethane	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
Bromoform	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
Bromomethane	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
Carbon Tetrachloride	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
Chlorobenzene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
Chloroethane	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
Chloroform	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
Chloromethane	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
cis-1,2-Dichloroethylene	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
cis-1,3-Dichloropropylene	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
Dibromochloromethane	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
Dichlorodifluoromethane	2.0	µg/L	<2.0	<2.0	<2.0	**	1	100%
Dichloromethane	2.0	µg/L	<2.0	<2.0	<2.0	**	1	100%
Ethylbenzene	0.40	µg/L	<0.40	<0.40	<0.40	**	1	100%
Hexachlorobutadiene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
Isopropylbenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	1	100%
m- & p-Xylene	0.40	µg/L	<0.40	<0.40	<0.40	**	1	100%
Methyl t-butyl ether (MTBE)	4.0	µg/L	<4.0	<4.0	<4.0	**	1	100%
o-Xylene	0.40	µg/L	<0.40	<0.40	<0.40	**	1	100%
Styrene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
Tetrachloroethylene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
Toluene	0.40	µg/L	<0.40	<0.40	<0.40	**	1	100%
trans-1,2-Dichloroethylene	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
trans-1,3-Dichloropropylene	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
Trichloroethylene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
Trichlorofluoromethane	4.0	µg/L	<4.0	<4.0	<4.0	**	1	100%
VH (C6-C10) [3]	300	µg/L	<300	<300	<300	**	1	100%
Vinyl Chloride	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
VPH (C6-10) - BTEX [4]	300	µg/L	<300	<300	<300	**	1	100%
Xylenes	0.40	µg/L	<0.40	<0.40	<0.40	**	1	100%

Analyte		Detection Limit	Units	Descriptive Statistics [1] Grab					
				Range		Mean	Stdev	N	%ND [2]
Extractable petroleum hydrocarbons									
LEPH (C10-C19 less PAH) [5]		0.20	mg/L	<0.20	<0.20	<0.20	**	1	100%
HEPH (C19-C32 less PAH) [6]		0.20	mg/L	0.26	0.26	0.26	**	1	0%
EPH (C10-C19)		0.20	mg/L	<0.20	<0.20	<0.20	**	1	100%
EPH (C19-C32)		0.20	mg/L	0.26	0.26	0.26	**	1	0%
Polycyclic aromatic hydrocarbons (PAH)									
Low molecular weight PAHs (LPAH)	2-Methylnaphthalene [7]	0.10	µg/L	<0.10	<0.10	<0.10	**	1	100%
	Phenanthrene	0.020	µg/L	<0.020	<0.020	<0.020	**	1	100%
	Acenaphthene	0.050	µg/L	<0.050	<0.050	<0.050	**	1	100%
	Acenaphthylene	0.050	µg/L	<0.050	<0.050	<0.050	**	1	100%
	Anthracene	0.010	µg/L	<0.010	<0.010	<0.010	**	1	100%
	Acridine [8]	0.050	µg/L	<0.050	<0.050	<0.050	**	1	100%
	Fluorene	0.050	µg/L	<0.050	<0.050	<0.050	**	1	100%
	Naphthalene	0.10	µg/L	<0.10	<0.10	<0.10	**	1	100%
	Quinoline [8]	0.050	µg/L	<0.050	<0.050	<0.050	**	1	100%
	Total LPAHs	0.10	µg/L	<0.10	<0.10	<0.10	**	1	100%
High molecular weight PAHs (HPAH)	Benz[a]anthracene	0.010	µg/L	<0.010	<0.010	<0.010	**	1	100%
	Benzo[a]pyrene	0.0050	µg/L	0.0097	0.0097	0.0097	**	1	0%
	Benzo[b+j]fluoranthene	0.030	µg/L	<0.030	<0.030	<0.030	**	1	100%
	Benzo[g,h,i]perylene	0.050	µg/L	<0.050	<0.050	<0.050	**	1	100%
	Benzo[k]fluoranthene	0.050	µg/L	<0.050	<0.050	<0.050	**	1	100%
	Chrysene	0.020	µg/L	<0.020	<0.020	<0.020	**	1	100%
	Dibenz[a,h]anthracene	0.0030	µg/L	<0.0030	<0.0030	<0.0030	**	1	100%
	Fluoranthene	0.020	µg/L	<0.020	<0.020	<0.020	**	1	100%
	Indeno[1,2,3-c,d]pyrene	0.050	µg/L	<0.050	<0.050	<0.050	**	1	100%
	Pyrene	0.020	µg/L	0.022	0.022	0.022	**	1	0%
	Total HPAHs	0.050	µg/L	<0.050	<0.050	<0.050	**	1	100%
Total PAH = LPAH + HPAH		0.10	µg/L	<0.10	<0.10	<0.10	**	1	100%

** Not applicable
< Results reported less than detection limit
1 Range, mean (geomean for microbiology), standard deviation, and number of samples (N) are provided. When results are less than (greater than for microbiology) the detection limit, the detection limit was used to caculate each statistical value
2 Percent of samples with result less than detection limit
3 Volatile Hydrocarbons containing all petroleum hydrocarbons in the carbon range of C6-C10, including BTEX and Styrene
4 Volatile Petroleum Hydrocarbons containing all pretroleum hydrocarbons in the carbon range of C6-C10 minus BTEX
5 LEPH = Light Extractable Petroleum Hydrocarbons
6 HEPH = Heavy Extractable Petroleum Hydrocarbons
7 Alkylated Low Molecular Weight PAHs
8 N-Heterocycle Low Molecular Weight PAHs

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]					
					Combined Fractions [2]					
					Comp					
					Range		Mean	Stdev	N	%ND [3]
Polybrominated diphenyl ethers (PBDEs)										
Di	PBDE 7	1.7	1.7	pg/L	<1.7	<1.7	<1.7	**	1	100%
Di	PBDE 8/11	1.3	1.3	pg/L	<1.3	<1.3	<1.3	**	1	100%
Di	PBDE 10	1.87	1.87	pg/L	<1.87	<1.87	<1.87	**	1	100%
Di	PBDE 12/13	1.19	1.19	pg/L	<1.19	<1.19	<1.19	**	1	100%
Di	PBDE 15	1.02	1.02	pg/L	<1.02	<1.02	<1.02	**	1	100%
Tri	PBDE 17/25	1.02	1.02	pg/L	3.58	3.58	3.58	**	1	0%
Tri	PBDE 28/33	1.02	1.02	pg/L	9.31	9.31	9.31	**	1	0%
Tri	PBDE 30	1.02	1.02	pg/L	<1.02	<1.02	<1.02	**	1	100%
Tri	PBDE 32	1.02	1.02	pg/L	<1.02	<1.02	<1.02	**	1	100%
Tri	PBDE 35	1.02	1.02	pg/L	<1.02	<1.02	<1.02	**	1	100%
Tri	PBDE 37	1.02	1.02	pg/L	2.37	2.37	2.37	**	1	0%
Tetra	PBDE 47	1.02	1.02	pg/L	266.00	266.00	266.00	**	1	0%
Tetra	PBDE 49	1.02	1.02	pg/L	10.00	10.00	10.00	**	1	0%
Tetra	PBDE 51	1.02	1.02	pg/L	1.16	1.16	1.16	**	1	0%
Tetra	PBDE 66	1.02	1.02	pg/L	7.24	7.24	7.24	**	1	0%
Tetra	PBDE 71	1.02	1.02	pg/L	2.69	2.69	2.69	**	1	0%
Tetra	PBDE 75	1.02	1.02	pg/L	<1.02	<1.02	<1.02	**	1	100%
Tetra	PBDE 77	1.02	1.02	pg/L	<1.02	<1.02	<1.02	**	1	100%
Tetra	PBDE 79	1.02	1.02	pg/L	<1.02	<1.02	<1.02	**	1	100%
Penta	PBDE 85	1.47	1.47	pg/L	9.30	9.30	9.30	**	1	0%
Penta	PBDE 99	1.1	1.1	pg/L	254	254	254	**	1	0%
Penta	PBDE 100	1.02	1.02	pg/L	58.6	58.6	58.6	**	1	0%
Penta	PBDE 105	1.96	1.96	pg/L	<1.96	<1.96	<1.96	**	1	100%
Penta	PBDE 116	2.34	2.34	pg/L	<2.34	<2.34	<2.34	**	1	100%
Penta	PBDE 119/120	1.61	1.61	pg/L	<1.61	<1.61	<1.61	**	1	100%
Penta	PBDE 126	1.02	1.02	pg/L	<1.02	<1.02	<1.02	**	1	100%
Hexa	PBDE 128	5.32	5.32	pg/L	<5.32	<5.32	<5.32	**	1	100%
Hexa	PBDE 138/166	1.47	1.47	pg/L	2.36	2.36	2.36	**	1	0%
Hexa	PBDE 140	1.02	1.02	pg/L	1.66	1.66	1.66	**	1	0%
Hexa	PBDE 153	1.03	1.03	pg/L	23.90	23.90	23.90	**	1	0%
Hexa	PBDE 154	1.1	1.1	pg/L	19.00	19.00	19.00	**	1	0%
Hexa	PBDE 155	1.02	1.02	pg/L	2.26	2.26	2.26	**	1	0%
Hepta	PBDE 181	3.23	3.23	pg/L	<3.23	<3.23	<3.23	**	1	100%
Hepta	PBDE 183	2.23	2.23	pg/L	15.40	15.40	15.40	**	1	0%
Hepta	PBDE 190	5.45	5.45	pg/L	<5.45	<5.45	<5.45	**	1	100%
Octa	PBDE 203	17.5	17.5	pg/L	35.40	35.40	35.40	**	1	0%
Nona	PBDE 206	10.6	10.6	pg/L	443.00	443.00	443.00	**	1	0%
Nona	PBDE 207	15.8	15.8	pg/L	534.00	534.00	534.00	**	1	0%
Nona	PBDE 208	14.5	14.5	pg/L	309.00	309.00	309.00	**	1	0%
Deca	PBDE 209	35.2	35.2	pg/L	7850.0	7850.0	7850.0	**	1	0%

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3 Percent of samples with result less than detection limit

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]					
					Combined Fractions [2]					
					Comp					
					Range		Mean	Stdev	N	%ND [3]
Polychlorinated biphenyls (PCBs)										
Mono	PCB 1	**	**	**	**	**	**	**	**	**
Mono	PCB 2	**	**	**	**	**	**	**	**	**
Mono	PCB 3	**	**	**	**	**	**	**	**	**
Di	PCB 4	**	**	**	**	**	**	**	**	**
Di	PCB 5	1.33	1.33	pg/L	<1.33	<1.33	<1.33	**	1	100%
Di	PCB 6	1.18	1.18	pg/L	<1.18	<1.18	<1.18	**	1	100%
Di	PCB 7	1.19	1.19	pg/L	13.80	13.80	13.80	**	1	0%
Di	PCB 8	1.1	1.1	pg/L	6.01	6.01	6.01	**	1	0%
Di	PCB 9	1.19	1.19	pg/L	<1.19	<1.19	<1.19	**	1	100%
Di	PCB 10	1.24	1.24	pg/L	<1.24	<1.24	<1.24	**	1	100%
Di	PCB 11	1.3	1.3	pg/L	27.5	27.5	27.5	**	1	0%
Di	PCB 12/13	1.3	1.3	pg/L	<1.3	<1.3	<1.3	**	1	100%
Di	PCB 14	1.2	1.2	pg/L	<1.2	<1.2	<1.2	**	1	100%
Di	PCB 15	1.99	1.99	pg/L	5.55	5.55	5.55	**	1	0%
Tri	PCB 16	0.886	0.886	pg/L	5.01	5.01	5.01	**	1	0%
Tri	PCB 17	0.764	0.764	pg/L	4.59	4.59	4.59	**	1	0%
Tri	PCB 18/30	0.624	0.624	pg/L	10.5	10.5	10.5	**	1	0%
Tri	PCB 19	2.06	2.06	pg/L	4.63	4.63	4.63	**	1	0%
Tri	PCB 20/28	0.679	0.679	pg/L	20.4	20.4	20.4	**	1	0%
Tri	PCB 21/33	0.648	0.648	pg/L	8.09	8.09	8.09	**	1	0%
Tri	PCB 22	0.722	0.722	pg/L	7.68	7.68	7.68	**	1	0%
Tri	PCB 23	0.711	0.711	pg/L	<0.711	<0.711	<0.711	**	1	100%
Tri	PCB 24	0.564	0.564	pg/L	<0.564	<0.564	<0.564	**	1	100%
Tri	PCB 25	0.583	0.583	pg/L	1.54	1.54	1.54	**	1	0%
Tri	PCB 26/29	0.674	0.674	pg/L	2.67	2.67	2.67	**	1	0%
Tri	PCB 27	0.545	0.545	pg/L	1.64	1.64	1.64	**	1	0%
Tri	PCB 31	0.64	0.64	pg/L	15	15	15	**	1	0%
Tri	PCB 32	0.671	0.671	pg/L	3.67	3.67	3.67	**	1	0%
Tri	PCB 34	0.701	0.701	pg/L	<0.701	<0.701	<0.701	**	1	100%
Tri	PCB 35	0.711	0.711	pg/L	<0.711	<0.711	<0.711	**	1	100%
Tri	PCB 36	0.659	0.659	pg/L	<0.659	<0.659	<0.659	**	1	100%
Tri	PCB 37	0.685	0.685	pg/L	5.57	5.57	5.57	**	1	0%
Tri	PCB 38	0.678	0.678	pg/L	<0.678	<0.678	<0.678	**	1	100%
Tri	PCB 39	0.645	0.645	pg/L	<0.645	<0.645	<0.645	**	1	100%
Tetra	PCB 40/41/71	0.512	0.512	pg/L	9.84	9.84	9.84	**	1	0%
Tetra	PCB 42	0.529	0.529	pg/L	3.79	3.79	3.79	**	1	0%
Tetra	PCB 43	0.597	0.597	pg/L	<0.597	<0.597	<0.597	**	1	100%
Tetra	PCB 44/47/65	0.512	0.512	pg/L	57.2	57.2	57.2	**	1	0%
Tetra	PCB 45/51	0.527	0.527	pg/L	6.61	6.61	6.61	**	1	0%
Tetra	PCB 46	0.594	0.594	pg/L	1.34	1.34	1.34	**	1	0%
Tetra	PCB 48	0.517	0.517	pg/L	4.93	4.93	4.93	**	1	0%
Tetra	PCB 49/69	0.512	0.512	pg/L	11.3	11.3	11.3	**	1	0%

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3 Percent of samples with result less than detection limit

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]					
					Combined Fractions [2]					
					Comp					
					Range		Mean	Stdev	N	%ND [3]
Polychlorinated biphenyls (PCBs)										
Tetra	PCB 50/53	0.514	0.514	pg/L	2.32	2.32	2.32	**	1	0%
Tetra	PCB 52	0.512	0.512	pg/L	24.6	24.6	24.6	**	1	0%
Tetra	PCB 54	0.775	0.775	pg/L	<0.775	<0.775	<0.775	**	1	100%
Tetra	PCB 55	0.972	0.972	pg/L	<0.972	<0.972	<0.972	**	1	100%
Tetra	PCB 56	0.977	0.977	pg/L	7.19	7.19	7.19	**	1	0%
Tetra	PCB 57	0.918	0.918	pg/L	<0.918	<0.918	<0.918	**	1	100%
Tetra	PCB 58	0.959	0.959	pg/L	<0.959	<0.959	<0.959	**	1	100%
Tetra	PCB 59/62/75	0.512	0.512	pg/L	1.94	1.94	1.94	**	1	0%
Tetra	PCB 60	0.967	0.967	pg/L	4.19	4.19	4.19	**	1	0%
Tetra	PCB 61/70/74/76	0.92	0.92	pg/L	29.70	29.70	29.70	**	1	0%
Tetra	PCB 63	0.886	0.886	pg/L	<0.886	<0.886	<0.886	**	1	100%
Tetra	PCB 64	0.512	0.512	pg/L	9.52	9.52	9.52	**	1	0%
Tetra	PCB 66	0.904	0.904	pg/L	15.40	15.40	15.40	**	1	0%
Tetra	PCB 67	0.806	0.806	pg/L	<0.806	<0.806	<0.806	**	1	100%
Tetra	PCB 68	0.877	0.877	pg/L	2.40	2.40	2.40	**	1	0%
Tetra	PCB 72	0.874	0.874	pg/L	<0.874	<0.874	<0.874	**	1	100%
Tetra	PCB 73	0.512	0.512	pg/L	0.58	0.58	0.58	**	1	0%
Tetra	PCB 77	0.891	0.891	pg/L	2.15	2.15	2.15	**	1	0%
Tetra	PCB 78	0.923	0.923	pg/L	<0.923	<0.923	<0.923	**	1	100%
Tetra	PCB 79	0.777	0.777	pg/L	<0.777	<0.777	<0.777	**	1	100%
Tetra	PCB 80	0.844	0.844	pg/L	<0.844	<0.844	<0.844	**	1	100%
Tetra	PCB 81	0.888	0.888	pg/L	<0.888	<0.888	<0.888	**	1	100%
Penta	PCB 82	0.623	0.623	pg/L	4.39	4.39	4.39	**	1	0%
Penta	PCB 83/99	0.562	0.562	pg/L	17.90	17.90	17.90	**	1	0%
Penta	PCB 84	0.645	0.645	pg/L	6.71	6.71	6.71	**	1	0%
Penta	PCB 85/116/117	0.512	0.512	pg/L	7.17	7.17	7.17	**	1	0%
Penta	PCB 86/87/97/109/119/125	0.512	0.512	pg/L	24.4	24.4	24.4	**	1	0%
Penta	PCB 88/91	0.573	0.573	pg/L	3.82	3.82	3.82	**	1	0%
Penta	PCB 89	0.604	0.604	pg/L	<0.604	<0.604	<0.604	**	1	100%
Penta	PCB 90/101/113	0.512	0.512	pg/L	32.20	32.20	32.20	**	1	0%
Penta	PCB 92	0.562	0.562	pg/L	5.30	5.30	5.30	**	1	0%
Penta	PCB 93/95/98/100/102	0.556	0.556	pg/L	26.7	26.7	26.7	**	1	0%
Penta	PCB 94	0.621	0.621	pg/L	<0.621	<0.621	<0.621	**	1	100%
Penta	PCB 96	0.512	0.512	pg/L	<0.512	<0.512	<0.512	**	1	100%
Penta	PCB 103	0.512	0.512	pg/L	<0.512	<0.512	<0.512	**	1	100%
Penta	PCB 104	0.575	0.575	pg/L	<0.575	<0.575	<0.575	**	1	100%
Penta	PCB 105	0.7	0.7	pg/L	15.50	15.50	15.50	**	1	0%
Penta	PCB 106	0.651	0.651	pg/L	<0.651	<0.651	<0.651	**	1	100%
Penta	PCB 107	0.674	0.674	pg/L	1.46	1.46	1.46	**	1	0%
Penta	PCB 108/124	0.731	0.731	pg/L	1.58	1.58	1.58	**	1	0%
Penta	PCB 110/115	0.512	0.512	pg/L	40.9	40.9	40.9	**	1	0%
Penta	PCB 111	0.512	0.512	pg/L	<0.512	<0.512	<0.512	**	1	100%
Penta	PCB 112	0.512	0.512	pg/L	<0.512	<0.512	<0.512	**	1	100%
Penta	PCB 114	0.744	0.744	pg/L	0.83	0.83	0.83	**	1	0%
Penta	PCB 118	0.746	0.746	pg/L	29.1	29.1	29.1	**	1	0%
Penta	PCB 120	0.512	0.512	pg/L	<0.512	<0.512	<0.512	**	1	100%
Penta	PCB 121	0.512	0.512	pg/L	<0.512	<0.512	<0.512	**	1	100%
Penta	PCB 122	0.78	0.78	pg/L	<0.78	<0.78	<0.78	**	1	100%

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3 Percent of samples with result less than detection limit

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]					
					Combined Fractions [2]					
					Comp					
					Range		Mean	Stdev	N	%ND [3]
Polychlorinated biphenyls (PCBs)										
Hexa	PCB 130	1.1	1.1	pg/L	2.29	2.29	2.29	**	1	0%
Hexa	PCB 131	1.07	1.07	pg/L	<1.07	<1.07	<1.07	**	1	100%
Hexa	PCB 132	1.11	1.11	pg/L	14.80	14.80	14.80	**	1	0%
Hexa	PCB 133	1.04	1.04	pg/L	1.10	1.10	1.10	**	1	0%
Hexa	PCB 134/143	1.05	1.05	pg/L	2.2	2.2	2.2	**	1	0%
Hexa	PCB 135/151/154	0.512	0.512	pg/L	11.6	11.6	11.6	**	1	0%
Hexa	PCB 136	0.512	0.512	pg/L	3.58	3.58	3.58	**	1	0%
Hexa	PCB 137	1.01	1.01	pg/L	3.08	3.08	3.08	**	1	0%
Hexa	PCB 139/140	0.94	0.94	pg/L	<0.94	<0.94	<0.94	**	1	100%
Hexa	PCB 141	0.999	0.999	pg/L	7.60	7.60	7.60	**	1	0%
Hexa	PCB 142	1.09	1.09	pg/L	<1.09	<1.09	<1.09	**	1	100%
Hexa	PCB 144	0.512	0.512	pg/L	1.02	1.02	1.02	**	1	0%
Hexa	PCB 145	0.512	0.512	pg/L	<0.512	<0.512	<0.512	**	1	100%
Hexa	PCB 146	0.927	0.927	pg/L	6.26	6.26	6.26	**	1	0%
Hexa	PCB 147/149	0.933	0.933	pg/L	30.7	30.7	30.7	**	1	0%
Hexa	PCB 148	0.512	0.512	pg/L	<0.512	<0.512	<0.512	**	1	100%
Hexa	PCB 150	0.512	0.512	pg/L	<0.512	<0.512	<0.512	**	1	100%
Hexa	PCB 152	0.512	0.512	pg/L	<0.512	<0.512	<0.512	**	1	100%
Hexa	PCB 153/168	0.785	0.785	pg/L	37	37	37	**	1	0%
Hexa	PCB 155	0.512	0.512	pg/L	<0.512	<0.512	<0.512	**	1	100%
Hexa	PCB 156/157	0.911	0.911	pg/L	6.68	6.68	6.68	**	1	0%
Hexa	PCB 158	0.67	0.67	pg/L	4.17	4.17	4.17	**	1	0%
Hexa	PCB 159	0.72	0.72	pg/L	<0.72	<0.72	<0.72	**	1	100%
Hexa	PCB 161	0.726	0.726	pg/L	<0.726	<0.726	<0.726	**	1	100%
Hexa	PCB 162	0.742	0.742	pg/L	<0.742	<0.742	<0.742	**	1	100%
Hexa	PCB 164	0.725	0.725	pg/L	3.6	3.6	3.6	**	1	0%
Hexa	PCB 165	0.838	0.838	pg/L	<0.838	<0.838	<0.838	**	1	100%
Hexa	PCB 167	0.725	0.725	pg/L	1.91	1.91	1.91	**	1	0%
Hexa	PCB 169	0.766	0.766	pg/L	<0.766	<0.766	<0.766	**	1	100%
Hepta	PCB 170	0.756	0.756	pg/L	15.00	15.00	15.00	**	1	0%
Hepta	PCB 171/173	0.67	0.67	pg/L	3.03	3.03	3.03	**	1	0%
Hepta	PCB 172	0.671	0.671	pg/L	2.03	2.03	2.03	**	1	0%
Hepta	PCB 174	0.609	0.609	pg/L	13.7	13.7	13.7	**	1	0%
Hepta	PCB 175	0.606	0.606	pg/L	<0.606	<0.606	<0.606	**	1	100%
Hepta	PCB 176	0.512	0.512	pg/L	1.92	1.92	1.92	**	1	0%
Hepta	PCB 177	0.666	0.666	pg/L	7.58	7.58	7.58	**	1	0%

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3 Percent of samples with result less than detection limit

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]					
					Combined Fractions [2]					
					Comp					
					Range		Mean	Stdev	N	%ND [3]
Polychlorinated biphenyls (PCBs)										
Hepta	PCB 183/185	0.604	0.604	pg/L	6.83	6.83	6.83	**	1	0%
Hepta	PCB 184	0.512	0.512	pg/L	<0.512	<0.512	<0.512	**	1	100%
Hepta	PCB 186	0.512	0.512	pg/L	<0.512	<0.512	<0.512	**	1	100%
Hepta	PCB 187	0.583	0.583	pg/L	15.1	15.1	15.1	**	1	0%
Hepta	PCB 188	0.523	0.523	pg/L	<0.523	<0.523	<0.523	**	1	100%
Hepta	PCB 189	0.512	0.512	pg/L	0.544	0.544	0.544	**	1	0%
Hepta	PCB 190	0.512	0.512	pg/L	3.34	3.34	3.34	**	1	0%
Hepta	PCB 191	0.512	0.512	pg/L	0.58	0.58	0.58	**	1	0%
Hepta	PCB 192	0.537	0.537	pg/L	<0.537	<0.537	<0.537	**	1	100%
Octa	PCB 194	0.512	0.512	pg/L	10.6	10.6	10.6	**	1	0%
Octa	PCB 195	0.559	0.559	pg/L	3.06	3.06	3.06	**	1	0%
Octa	PCB 196	0.699	0.699	pg/L	3.09	3.09	3.09	**	1	0%
Octa	PCB 197/200	0.514	0.514	pg/L	0.81	0.81	0.81	**	1	0%
Octa	PCB 198/199	0.738	0.738	pg/L	8.76	8.76	8.76	**	1	0%
Octa	PCB 201	0.512	0.512	pg/L	0.90	0.90	0.90	**	1	0%
Octa	PCB 202	0.827	0.827	pg/L	<0.827	<0.827	<0.827	**	1	100%
Octa	PCB 203	0.674	0.674	pg/L	5.4	5.4	5.4	**	1	0%
Octa	PCB 204	0.518	0.518	pg/L	<0.518	<0.518	<0.518	**	1	100%
Octa	PCB 205	0.512	0.512	pg/L	<0.512	<0.512	<0.512	**	1	100%
Nona	PCB 206	4.3	4.3	pg/L	5.69	5.69	5.69	**	1	0%
Nona	PCB 207	2.88	2.88	pg/L	<2.88	<2.88	<2.88	**	1	100%
Nona	PCB 208	2.96	2.96	pg/L	<2.96	<2.96	<2.96	**	1	100%
Deca	PCB 209	0.78	0.78	pg/L	4.84	4.84	4.84	**	1	0%

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3 Percent of samples with result less than detection limit

Analyte	Detection Limit	Units	Descriptive Statistics [1]																	
			Grab						Composite						Total [3]					
			Range		Mean	Stdev	N	%ND[2]	Range		Mean	Stdev	N	%ND[2]	Range		Mean	Stdev	N	%ND[2]
Pharmaceuticals																				
Acetaminophen	3	ng/L	1160	1160	1160	**	1	0%	975	975	975	**	1	0%	975	1,160	1,068	131	2	0%
Bisphenol A	5	ng/L	30	30	30	**	1	0%	<5.0	<5.0	<5.0	**	1	100%	<5.0	30	<17.5	<17.7	2	50%
Caffeine	100	ng/L	2260	2260	2260	**	1	0%	625	625	625	**	1	0%	625	2,260	1,443	1,156	2	0%
Clopidogrel	5	ng/L	<5.0	<5.0	<5.0	**	1	100%	<5.0	<5.0	<5.0	**	1	100%	<5.0	<5.0	<5.0	<0.0	2	100%
Diclofenac	1	ng/L	28.7	28.7	28.7	**	1	0%	11.3	11.3	11.3	**	1	0%	11.3	28.7	20	12.3	2	0%
Fluoxetine	20	ng/L	<20.0	<20.0	<20.0	**	1	100%	<20.0	<20.0	<20.0	**	1	100%	<20.0	<20.0	<20.0	<0.0	2	100%
Gemfibrozil	2	ng/L	3.7	3.7	3.7	**	1	0%	<2.0	<2.0	<2.0	**	1	100%	<2.0	3.7	<2.9	<1.2	2	50%
Ibuprofen	5	ng/L	56.5	56.5	56.5	**	1	0%	37.7	37.7	37.7	**	1	0%	37.7	56.5	47.1	13.3	2	0%
Naproxen	5	ng/L	45.8	45.8	45.8	**	1	0%	25.9	25.9	25.9	**	1	0%	25.9	45.8	35.9	14.1	2	0%
Primidone	2	ng/L	<2.0	<2.0	<2.0	**	1	100%	<2.0	<2.0	<2.0	**	1	100%	<2.0	<2.0	<2.0	<0.0	2	100%
Sulfamethoxazole	1	ng/L	1.7	1.7	1.7	**	1	0%	1.2	1.2	1.2	**	1	0%	1.2	1.7	1.5	0.4	2	0%
Triclosan	20	ng/L	<20.0	<20.0	<20.0	**	1	100%	24.3	24.3	24.3	**	1	0%	<20.0	24.3	<22.2	<3.0	2	50%
Trimethoprim	1	ng/L	1.4	1.4	1.4	**	1	0%	1.1	1.1	1.1	**	1	0%	1.1	1.4	1.3	0.2	2	0%
Organic Compounds																				
6PPD-Quinone	0.002	µg/L	0.0342	0.0342	0.0342	**	1	0%	**	**	**	**	**	**	**	**	**	**	**	**

** Not applicable

< Results reported less than detection limit

1 Range, mean, standard deviation, and number of samples (N) are provided. When results are less than the detection limit, the detection limit was used to calculate each statistical value

2 Percent of samples with result less than detection limit

3 Total includes both grab and composite

MANITOBA CSO QUALITY MONITORING, 2021 – MICROBIOLOGY, GENERAL CHEMISTRY, METALS & TOXICITY

Analyte	Detection Limit	Units	Descriptive Statistics [1]																	
			Grab						Composite						Total [4]					
			Range		Mean	Stdev	N	%ND[3]	Range		Mean	Stdev	N	%ND[3]	Range		Mean	Stdev	N	%ND[3]
Microbiology [2]																				
Ecoli	1800-18000	MPN/100mls	402,000	402,000	402,000	**	1	0%	207,000	207,000	207,000	**	1	0%	207,000	402,000	289,000	138,000	2	0%
Enterococci	10-100	MPN/100mls	355,000	355,000	355,000	**	1	0%	73,000	73,000	73,000	**	1	0%	73,000	355,000	161,000	199,000	2	0%
Fecal Coliform	1800-18000	MPN/100mls	402,000	402,000	402,000	**	1	0%	336,000	336,000	336,000	**	1	0%	336,000	402,000	367,000	47,000	2	0%
Inorganic Chemistry and Physical																				
Biochemical Oxygen Demand	10	mg/L	<10	<10	<10	**	1	100%	24	24	24	**	1	0%	<10	24	<17	<10	2	50%
Chemical Oxygen Demand	20	mg/L	43	43	43	**	1	0%	115	115	115	**	1	0%	43	115	79	51	2	0%
Conductivity	1	µmho/cm	135	135	135	**	1	0%	65	65	65	**	1	0%	65	135	100	49	2	0%
Hardness as CACO3	0.2	mg/L	42.5	42.5	42.5	**	1	0%	31.0	31.0	31.0	**	1	0%	31	42.5	36.8	8.1	2	0%
Nitrogen - Ammonia as N	0.2	mg/L	0.3	0.3	0.30	**	1	0%	0.6	0.6	0.60	**	1	0%	0.3	0.6	0.50	0.2	2	0%
Nitrogen - Nitrate as N	0.01	mg/L	1.01	1.01	1.01	**	1	0%	0.31	0.31	0.31	**	1	0%	0.31	1.01	0.66	0.49	2	0%
Nitrogen - Nitrite as N	0.01	mg/L	0.01	0.01	0.01	**	1	0%	0.01	0.01	0.01	**	1	0%	0.01	0.01	0.01	0.00	2	0%
pH	0.1	PH	7.0	7	7.0	**	1	0%	7.3	7.3	7.3	**	1	0%	7	7.3	7.2	0.2	2	0%
Total Suspended Solids	2-7	mg/L	16	16	16	**	1	0%	191	191	191	**	1	0%	16	191	104	124	2	0%
Volatile Suspended Solids	2-7	mg/L	9	9	9	**	1	0%	80	80	80	**	1	0%	9	80	45	50	2	0%
Toxicity [5]																				
LC50 Rainbow Trout 96-h	**	%vol/vol	100	100	100	**	1	**	**	**	**	**	**	**	**	**	**	**	**	**
Total Metals																				
Aluminum Total	5	µg/L	503	503	503	**	1	0%	4480	4480	4480	**	1	0%	503	4480	2492	2812	2	0%
Arsenic Total	0.5	µg/L	1.3	1.3	1.3	**	1	0%	4.7	4.7	4.7	**	1	0%	1.3	4.7	3.0	2.4	2	0%
Barium Total	0.5	µg/L	17.2	17.2	17.2	**	1	0%	50.6	50.6	50.6	**	1	0%	17.2	50.6	33.9	23.6	2	0%
Boron Total	10	µg/L	16	16	16.00	**	1	0%	14	14	14.00	**	1	0%	14	16	15.00	1	2	0%
Cadmium Total	0.2	µg/L	<0.2	<0.2	<0.2	**	1	100%	0.3	0.3	0.30	**	1	0%	<0.2	0.3	<0.3	<0.1	2	50%
Calcium Total	20-200	µg/L	14100	14100	14100	**	1	0%	9570	9570	9570	**	1	0%	9570	14100	11835	3203	2	0%
Chromium Total	0.5	µg/L	1.1	1.1	1.1	**	1	0%	10.9	10.9	10.9	**	1	0%	1.1	10.9	6.0	6.9	2	0%
Cobalt Total	0.5	µg/L	<0.5	<0.5	<0.5	**	1	100%	2	2	2.00	**	1	0%	<0.5	2	<1.3	<1.1	2	50%
Copper Total	0.5	µg/L	7.6	7.6	7.6	**	1	0%	56.4	56.4	56.4	**	1	0%	7.6	56.4	32.0	34.5	2	0%
Iron Total	5	µg/L	470	470	470	**	1	0%	4200	4200	4200	**	1	0%	470	4200	2335	2638	2	0%
Lead Total	0.5	µg/L	2.4	2.4	2.4	**	1	0%	17	17	17.0	**	1	0%	2.4	17.0	9.7	10.3	2	0%
Magnesium Total	10	µg/L	1790	1790	1790	**	1	0%	1730	1730	1730	**	1	0%	1730	1790	1760	42	2	0%
Manganese Total	0.5	µg/L	32.9	32.9	32.9	**	1	0%	113	113	113.0	**	1	0%	32.9	113	73.0	56.6	2	0%
Mercury Total	0.05	µg/L	<0.05	<0.05	<0.05	**	1	100%	0.06	0.06	0.06	**	1	0%	<0.05	0.06	<0.06	<0.01	2	50%
Molybdenum Total	0.5	µg/L	0.8	0.8	0.8	**	1	0%	1.2	1.2	1.20	**	1	0%	0.8	1.2	1.00	0.3	2	0%
Nickel Total	0.5	µg/L	1.4	1.4	1.4	**	1	0%	5	5	5.0	**	1	0%	1.4	5	3.2	2.5	2	0%
Phosphorus Total	20	µg/L	233	233	233	**	1	0%	799	799	799	**	1	0%	233	799	516	400	2	0%
Selenium Total	0.5	µg/L	<0.5	<0.5	<0.5	**	1	100%	<0.5	<0.5	<0.5	**	1	100%	<0.5	<0.5	<0.5	<0.0	2	100%
Silver Total	0.5	µg/L	<0.5	<0.5	<0.5	**	1	100%	<0.5	<0.5	<0.5	**	1	100%	<0.5	<0.5	<0.5	<0.0	2	100%
Sodium Total	50	µg/L	7860	7860	7860	**	1	0%	4400	4400	4400	**	1	0%	4400	7860	6130	2447	2	0%
Zinc Total	3-30	µg/L	28	28	28	**	1	0%	155	155	155	**	1	0%	28	155	92	90	2	0%
Dissolved Metals																				
Aluminium Dissolved	5	µg/L	69	69	69	**	1	0%	54	54	54	**	1	0%	54	69	62	11	2	0%
Arsenic Dissolved	0.5	µg/L	1.1	1.1	1.1	**	1	0%	2.6	2.6	2.6	**	1	0%	1.1	2.6	1.9	1.1	2	0%
Barium Dissolved	0.5	µg/L	14	14	14.0	**	1	0%	6.8	6.8	6.8	**	1	0%	6.8	14	10.4	5.1	2	0%
Boron Dissolved	10	µg/L	17	17	17	**	1	0%	10	10	10	**	1	0%	10	17	14	5	2	0%
Cadmium Dissolved	0.2	µg/L	<0.2	<0.2	<0.2	**	1	100%	<0.2	<0.2	<0.2	**	1	100%	<0.2	<0.2	<0.2	<0.0	2	100%
Calcium Dissolved	20-200	µg/L	13800	13800	13800	**	1	0%	6150	6150	6150	**	1	0%	6150	13800	9975	5409	2	0%
Chromium Dissolved	0.5	µg/L	0.6	0.6	0.6	**	1	0%	2.2	2.2	2.2	**	1	0%	0.6	2.2	1.4	1.1	2	0%
Cobalt Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	**	1	100%	<0.5	<0.5	<0.5	**	1	100%	<0.5	<0.5	<0.5	<0.0	2	100%
Copper Dissolved	0.5	µg/L	4.6	4.6	4.6	**	1	0%	7.9	7.9	7.9	**	1	0%	4.6	7.9	6.3	2.3	2	0%
Iron Dissolved	5	µg/L	64	64	64	**	1	0%	64	64	64	**	1	0%	64	64	64	0	2	0%
Lead Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	**	1	100%	<0.5	<0.5	<0.5	**	1	100%	<0.5	<0.5	<0.5	<0.0	2	100%
Magnesium Dissolved	10	µg/L	1660	1660	1660	**	1	0%	520	520	520	**	1	0%	520	1660	1090	806	2	0%
Manganese Dissolved	0.5	µg/L	18.5	18.5	18.5	**	1	0%	11.6	11.6	11.6	**	1	0%	11.6	18.5	15.1	4.9	2	0%
Molybdenum Dissolved	0.5	µg/L	0.6	0.6	0.60	**	1	0%	<0.5	<0.5	<0.5	**	1	100%	<0.5	0.6	<0.6	<0.1	2	50%
Nickel Dissolved	0.5	µg/L	1	1	1.00	**	1	0%	<0.5	<0.5	<0.5	**	1	100%	<0.5	1	<0.8	<0.4	2	50%
Phosphorus Dissolved	20	µg/L	137	137	137	**	1	0%	175	175	175	**	1	0%	137	175	156	27	2	0%
Selenium Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	**	1	100%	<0.5	<0.5	<0.5	**	1	100%	<0.5	<0.5	<0.5	<0.0	2	100%
Silver Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	**	1	100%	<0.5	<0.5	<0.5	**	1	100%	<0.5	<0.5	<0.5	<0.0	2	100%
Sodium Dissolved	50	µg/L	7740	7740	7740	**	1	0%	3640	3640	3640	**	1	0%	3640	7740	5690	2899	2	0%
Zinc Dissolved	3	µg/L	11	11	11	**	1	0%	15	15	15	**	1	0%	11	15	13	3	2	0%

** Not applicable

< Results reported less than detection limit

1 Range, mean (geomean for microbiology), standard deviation, and number of samples (N) are provided. When results are less than (greater than for microbiology) the detection limit, the detection limit was used to calculate each statistical value

2 Every sample for microbiology was collected with a duplicate, the result reported is the geomean of duplicates

3 Percent of samples with result less than detection limit

4 Total includes both grab and composite

5 LC50 results represent % survival, results show 0% mortality throughout test

Analyte	Detection Limit	Units	Descriptive Statistics [1]					
			Grab					
			Range		Mean	Stdev	N	%ND [2]
Volatile petroleum hydrocarbons								
1,1,1,2-Tetrachloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,1,1-Trichloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,1,2,2-Tetrachloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,1,2-Trichloro/1,2,2-Trifluoroethane	2.0	µg/L	<2.0	<2.0	<2.0	**	1	100%
1,1,2-Trichloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,1-Dichloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,1-Dichloroethylene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,2,3-Trichlorobenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	1	100%
1,2,4-Trichlorobenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	1	100%
1,2-Dibromoethane	0.20	µg/L	<0.20	<0.20	<0.20	**	1	100%
1,2-Dichlorobenzene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,2-Dichloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,2-Dichloropropane	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,3,5-Trimethylbenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	1	100%
1,3-Butadiene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,3-Dichlorobenzene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
1,3-Dichloropropane	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
1,4-Dichlorobenzene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
Benzene	0.40	µg/L	<0.40	<0.40	<0.40	**	1	100%
Bromobenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	1	100%
Bromodichloromethane	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
Bromoform	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
Bromomethane	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
Carbon Tetrachloride	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
Chlorobenzene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
Chloroethane	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
Chloroform	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
Chloromethane	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
cis-1,2-Dichloroethylene	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
cis-1,3-Dichloropropylene	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
Dibromochloromethane	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
Dichlorodifluoromethane	2.0	µg/L	<2.0	<2.0	<2.0	**	1	100%
Dichloromethane	2.0	µg/L	<2.0	<2.0	<2.0	**	1	100%
Ethylbenzene	0.40	µg/L	<0.40	<0.40	<0.40	**	1	100%
Hexachlorobutadiene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
Isopropylbenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	1	100%
m- & p-Xylene	0.40	µg/L	<0.40	<0.40	<0.40	**	1	100%
Methyl t-butyl ether (MTBE)	4.0	µg/L	<4.0	<4.0	<4.0	**	1	100%
o-Xylene	0.40	µg/L	<0.40	<0.40	<0.40	**	1	100%
Styrene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
Tetrachloroethylene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
Toluene	0.40	µg/L	<0.40	<0.40	<0.40	**	1	100%
trans-1,2-Dichloroethylene	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
trans-1,3-Dichloropropylene	1.0	µg/L	<1.0	<1.0	<1.0	**	1	100%
Trichloroethylene	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
Trichlorofluoromethane	4.0	µg/L	<4.0	<4.0	<4.0	**	1	100%
VH (C6-C10) [3]	300	µg/L	<300	<300	<300	**	1	100%
Vinyl Chloride	0.50	µg/L	<0.50	<0.50	<0.50	**	1	100%
VPH (C6-10) - BTEX [4]	300	µg/L	<300	<300	<300	**	1	100%
Xylenes	0.40	µg/L	<0.40	<0.40	<0.40	**	1	100%

Analyte		Detection Limit	Units	Descriptive Statistics [1]					
				Grab					
				Range		Mean	Stdev	N	%ND [2]
Extractable petroleum hydrocarbons									
LEPH (C10-C19 less PAH) [5]		0.20	mg/L	<0.20	<0.20	<0.20	**	1	100%
HEPH (C19-C32 less PAH) [6]		0.20	mg/L	<0.20	<0.20	<0.20	**	1	100%
EPH (C10-C19)		0.20	mg/L	<0.20	<0.20	<0.20	**	1	100%
EPH (C19-C32)		0.20	mg/L	<0.20	<0.20	<0.20	**	1	100%
Polycyclic aromatic hydrocarbons (PAH)									
Low molecular weight PAHs (LPAH)	2-Methylnaphthalene [7]	0.10	µg/L	<0.10	<0.10	<0.10	**	1	100%
	Phenanthrene	0.020	µg/L	<0.020	<0.020	<0.020	**	1	100%
	Acenaphthene	0.050	µg/L	<0.050	<0.050	<0.050	**	1	100%
	Acenaphthylene	0.050	µg/L	<0.050	<0.050	<0.050	**	1	100%
	Anthracene	0.010	µg/L	<0.010	<0.010	<0.010	**	1	100%
	Acridine [8]	0.050	µg/L	<0.050	<0.050	<0.050	**	1	100%
	Fluorene	0.050	µg/L	<0.050	<0.050	<0.050	**	1	100%
	Naphthalene	0.10	µg/L	<0.10	<0.10	<0.10	**	1	100%
	Quinoline [8]	0.050	µg/L	<0.050	<0.050	<0.050	**	1	100%
	Total LPAHs	0.10	µg/L	<0.10	<0.10	<0.10	**	1	100%
High molecular weight PAHs (HPAH)	Benz[a]anthracene	0.010	µg/L	<0.010	<0.010	<0.010	**	1	100%
	Benzo[a]pyrene	0.0050	µg/L	<0.0050	<0.0050	<0.0050	**	1	100%
	Benzo[b+j]fluoranthene	0.030	µg/L	<0.030	<0.030	<0.030	**	1	100%
	Benzo[g,h,i]perylene	0.050	µg/L	<0.050	<0.050	<0.050	**	1	100%
	Benzo[k]fluoranthene	0.050	µg/L	<0.050	<0.050	<0.050	**	1	100%
	Chrysene	0.020	µg/L	<0.020	<0.020	<0.020	**	1	100%
	Dibenz[a,h]anthracene	0.0030	µg/L	<0.0030	<0.0030	<0.0030	**	1	100%
	Fluoranthene	0.020	µg/L	<0.020	<0.020	<0.020	**	1	100%
	Indeno[1,2,3-c,d]pyrene	0.050	µg/L	<0.050	<0.050	<0.050	**	1	100%
	Pyrene	0.020	µg/L	<0.020	<0.020	<0.020	**	1	100%
	Total HPAHs	0.050	µg/L	<0.050	<0.050	<0.050	**	1	100%
Total PAH = LPAH + HPAH		0.10	µg/L	<0.10	<0.10	<0.10	**	1	100%

** Not applicable
< Results reported less than detection limit
1 Range, mean (geomean for microbiology), standard deviation, and number of samples (N) are provided. When results are less than (greater than for microbiology) the detection limit, the detection limit was used to caculate each statistical value
2 Percent of samples with result less than detection limit
3 Volatile Hydrocarbons containing all petroleum hydrocarbons in the carbon range of C6-C10, including BTEX and Styrene
4 Volatile Petroleum Hydrocarbons containing all pretroleum hydrocarbons in the carbon range of C6-C10 minus BTEX
5 LEPH = Light Extractable Petroleum Hydrocarbons
6 HEPH = Heavy Extractable Petroleum Hydrocarbons
7 Alkylated Low Molecular Weight PAHs
8 N-Heterocycle Low Molecular Weight PAHs

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1] Combined Fractions [2] Comp					
					Range		Mean	Stdev	N	%ND [3]
Polybrominated diphenyl ethers (PBDEs)										
Di	PBDE 7	1.03	1.03	pg/L	1.15	1.15	1.15	**	1	0%
Di	PBDE 8/11	1.03	1.03	pg/L	1.27	1.27	1.27	**	1	0%
Di	PBDE 10	1.03	1.03	pg/L	<1.03	<1.03	<1.03	**	1	100%
Di	PBDE 12/13	1.03	1.03	pg/L	1.54	1.54	1.54	**	1	0%
Di	PBDE 15	1.03	1.03	pg/L	4.33	4.33	4.33	**	1	0%
Tri	PBDE 17/25	1.03	1.03	pg/L	28.50	28.50	28.50	**	1	0%
Tri	PBDE 28/33	1.03	1.03	pg/L	63.20	63.20	63.20	**	1	0%
Tri	PBDE 30	1.03	1.03	pg/L	<1.03	<1.03	<1.03	**	1	100%
Tri	PBDE 32	1.03	1.03	pg/L	<1.03	<1.03	<1.03	**	1	100%
Tri	PBDE 35	1.03	1.03	pg/L	3.2	3.2	3.2	**	1	0%
Tri	PBDE 37	1.03	1.03	pg/L	6.4	6.4	6.4	**	1	0%
Tetra	PBDE 47	1.6	1.6	pg/L	2410.00	2410.00	2410.00	**	1	0%
Tetra	PBDE 49	2.42	2.42	pg/L	118.00	118.00	118.00	**	1	0%
Tetra	PBDE 51	1.78	1.78	pg/L	11.4	11.40	11.4	**	1	0%
Tetra	PBDE 66	2.98	2.98	pg/L	140	140	140	**	1	0%
Tetra	PBDE 71	2.31	2.31	pg/L	17.9	17.9	17.9	**	1	0%
Tetra	PBDE 75	1.82	1.82	pg/L	2.69	2.69	2.69	**	1	0%
Tetra	PBDE 77	1.57	1.57	pg/L	<1.57	<1.57	<1.57	**	1	100%
Tetra	PBDE 79	1.84	1.84	pg/L	5.06	5.06	5.06	**	1	0%
Penta	PBDE 85	13.9	13.9	pg/L	175.00	175.00	175.00	**	1	0%
Penta	PBDE 99	10.6	10.6	pg/L	3240	3240	3240	**	1	0%
Penta	PBDE 100	7.34	7.34	pg/L	625	625	625	**	1	0%
Penta	PBDE 105	17.2	17.2	pg/L	<17.2	<17.2	<17.2	**	1	100%
Penta	PBDE 116	23	23	pg/L	76.1	76.1	76.1	**	1	0%
Penta	PBDE 119/120	15.9	15.9	pg/L	26.50	26.50	26.50	**	1	0%
Penta	PBDE 126	8.69	8.69	pg/L	<8.69	<8.69	<8.69	**	1	100%
Hexa	PBDE 128	37.8	37.8	pg/L	<37.8	<37.8	<37.8	**	1	100%
Hexa	PBDE 138/166	7.26	7.26	pg/L	55	55.00	55	**	1	0%
Hexa	PBDE 140	5.93	5.93	pg/L	24.5	24.5	24.5	**	1	0%
Hexa	PBDE 153	5.96	5.96	pg/L	415.00	415.00	415.00	**	1	0%
Hexa	PBDE 154	6.96	6.96	pg/L	243.00	243.00	243.00	**	1	0%
Hexa	PBDE 155	4.34	4.34	pg/L	18.70	18.70	18.70	**	1	0%
Hepta	PBDE 181	32.8	32.8	pg/L	34.3	34.3	34.3	**	1	0%
Hepta	PBDE 183	21.7	21.7	pg/L	320.00	320.00	320.00	**	1	0%
Hepta	PBDE 190	56.5	56.5	pg/L	62.6	62.6	62.6	**	1	0%
Octa	PBDE 203	108	108	pg/L	1020.00	1020.00	1020.00	**	1	0%
Nona	PBDE 206	33.6	33.6	pg/L	2340.00	2340.00	2340.00	**	1	0%
Nona	PBDE 207	55.3	55.3	pg/L	4540.00	4540.00	4540.00	**	1	0%
Nona	PBDE 208	58.6	58.6	pg/L	4510.00	4510.00	4510.00	**	1	0%
Deca	PBDE 209	138	138	pg/L	36900.0	36900.0	36900.0	**	1	0%

< Results reported less than detection limit

1 Range, mean, standard deviation, and number of samples (N) are provided. When results are less than the detection limit, the detection limit was used to calculate each statistical value

2 Solid and aqueous fractions of the samples were analyzed separately, results are presented as a total of both solid and aqueous fractions

3 Percent of samples with result less than detection limit

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]					
					Combined Fractions [2]					
					Comp					
					Range		Mean	Stdev	N	%ND [3]
Polychlorinated biphenyls (PCBs)										
Mono	PCB 1	0.513	0.513	pg/L	11.1	11.1	11.1	**	1	0%
Mono	PCB 2	0.513	0.513	pg/L	9.63	9.63	9.63	**	1	0%
Mono	PCB 3	0.513	0.513	pg/L	14	14	14	**	1	0%
Di	PCB 4	2.49	2.49	pg/L	38.1	38.1	38.1	**	1	0%
Di	PCB 5	1.76	1.76	pg/L	2.32	2.32	2.32	**	1	0%
Di	PCB 6	1.53	1.53	pg/L	21.60	21.60	21.60	**	1	0%
Di	PCB 7	1.56	1.56	pg/L	4.35	4.35	4.35	**	1	0%
Di	PCB 8	1.37	1.37	pg/L	84	84	84	**	1	0%
Di	PCB 9	1.46	1.46	pg/L	5.25	5.25	5.25	**	1	0%
Di	PCB 10	1.49	1.49	pg/L	1.83	1.83	1.83	**	1	0%
Di	PCB 11	1.65	1.65	pg/L	454	454	454	**	1	0%
Di	PCB 12/13	1.6	1.6	pg/L	19.00	19.00	19.00	**	1	0%
Di	PCB 14	1.59	1.59	pg/L	1.74	1.74	1.74	**	1	0%
Di	PCB 15	1.85	1.85	pg/L	72.4	72.40	72.4	**	1	0%
Tri	PCB 16	0.513	0.513	pg/L	63.6	63.6	63.6	**	1	0%
Tri	PCB 17	0.513	0.513	pg/L	59.7	59.7	59.7	**	1	0%
Tri	PCB 18/30	0.513	0.513	pg/L	132	132	132	**	1	0%
Tri	PCB 19	0.513	0.513	pg/L	15.8	15.8	15.8	**	1	0%
Tri	PCB 20/28	0.513	0.513	pg/L	232	232	232	**	1	0%
Tri	PCB 21/33	0.513	0.513	pg/L	134.00	134.00	134.00	**	1	0%
Tri	PCB 22	0.551	0.551	pg/L	96.3	96.3	96.3	**	1	0%
Tri	PCB 23	0.514	0.514	pg/L	<0.514	<0.514	<0.514	**	1	100%
Tri	PCB 24	0.513	0.513	pg/L	1.95	1.95	1.95	**	1	0%
Tri	PCB 25	0.513	0.513	pg/L	17.2	17.2	17.2	**	1	0%
Tri	PCB 26/29	0.513	0.513	pg/L	38.90	38.90	38.90	**	1	0%
Tri	PCB 27	0.513	0.513	pg/L	8.91	8.91	8.91	**	1	0%
Tri	PCB 31	0.513	0.513	pg/L	193	193	193	**	1	0%
Tri	PCB 32	0.513	0.513	pg/L	41.2	41.20	41.2	**	1	0%
Tri	PCB 34	0.513	0.513	pg/L	1.41	1.41	1.41	**	1	0%
Tri	PCB 35	0.591	0.591	pg/L	19.40	19.40	19.40	**	1	0%
Tri	PCB 36	0.513	0.513	pg/L	4.91	4.91	4.91	**	1	0%
Tri	PCB 37	0.583	0.583	pg/L	98.90	98.90	98.90	**	1	0%
Tri	PCB 38	0.513	0.513	pg/L	<0.513	<0.513	<0.513	**	1	100%
Tri	PCB 39	0.515	0.515	pg/L	4.14	4.14	4.14	**	1	0%
Tetra	PCB 40/41/71	0.513	0.513	pg/L	111	111.00	111	**	1	0%
Tetra	PCB 42	0.513	0.513	pg/L	45.5	45.5	45.5	**	1	0%
Tetra	PCB 43	0.513	0.513	pg/L	8.53	8.53	8.53	**	1	0%
Tetra	PCB 44/47/65	0.513	0.513	pg/L	215	215	215	**	1	0%
Tetra	PCB 45/51	0.513	0.513	pg/L	40	40	40	**	1	0%
Tetra	PCB 46	0.513	0.513	pg/L	11.7	11.7	11.7	**	1	0%
Tetra	PCB 48	0.513	0.513	pg/L	40.30	40.30	40.30	**	1	0%
Tetra	PCB 49/69	0.513	0.513	pg/L	105	105	105	**	1	0%

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2 Solid and aqueous fractions of the samples were analyzed separately, results are presented as a total of both solid and aqueous fractions

3 Percent of samples with result less than detection limit

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1] Combined Fractions [2] Comp					
					Range		Mean	Stdev	N	%ND [3]
Polychlorinated biphenyls (PCBs)										
Tetra	PCB 50/53	0.513	0.513	pg/L	25.9	25.9	25.9	**	1	0%
Tetra	PCB 52	0.513	0.513	pg/L	241	241	241	**	1	0%
Tetra	PCB 54	0.513	0.513	pg/L	0.915	0.915	0.915	**	1	0%
Tetra	PCB 55	0.82	0.82	pg/L	5.36	5.36	5.36	**	1	0%
Tetra	PCB 56	0.801	0.801	pg/L	89.90	89.90	89.90	**	1	0%
Tetra	PCB 57	0.719	0.719	pg/L	0.954	0.954	0.954	**	1	0%
Tetra	PCB 58	0.757	0.757	pg/L	<0.757	<0.757	<0.757	**	1	100%
Tetra	PCB 59/62/75	0.513	0.513	pg/L	16.8	16.8	16.8	**	1	0%
Tetra	PCB 60	0.793	0.793	pg/L	51.10	51.10	51.10	**	1	0%
Tetra	PCB 61/70/74/76	0.679	0.679	pg/L	330.00	330.00	330.00	**	1	0%
Tetra	PCB 63	0.745	0.745	pg/L	6.45	6.45	6.45	**	1	0%
Tetra	PCB 64	0.513	0.513	pg/L	86.4	86.4	86.4	**	1	0%
Tetra	PCB 66	0.744	0.744	pg/L	163.00	163.00	163.00	**	1	0%
Tetra	PCB 67	0.651	0.651	pg/L	6.85	6.85	6.85	**	1	0%
Tetra	PCB 68	0.711	0.711	pg/L	7.41	7.41	7.41	**	1	0%
Tetra	PCB 72	0.703	0.703	pg/L	1.36	1.36	1.36	**	1	0%
Tetra	PCB 73	0.513	0.513	pg/L	<0.513	<0.513	<0.513	**	1	100%
Tetra	PCB 77	0.76	0.76	pg/L	41.20	41.20	41.20	**	1	0%
Tetra	PCB 78	0.751	0.751	pg/L	<0.751	<0.751	<0.751	**	1	100%
Tetra	PCB 79	0.6	0.6	pg/L	5.74	5.74	5.74	**	1	0%
Tetra	PCB 80	0.685	0.685	pg/L	<0.685	<0.685	<0.685	**	1	100%
Tetra	PCB 81	0.748	0.748	pg/L	1.75	1.75	1.75	**	1	0%
Penta	PCB 82	1.09	1.09	pg/L	71.00	71.00	71.00	**	1	0%
Penta	PCB 83/99	1.04	1.04	pg/L	275.00	275.00	275.00	**	1	0%
Penta	PCB 84	1.16	1.16	pg/L	131	131	131	**	1	0%
Penta	PCB 85/116/117	0.838	0.838	pg/L	98	98	98	**	1	0%
Penta	PCB 86/87/97/109/119/125	0.849	0.849	pg/L	423	423	423	**	1	0%
Penta	PCB 88/91	0.99	0.99	pg/L	59.2	59.2	59.2	**	1	0%
Penta	PCB 89	1.07	1.07	pg/L	5.03	5.03	5.03	**	1	0%
Penta	PCB 90/101/113	0.844	0.844	pg/L	494.00	494.00	494.00	**	1	0%
Penta	PCB 92	1.04	1.04	pg/L	92.40	92.40	92.40	**	1	0%
Penta	PCB 93/95/98/100/102	0.985	0.985	pg/L	409	409	409	**	1	0%
Penta	PCB 94	1.1	1.1	pg/L	2.22	2.22	2.22	**	1	0%
Penta	PCB 96	0.513	0.513	pg/L	2.83	2.83	2.83	**	1	0%
Penta	PCB 103	0.9	0.9	pg/L	2.67	2.67	2.67	**	1	0%
Penta	PCB 104	0.513	0.513	pg/L	<0.513	<0.513	<0.513	**	1	100%
Penta	PCB 105	1.73	1.73	pg/L	221.00	221.00	221.00	**	1	0%
Penta	PCB 106	1.72	1.72	pg/L	<1.72	<1.72	<1.72	**	1	100%
Penta	PCB 107	1.69	1.69	pg/L	26	26	26	**	1	0%
Penta	PCB 108/124	1.86	1.86	pg/L	16	16	16	**	1	0%
Penta	PCB 110/115	0.734	0.734	pg/L	670	670	670	**	1	0%
Penta	PCB 111	0.725	0.725	pg/L	<0.725	<0.725	<0.725	**	1	100%
Penta	PCB 112	0.702	0.702	pg/L	<0.702	<0.702	<0.702	**	1	100%
Penta	PCB 114	1.74	1.74	pg/L	12.20	12.20	12.20	**	1	0%
Penta	PCB 118	1.8	1.8	pg/L	464	464	464	**	1	0%
Penta	PCB 120	0.679	0.679	pg/L	<0.679	<0.679	<0.679	**	1	100%
Penta	PCB 121	0.789	0.789	pg/L	<0.789	<0.789	<0.789	**	1	100%
Penta	PCB 122	1.92	1.92	pg/L	7.43	7.43	7.43	**	1	0%

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2 Solid and aqueous fractions of the samples were analyzed separately, results are presented as a total of both solid and aqueous fractions

3 Percent of samples with result less than detection limit

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]					
					Combined Fractions [2]					
					Comp					
					Range		Mean	Stdev	N	%ND [3]
Polychlorinated biphenyls (PCBs)										
Penta	PCB 123	2.7	2.7	pg/L	9.48	9.48	9.48	**	1	0%
Penta	PCB 126	1.84	1.84	pg/L	5.23	5.23	5.23	**	1	0%
Penta	PCB 127	1.73	1.73	pg/L	<1.73	<1.73	<1.73	**	1	100%
Hexa	PCB 128/166	1.28	1.28	pg/L	123	123	123	**	1	0%
Hexa	PCB 129/138/160/163	1.33	1.33	pg/L	695	695	695	**	1	0%
Hexa	PCB 130	1.72	1.72	pg/L	46.5	46.5	46.5	**	1	0%
Hexa	PCB 131	1.7	1.7	pg/L	7.46	7.46	7.46	**	1	0%
Hexa	PCB 132	1.81	1.81	pg/L	221.00	221.00	221.00	**	1	0%
Hexa	PCB 133	1.53	1.53	pg/L	7.92	7.92	7.92	**	1	0%
Hexa	PCB 134/143	1.69	1.69	pg/L	26	26	26	**	1	0%
Hexa	PCB 135/151/154	0.513	0.513	pg/L	182	182	182	**	1	0%
Hexa	PCB 136	0.513	0.513	pg/L	70.2	70.2	70.2	**	1	0%
Hexa	PCB 137	1.69	1.69	pg/L	41.7	41.7	41.7	**	1	0%
Hexa	PCB 139/140	1.55	1.55	pg/L	10.40	10.40	10.40	**	1	0%
Hexa	PCB 141	1.44	1.44	pg/L	117.00	117.00	117.00	**	1	0%
Hexa	PCB 142	1.77	1.77	pg/L	<1.77	<1.77	<1.77	**	1	100%
Hexa	PCB 144	0.513	0.513	pg/L	27.4	27.4	27.4	**	1	0%
Hexa	PCB 145	0.513	0.513	pg/L	0.588	0.588	0.588	**	1	0%
Hexa	PCB 146	1.35	1.35	pg/L	80.2	80.2	80.2	**	1	0%
Hexa	PCB 147/149	1.55	1.55	pg/L	383	383	383	**	1	0%
Hexa	PCB 148	0.513	0.513	pg/L	<0.513	<0.513	<0.513	**	1	100%
Hexa	PCB 150	0.513	0.513	pg/L	0.78	0.78	0.78	**	1	0%
Hexa	PCB 152	0.513	0.513	pg/L	0.814	0.814	0.814	**	1	0%
Hexa	PCB 153/168	1.19	1.19	pg/L	483	483	483	**	1	0%
Hexa	PCB 155	0.513	0.513	pg/L	1.74	1.74	1.74	**	1	0%
Hexa	PCB 156/157	1.36	1.36	pg/L	96.7	96.7	96.7	**	1	0%
Hexa	PCB 158	1.03	1.03	pg/L	74.10	74.10	74.10	**	1	0%
Hexa	PCB 159	1.02	1.02	pg/L	<1.02	<1.02	<1.02	**	1	100%
Hexa	PCB 161	1.13	1.13	pg/L	<1.13	<1.13	<1.13	**	1	100%
Hexa	PCB 162	0.986	0.986	pg/L	5.4	5.40	5.4	**	1	0%
Hexa	PCB 164	1.1	1.1	pg/L	48.7	48.7	48.7	**	1	0%
Hexa	PCB 165	1.29	1.29	pg/L	<1.29	<1.29	<1.29	**	1	100%
Hexa	PCB 167	1.02	1.02	pg/L	30.80	30.80	30.80	**	1	0%
Hexa	PCB 169	1.16	1.16	pg/L	<1.16	<1.16	<1.16	**	1	100%
Hepta	PCB 170	0.552	0.552	pg/L	110.00	110.00	110.00	**	1	0%
Hepta	PCB 171/173	0.605	0.605	pg/L	38.20	38.20	38.20	**	1	0%
Hepta	PCB 172	0.657	0.657	pg/L	21.8	21.80	21.8	**	1	0%
Hepta	PCB 174	0.605	0.605	pg/L	132	132	132	**	1	0%
Hepta	PCB 175	0.646	0.646	pg/L	5.53	5.53	5.53	**	1	0%
Hepta	PCB 176	0.515	0.515	pg/L	17.3	17.3	17.3	**	1	0%
Hepta	PCB 177	0.61	0.61	pg/L	74.5	74.5	74.5	**	1	0%

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3 Percent of samples with result less than detection limit

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1] Combined Fractions [2] Comp					
					Range		Mean	Stdev	N	%ND [3]
Polychlorinated biphenyls (PCBs)										
Hepta	PCB 178	0.68	0.68	pg/L	30.4	30.4	30.4	**	1	0%
Hepta	PCB 179	0.513	0.513	pg/L	61.00	61.00	61.00	**	1	0%
Hepta	PCB 180/193	0.513	0.513	pg/L	257	257	257	**	1	0%
Hepta	PCB 181	0.574	0.574	pg/L	1.84	1.84	1.84	**	1	0%
Hepta	PCB 182	0.603	0.603	pg/L	1.41	1.41	1.41	**	1	0%
Hepta	PCB 183/185	0.62	0.62	pg/L	91.2	91.2	91.2	**	1	0%
Hepta	PCB 184	0.513	0.513	pg/L	3.66	3.66	3.66	**	1	0%
Hepta	PCB 186	0.538	0.538	pg/L	<0.538	<0.538	<0.538	**	1	100%
Hepta	PCB 187	0.607	0.607	pg/L	172	172	172	**	1	0%
Hepta	PCB 188	0.513	0.513	pg/L	<0.513	<0.513	<0.513	**	1	100%
Hepta	PCB 189	0.882	0.882	pg/L	5	5	5	**	1	0%
Hepta	PCB 190	0.513	0.513	pg/L	31.40	31.40	31.40	**	1	0%
Hepta	PCB 191	0.513	0.513	pg/L	5.96	5.96	5.96	**	1	0%
Hepta	PCB 192	0.532	0.532	pg/L	<0.532	<0.532	<0.532	**	1	100%
Octa	PCB 194	0.513	0.513	pg/L	43.2	43.2	43.2	**	1	0%
Octa	PCB 195	0.513	0.513	pg/L	17.30	17.30	17.30	**	1	0%
Octa	PCB 196	0.513	0.513	pg/L	27.8	27.8	27.8	**	1	0%
Octa	PCB 197/200	0.513	0.513	pg/L	8.50	8.50	8.50	**	1	0%
Octa	PCB 198/199	0.513	0.513	pg/L	70.80	70.80	70.80	**	1	0%
Octa	PCB 201	0.513	0.513	pg/L	8.01	8.01	8.01	**	1	0%
Octa	PCB 202	0.513	0.513	pg/L	14.60	14.60	14.60	**	1	0%
Octa	PCB 203	0.513	0.513	pg/L	46.7	46.7	46.7	**	1	0%
Octa	PCB 204	0.513	0.513	pg/L	<0.513	<0.513	<0.513	**	1	100%
Octa	PCB 205	0.513	0.513	pg/L	2.62	2.62	2.62	**	1	0%
Nona	PCB 206	1.23	1.23	pg/L	28.1	28.1	28.1	**	1	0%
Nona	PCB 207	0.831	0.831	pg/L	3.54	3.54	3.54	**	1	0%
Nona	PCB 208	0.852	0.852	pg/L	9.42	9.42	9.42	**	1	0%
Deca	PCB 209	0.513	0.513	pg/L	15.2	15.2	15.2	**	1	0%

< Results reported less than detection limit

1 Range, mean, standard deviation, and number of samples (N) are provided. When results are less than the detection limit, the detection limit was used to calculate each statistical value

2 Solid and aqueous fractions of the samples were analyzed separately, results are presented as a total of both solid and aqueous fractions

3 Percent of samples with result less than detection limit

Analyte	Detection Limit	Units	Descriptive Statistics [1]																	
			Grab						Composite						Total [3]					
			Range		Mean	Stdev	N	%ND[2]	Range		Mean	Stdev	N	%ND[2]	Range		Mean	Stdev	N	%ND[2]
Pharmaceuticals																				
Acetaminophen	3	ng/L	2240	2240	2240	**	1	0%	2,710	2,710	2,710	**	1	0%	2,240	2,710	2,475	332	2	0%
Bisphenol A	5	ng/L	11.2	11.2	11.2	**	1	0%	81	81	81	**	1	0%	11	81	46	49	2	0%
Caffeine	100	ng/L	1650	1650	1650	**	1	0%	2,690	2,690	2,690	**	1	0%	1,650	2,690	2,170	735	2	0%
Clopidogrel	5	ng/L	22.3	22.3	22.3	**	1	0%	<5.0	<5.0	<5.0	**	1	100%	<5.0	22.3	<13.7	<12.2	2	50%
Diclofenac	1	ng/L	269	269	269	**	1	0%	37.3	37.3	37.3	**	1	0%	37.3	269	153.2	163.8	2	0%
Fluoxetine	20	ng/L	<20.0	<20.0	<20.0	**	1	100%	<2000	<2000	<2000	**	1	100%	<20.0	<2000	<1010.0	<1400.1	2	100%
Gemfibrozil	2	ng/L	<2.0	<2.0	<2.0	**	1	100%	<2.0	<2.0	<2.0	**	1	100%	<2.0	<2.0	<2.0	<0.0	2	100%
Ibuprofen	5	ng/L	110	110	110	**	1	0%	93	93	93	**	1	0%	93	110	101.5	12	2	0%
Naproxen	5	ng/L	29.1	29.1	29.1	**	1	0%	71	71	71	**	1	0%	29.1	71	50.1	29.6	2	0%
Primidone	2	ng/L	<2.0	<2.0	<2.0	**	1	100%	<2.0	<2.0	<2.0	**	1	100%	<2.0	<2.0	<2.0	<0.0	2	100%
Sulfamethoxazole	1	ng/L	1.7	1.7	1.7	**	1	0%	2.8	2.8	2.8	**	1	0%	1.7	2.8	2.3	0.8	2	0%
Triclosan	20	ng/L	<20.0	<20.0	<20.0	**	1	100%	24.2	24.2	24.2	**	1	0%	<20.0	24.2	<22.1	<3.0	2	50%
Trimethoprim	1	ng/L	2.8	2.8	2.8	**	1	0%	3.3	3.3	3.3	**	1	0%	2.8	3.3	3.1	0.4	2	0%
Organic Compounds																				
6PPD-Quinone	0.002	µg/L	0.0144	0.0144	0.0144	**	1	0%	**	**	**	**	**	**	**	**	**	**	**	**

** Not applicable
< Results reported less than detection limit

1 Range, mean, standard deviation, and number of samples (N) are provided. When results are less than the detection limit, the detection limit was used to calculate each statistical value

2 Percent of samples with result less than detection limit
3 Total includes both grab and composite

Analyte	Detection Limit	Units	Descriptive Statistics [1]																	
			Grab						Composite						Total [4]					
			Range		Mean	Stdev	N	%ND[3]	Range		Mean	Stdev	N	%ND[3]	Range		Mean	Stdev	N	%ND[3]
Microbiology [2]																				
Ecoli	1800-18000	MPN/100mls	390,000	402,000	396,000	9,000	2	0%	207,000	1,487,000	555,000	905,000	2	0%	207,000	1,487,000	469,000	584,000	4	0%
Enterococci	10-100	MPN/100mls	112,000	222,000	158,000	78,000	2	0%	201,000	242,000	220,000	29,000	2	0%	112,000	242,000	187,000	57,000	4	0%
Fecal Coliform	1800-18000	MPN/100mls	390,000	490,000	437,000	71,000	2	0%	245,000	2,133,000	722,000	1,335,000	2	0%	245,000	2,133,000	562,000	885,000	4	0%
Inorganic Chemistry and Physical																				
Biochemical Oxygen Demand	10	mg/L	17	39	28	16.0	2	0%	21	44	33	16	2	0%	17	44	30	13	4	0%
Chemical Oxygen Demand	20	mg/L	54	82	68	20	2	0%	60	121	91	43	2	0%	54	121	79	30	4	0%
Conductivity	1	µmho/cm	172	212	192	28	2	0%	168	240	204	51	2	0%	168	240	198	34	4	0%
Hardness as CACO3	0.2	mg/L	35.3	41.4	38.4	4.3	2	0%	32.3	36.1	34.2	2.7	2	0%	32.3	41.4	36.3	3.8	4	0%
Nitrogen - Ammonia as N	0.2	mg/L	1.8	6.5	4.20	3.30	2	0%	4.4	8.4	6.40	2.8	2	0%	1.8	8.4	5.30	2.8	4	0%
Nitrogen - Nitrate as N	0.01	mg/L	0.32	0.59	0.46	0.19	2	0%	0.19	0.48	0.34	0.21	2	0%	0.19	0.59	0.40	0.18	4	0%
Nitrogen - Nitrite as N	0.01	mg/L	0.04	0.16	0.10	0.08	2	0%	0.03	0.08	0.06	0.04	2	0%	0.03	0.16	0.08	0.06	4	0%
pH	0.1	PH	7.0	7.1	7.1	0.1	2	0%	7.2	7.2	7.2	0.0	2	0%	7	7.2	7.1	0.1	4	0%
Total Suspended Solids	2-7	mg/L	28	36	32	6	2	0%	25	48	37	16	2	0%	25	48	34	10	4	0%
Volatile Suspended Solids	2-7	mg/L	18	33	26	11	2	0%	21	43	32	16	2	0%	18	43	29	12	4	0%
Toxicity [2]																				
LC50 Rainbow Trout 96-h	**	%vol/vol	100	100	100	**	1	**	**	**	**	**	**	**	**	**	**	**	**	**
Total Metals																				
Aluminum Total	5	µg/L	227	468	348	170	2	0%	194	234	214	28	2	0%	194	468	281	126	4	0%
Arsenic Total	0.5	µg/L	0.7	1	0.9	0.2	2	0%	0.6	0.7	0.7	0.1	2	0%	0.6	1	0.8	0.2	4	0%
Barium Total	0.5	µg/L	13.8	18.8	16.3	3.5	2	0%	12.9	16	14.5	2.2	2	0%	12.9	18.8	15.4	2.6	4	0%
Boron Total	10	µg/L	23	27	25	3	2	0%	28	37	33	6	2	0%	23	37	29	6	4	0%
Cadmium Total	0.2	µg/L	<0.2	<0.2	<0.2	<0.0	2	100%	<0.2	<0.2	<0.2	<0.0	2	100%	<0.2	<0.2	<0.2	<0.0	4	100%
Calcium Total	20-200	µg/L	11300	14100	12700	1980	2	0%	10800	11600	11200	566	2	0%	10800	14100	11950	1471	4	0%
Chromium Total	0.5	µg/L	0.7	1.2	1.0	0.4	2	0%	0.6	0.7	0.7	0.1	2	0%	0.6	1.2	0.8	0.3	4	0%
Cobalt Total	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	4	100%
Copper Total	0.5	µg/L	10.6	19.7	15.2	6.4	2	0%	11	22.5	16.8	8.1	2	0%	10.6	22.5	16.0	6.1	4	0%
Iron Total	5	µg/L	528	547	538	13	2	0%	344	485	415	100	2	0%	344	547	476	92	4	0%
Lead Total	0.5	µg/L	1.2	2.6	1.9	1.0	2	0%	1.3	1.5	1.4	0.1	2	0%	1.2	2.6	1.7	0.6	4	0%
Magnesium Total	10	µg/L	1520	1700	1610	127	2	0%	1310	1720	1515	290	2	0%	1310	1720	1563	191	4	0%
Manganese Total	0.5	µg/L	19.9	25.9	22.9	4.2	2	0%	17.9	26.7	22.3	6.2	2	0%	17.9	26.7	22.6	4.4	4	0%
Mercury Total	0.05	µg/L	<0.05	<0.05	<0.05	<0.00	2	100%	<0.05	<0.05	<0.05	<0.00	2	100%	<0.05	<0.05	<0.05	<0.00	4	100%
Molybdenum Total	0.5	µg/L	0.9	1.0	1.0	0.1	2	0%	0.7	0.8	0.80	0.1	2	0%	0.7	1.0	0.90	0.1	4	0%
Nickel Total	0.5	µg/L	0.9	1	1.0	0.1	2	0%	0.8	1.1	1.0	0.2	2	0%	0.8	1.1	1.0	0.1	4	0%
Phosphorus Total	20	µg/L	539	1220	880	482	2	0%	752	1440	1096	486	2	0%	539	1440	988	414	4	0%
Selenium Total	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	4	100%
Silver Total	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	4	100%
Sodium Total	50-500	µg/L	13100	16500	14800	2404	2	0%	11100	19000	15050	5586	2	0%	11100	19000	14925	3514	4	0%
Zinc Total	3	µg/L	29	29	29	0	2	0%	26	37	32	8	2	0%	26	37	30	5	4	0%
Dissolved Metals																				
Aluminium Dissolved	5	µg/L	23	27	25	3	2	0%	20	25	23	4	2	0%	20	27	24	3	4	0%
Arsenic Dissolved	0.5	µg/L	0.7	0.8	0.8	0.1	2	0%	0.6	0.6	0.6	0.0	2	0%	0.6	0.8	0.7	0.1	4	0%
Barium Dissolved	0.5	µg/L	9.7	14.3	12.0	3.3	2	0%	9.1	13	11.1	2.8	2	0%	9.1	14.3	11.5	2.5	4	0%
Boron Dissolved	10	µg/L	23	25	24	1	2	0%	27	36	32	6	2	0%	23	36	28	6	4	0%
Cadmium Dissolved	0.2	µg/L	<0.2	<0.2	<0.2	<0.0	2	100%	<0.2	<0.2	<0.2	<0.0	2	100%	<0.2	<0.2	<0.2	<0.0	4	100%
Calcium Dissolved	20-200	µg/L	10200	13400	11800	2263	2	0%	9500	10700	10100	849	2	0%	9500	13400	10950	1706	4	0%
Chromium Dissolved	0.5	µg/L	<0.5	0.6	<0.6	<0.1	2	50%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	0.6	<0.5	<0.1	4	75%
Cobalt Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	4	100%
Copper Dissolved	0.5	µg/L	4.2	8.9	6.6	3.3	2	0%	5.1	10.7	7.9	4.0	2	0%	4.2	10.7	7.2	3.1	4	0%
Iron Dissolved	5	µg/L	56	187	122	93	2	0%	74	148	111	52	2	0%	56	187	116	62	4	0%
Lead Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	4	100%
Magnesium Dissolved	10	µg/L	1370	1570	1470	141	2	0%	1130	1540	1335	290	2	0%	1130	1570	1403	202	4	0%
Manganese Dissolved	0.5	µg/L	10.8	19.4	15.1	6.1	2	0%	12.2	20.2	16.2	5.7	2	0%	10.8	20.2	15.7	4.8	4	0%
Molybdenum Dissolved	0.5	µg/L	0.8	0.9	0.90	0.1	2	0%	0.6	0.7	0.70	0.10	2	0%	0.6	0.9	0.80	0.1	4	0%
Nickel Dissolved	0.5	µg/L	0.6	0.6	0.60	0.0	2	0%	<0.5	0.7	<0.6	<0.1	2	50%	<0.5	0.7	<0.6	<0.1	4	25%
Phosphorus Dissolved	20	µg/L	319	772	546	320	2	0%	357	817	587	325	2	0%	319	817	566	265	4	0%
Selenium Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	4	100%
Silver Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	2	100%	<0.5	<0.5	<0.5	<0.0	4	100%
Sodium Dissolved	50-500	µg/L	12700	15300	14000	1838	2	0%	10200	18400	14300	5798	2	0%	10200	18400	14150	3516	4	0%
Zinc Dissolved	3	µg/L	13	13	13	0	2	0%	12	18	15	4	2	0%	12	18	14	3	4	0%

** Not applicable

< Results reported less than detection limit

1 Range, mean (geomean for microbiology), standard deviation, and number of samples (N) are provided. When results are less than (greater than for microbiology) the detection limit, the detection limit was used to calculate each statistical value

2 Every sample for microbiology was collected with a duplicate, the result reported is the geomean of duplicates

3 Percent of samples with result less than detection limit

4 Total includes both grab and composite

5 LC50 results represent % survival, results show 0% mortality throughout test

Analyte	Detection Limit	Units	Descriptive Statistics [1]					
			Grab					
			Range		Mean	Stdev	N	%ND [2]
Volatile petroleum hydrocarbons								
1,1,1,2-Tetrachloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
1,1,1-Trichloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
1,1,2,2-Tetrachloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
1,1,2-Trichloro/1,2,2-Trifluoroethane	2.0	µg/L	<2.0	<2.0	<2.0	**	2	100%
1,1,2-Trichloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
1,1-Dichloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
1,1-Dichloroethylene	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
1,2,3-Trichlorobenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	2	100%
1,2,4-Trichlorobenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	2	100%
1,2-Dibromoethane	0.20	µg/L	<0.20	<0.20	<0.20	**	2	100%
1,2-Dichlorobenzene	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
1,2-Dichloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
1,2-Dichloropropane	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
1,3,5-Trimethylbenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	2	100%
1,3-Butadiene	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
1,3-Dichlorobenzene	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
1,3-Dichloropropane	1.0	µg/L	<1.0	<1.0	<1.0	**	2	100%
1,4-Dichlorobenzene	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
Benzene	0.40	µg/L	<0.40	<0.40	<0.40	**	2	100%
Bromobenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	2	100%
Bromodichloromethane	1.0	µg/L	<1.0	<1.0	<1.0	**	2	100%
Bromoform	1.0	µg/L	<1.0	<1.0	<1.0	**	2	100%
Bromomethane	1.0	µg/L	<1.0	<1.0	<1.0	**	2	100%
Carbon Tetrachloride	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
Chlorobenzene	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
Chloroethane	1.0	µg/L	<1.0	<1.0	<1.0	**	2	100%
Chloroform	1.0	µg/L	1.1	2.1	1.6	0.7	2	0%
Chloromethane	1.0	µg/L	<1.0	<1.0	<1.0	**	2	100%
cis-1,2-Dichloroethylene	1.0	µg/L	<1.0	<1.0	<1.0	**	2	100%
cis-1,3-Dichloropropylene	1.0	µg/L	<1.0	<1.0	<1.0	**	2	100%
Dibromochloromethane	1.0	µg/L	<1.0	<1.0	<1.0	**	2	100%
Dichlorodifluoromethane	2.0	µg/L	<2.0	<2.0	<2.0	**	2	100%
Dichloromethane	2.0	µg/L	<2.0	<2.0	<2.0	**	2	100%
Ethylbenzene	0.40	µg/L	<0.40	<0.40	<0.40	**	2	100%
Hexachlorobutadiene	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
Isopropylbenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	2	100%
m- & p-Xylene	0.40	µg/L	<0.40	2.4	<1.40	<1.41	2	50%
Methyl t-butyl ether (MTBE)	4.0	µg/L	<4.0	<4.0	<4.0	**	2	100%
o-Xylene	0.40	µg/L	<0.40	1.4	<0.90	<0.71	2	50%
Styrene	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
Tetrachloroethylene	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
Toluene	0.40	µg/L	2.3	2.5	2.4	0.1	2	0%
trans-1,2-Dichloroethylene	1.0	µg/L	<1.0	<1.0	<1.0	**	2	100%
trans-1,3-Dichloropropylene	1.0	µg/L	<1.0	<1.0	<1.0	**	2	100%
Trichloroethylene	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
Trichlorofluoromethane	4.0	µg/L	<4.0	<4.0	<4.0	**	2	100%
VH (C6-C10) [3]	300	µg/L	<300	<300	<300	**	2	100%
Vinyl Chloride	0.50	µg/L	<0.50	<0.50	<0.50	**	2	100%
VPH (C6-10) - BTEX [4]	300	µg/L	<300	<300	<300	**	2	100%
Xylenes	0.40	µg/L	<0.40	3.7	<2.05	<2.33	2	50%

Analyte		Detection Limit	Units	Descriptive Statistics [1]					
				Grab					
				Range		Mean	Stdev	N	%ND [2]
Extractable petroleum hydrocarbons									
LEPH (C10-C19 less PAH) [5]		0.20	mg/L	<0.20	<0.20	<0.20	**	2	100%
HEPH (C19-C32 less PAH) [6]		0.20	mg/L	0.32	0.79	0.56	0.33	2	0%
EPH (C10-C19)		0.20	mg/L	<0.20	<0.20	<0.20	**	2	100%
EPH (C19-C32)		0.20	mg/L	0.32	0.79	0.56	0.33	2	0%
Polycyclic aromatic hydrocarbons (PAH)									
Low molecular weight PAHs (LPAH)	2-Methylnaphthalene [7]	0.10	µg/L	<0.10	<0.10	<0.10	**	2	100%
	Phenanthrene	0.020	µg/L	0.025	0.038	0.032	0.009	2	0%
	Acenaphthene	0.050	µg/L	<0.050	0.052	<0.051	<0.001	2	50%
	Acenaphthylene	0.050	µg/L	<0.050	<0.050	<0.050	**	2	100%
	Anthracene	0.010	µg/L	<0.010	<0.010	<0.010	**	2	100%
	Acridine [8]	0.050	µg/L	<0.050	<0.050	<0.050	**	2	100%
	Fluorene	0.050	µg/L	<0.050	<0.050	<0.050	**	2	100%
	Naphthalene	0.10	µg/L	<0.10	<0.10	<0.10	**	2	100%
	Quinoline [8]	0.050	µg/L	0.054	0.055	0.055	0.001	2	0%
	Total LPAHs	0.10	µg/L	0.14	0.14	0.14	0	2	0%
High molecular weight PAHs (HPAH)	Benz[a]anthracene	0.010	µg/L	<0.010	<0.010	<0.010	**	2	100%
	Benzo[a]pyrene	0.0050	µg/L	<0.0050	<0.013	<0.0090	**	2	100%
	Benzo[b+j]fluoranthene	0.030	µg/L	<0.030	<0.030	<0.030	**	2	100%
	Benzo[g,h,i]perylene	0.050	µg/L	<0.050	<0.050	<0.050	**	2	100%
	Benzo[k]fluoranthene	0.050	µg/L	<0.050	<0.050	<0.050	**	2	100%
	Chrysene	0.020	µg/L	<0.020	0.022	<0.021	<0.001	2	50%
	Dibenz[a,h]anthracene	0.0030	µg/L	<0.0030	<0.0030	<0.0030	**	2	100%
	Fluoranthene	0.020	µg/L	<0.020	0.032	<0.026	<0.008	2	50%
	Indeno[1,2,3-c,d]pyrene	0.050	µg/L	<0.050	<0.050	<0.050	**	2	100%
	Pyrene	0.020	µg/L	<0.020	0.029	<0.025	<0.006	2	50%
	Total HPAHs	0.050	µg/L	<0.050	0.083	<0.067	<0.023	2	50%
Total PAH = LPAH + HPAH		0.10	µg/L	0.14	0.22	0.18	0.06	2	0%

** Not applicable
< Results reported less than detection limit
1 Range, mean (geomean for microbiology), standard deviation, and number of samples (N) are provided. When results are less than (greater than for microbiology) the detection limit, the detection limit was used to caculate each statistical value
2 Percent of samples with result less than detection limit
3 Volatile Hydrocarbons containing all petroleum hydrocarbons in the carbon range of C6-C10, including BTEX and Styrene
4 Volatile Petroleum Hydrocarbons containing all pretroleum hydrocarbons in the carbon range of C6-C10 minus BTEX
5 LEPH = Light Extractable Petroleum Hydrocarbons
6 HEPH = Heavy Extractable Petroleum Hydrocarbons
7 Alkylated Low Molecular Weight PAHs
8 N-Heterocycle Low Molecular Weight PAHs

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]																	
					Combined Fractions [2]																	
					Grab						Composite						Total					
					Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]
Polybrominated diphenyl ethers (PBDEs)																						
Di	PBDE 7	1.06	1.07	pg/L	<1.06	<1.07	<1.07	<0.01	2	100%	<1.06	<1.06	<1.06	<0.00	2	100%	<1.06	<1.07	<1.06	<0.01	4	100%
Di	PBDE 8/11	1.05	1.06	pg/L	<1.05	<1.06	<1.06	<0.01	2	100%	<1.06	<1.06	<1.06	<0.00	2	100%	<1.05	<1.06	<1.06	<0.01	4	100%
Di	PBDE 10	1.06	1.21	pg/L	<1.15	<1.21	<1.18	<0.04	2	100%	<1.06	<1.06	<1.06	<0.00	2	100%	<1.06	<1.21	<1.12	<0.07	4	100%
Di	PBDE 12/13	1.05	1.06	pg/L	<1.05	<1.06	<1.06	<0.01	2	100%	<1.06	<1.06	<1.06	<0.00	2	100%	<1.05	<1.06	<1.06	<0.01	4	100%
Di	PBDE 15	1.05	1.06	pg/L	1.63	2.02	1.83	0.28	2	0%	1.74	2.78	2.26	0.74	2	0%	1.63	2.78	2.04	0.52	4	0%
Tri	PBDE 17/25	1.05	1.06	pg/L	10.20	15.30	12.80	3.60	2	0%	18.70	26.30	22.50	5.40	2	0%	10.20	26.30	17.60	6.80	4	0%
Tri	PBDE 28/33	1.05	1.06	pg/L	19.80	32.30	26.10	8.80	2	0%	38.90	58.90	48.90	14.10	2	0%	19.80	58.90	37.50	16.30	4	0%
Tri	PBDE 30	1.05	1.06	pg/L	<1.05	<1.06	<1.06	<0.01	2	100%	<1.06	<1.06	<1.06	<0.00	2	100%	<1.05	<1.06	<1.06	<0.01	4	100%
Tri	PBDE 32	1.05	1.06	pg/L	<1.05	<1.06	<1.06	<0.01	2	100%	<1.06	<1.06	<1.06	<0.00	2	100%	<1.05	<1.06	<1.06	<0.01	4	100%
Tri	PBDE 35	1.05	1.06	pg/L	<1.05	<1.06	<1.06	<0.01	2	100%	<1.06	1.11	<1.09	<0.04	2	50%	<1.05	1.11	<1.07	<0.03	4	75%
Tri	PBDE 37	1.05	1.06	pg/L	3.02	3.27	3.15	0.18	2	0%	3.48	3.58	3.53	0.07	2	0%	3.02	3.58	3.34	0.25	4	0%
Tetra	PBDE 47	1.05	1.06	pg/L	1300.00	1590.00	1445.00	205.00	2	0%	2250.00	3200.00	2725.00	672.00	2	0%	1300.00	3200.00	2085.00	843.00	4	0%
Tetra	PBDE 49	1.05	1.06	pg/L	30.00	31.00	31.00	1.00	2	0%	52.40	71.20	61.80	13.30	2	0%	30.00	71.20	46.20	19.60	4	0%
Tetra	PBDE 51	1.05	1.06	pg/L	4.38	4.41	4.4	0.02	2	0%	5.79	9.66	7.73	2.74	2	0%	4.38	9.66	6.06	2.49	4	0%
Tetra	PBDE 66	1.05	1.06	pg/L	17.3	25.4	21.4	5.7	2	0%	37.3	59.1	48.2	15.4	2	0%	17.3	59.1	34.8	18.2	4	0%
Tetra	PBDE 71	1.05	1.06	pg/L	4.15	4.43	4.29	0.2	2	0%	7.01	9.68	8.35	1.89	2	0%	4.15	9.68	6.32	2.59	4	0%
Tetra	PBDE 75	1.05	1.06	pg/L	1.53	2.26	1.9	0.52	2	0%	2.96	3.12	3.04	0.11	2	0%	1.53	3.12	2.47	0.73	4	0%
Tetra	PBDE 77	1.05	1.06	pg/L	<1.05	<1.06	<1.06	<0.01	2	100%	<1.06	<1.06	<1.06	<0.00	2	100%	<1.05	<1.06	<1.06	<0.01	4	100%
Tetra	PBDE 79	1.05	1.06	pg/L	1.08	2.02	1.55	0.66	2	0%	2.24	2.95	2.6	0.5	2	0%	1.08	2.95	2.07	0.77	4	0%
Penta	PBDE 85	1.06	2.52	pg/L	53.20	61.40	57.30	5.80	2	0%	98.10	140.00	119.10	29.60	2	0%	53.20	140.00	88.20	39.70	4	0%
Penta	PBDE 99	1.06	1.8	pg/L	1230	1390	1310	113	2	0%	2200	3130	2665	658	2	0%	1230	3130	1988	872	4	0%
Penta	PBDE 100	1.05	1.4	pg/L	255	287	271	23	2	0%	449	638	544	134	2	0%	255	638	407	176	4	0%
Penta	PBDE 105	1.36	3.34	pg/L	<1.36	<2.18	<1.77	<0.58	2	100%	<2.07	<3.34	<2.71	<0.90	2	100%	<1.36	<3.34	<2.24	<0.82	4	100%
Penta	PBDE 116	1.62	3.99	pg/L	<1.62	<2.61	<2.12	<0.70	2	100%	<2.48	<3.99	<3.24	<1.07	2	100%	<1.62	<3.99	<2.68	<0.98	4	100%
Penta	PBDE 119/120	1.12	2.75	pg/L	3.52	4.07	3.80	0.39	2	0%	4.48	5.60	5.04	0.79	2	0%	3.52	5.60	4.42	0.88	4	0%
Penta	PBDE 126	1.05	1.53	pg/L	<1.05	<1.06	<1.06	<0.01	2	100%	<1.06	<1.53	<1.30	<0.33	2	100%	<1.05	<1.53	<1.18	<0.24	4	100%
Hexa	PBDE 128	2.44	16.8	pg/L	<2.44	<3.21	<2.83	<0.54	2	100%	<8.91	<16.8	<12.86	<5.58	2	100%	<2.44	<16.8	<7.84	<6.63	4	100%
Hexa	PBDE 138/166	1.41	3.04	pg/L	10.7	13.80	12.3	2.2	2	0%	21.8	30.70	26.3	6.3	2	0%	10.7	30.70	19.3	9	4	0%
Hexa	PBDE 140	1.05	2.09	pg/L	4.14	4.58	4.36	0.31	2	0%	6.67	8.67	7.67	1.41	2	0%	4.14	8.67	6.02	2.09	4	0%
Hexa	PBDE 153	1.05	2.11	pg/L	102.00	121.00	112.00	13.00	2	0%	190.00	285.00	238.00	67.00	2	0%	102.00	285.00	175.00	83.00	4	0%
Hexa	PBDE 154	1.15	2.41	pg/L	79.10	92.60	85.90	9.50	2	0%	141.00	219.00	180.00	55.00	2	0%	79.10	219.00	132.90	63.20	4	0%
Hexa	PBDE 155	1.05	1.42	pg/L	6.37	8.68	7.53	1.63	2	0%	10.40	16.40	13.40	4.20	2	0%	6.37	16.40	10.46	4.29	4	0%
Hepta	PBDE 181	1.47	2.74	pg/L	<1.47	<1.91	<1.69	<0.31	2	100%	<2.25	<2.74	<2.50	<0.35	2	100%	<1.47	<2.74	<2.09	<0.54	4	100%
Hepta	PBDE 183	1.06	1.89	pg/L	29.40	74.60	52.00	32.00	2	0%	41.50	45.30	43.40	2.70	2	0%	29.40	74.60	47.70	19.20	4	0%
Hepta	PBDE 190	2.48	4.63	pg/L	<3.23	4.21	<3.72	<0.69	2	50%	<3.8	<4.63	<4.22	<0.59	2	100%	<3.23	<4.63	<3.97	<0.60	4	75%
Octa	PBDE 203	5.71	11.2	pg/L	12.90	34.20	23.60	15.10	2	0%	22.00	29.20	25.60	5.10	2	0%	12.90	34.20	24.60	9.30	4	0%
Nona	PBDE 206	4.27	6.43	pg/L	155.00	168.00	162.00	9.00	2	0%	229.00	328.00	279.00	70.00	2	0%	155.00	328.00	220.00	79.00	4	0%
Nona	PBDE 207	6.38	9.61	pg/L	175.00	207.00	191.00	23.00	2	0%	336.00	451.00	394.00	81.00	2	0%	175.00	451.00	292.00	127.00	4	0%
Nona	PBDE 208	5.83	8.77	pg/L	93.10	108.00	100.60	10.50	2	0%	168.00	206.00	187.00	27.00	2	0%	93.10	206.00	143.80	52.60	4	0%
Deca	PBDE 209	20.4	32	pg/L	2510.0	2870.0	2690.0	255.0	2	0%	3760.0	6890.0	5325.0	2213.0	2	0%	2510.0	6890.0	4008.0	1992.0	4	0%

< Results reported less than detection limit

1 Range, mean, standard deviation, and number of samples (N) are provided. When results are less than the detection limit, the detection limit was used to calculate each statistical value

2 Solid and aqueous fractions of the samples were analyzed separately, results are presented as a total of both solid and aqueous fractions

3 Percent of samples with result less than detection limit

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]																	
					Combined Fractions [2]																	
					Grab						Composite						Total					
					Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]
Polychlorinated biphenyls (PCBs)																						
Mono	PCB 1	0.545	0.876	pg/L	2.89	3.99	3.44	0.78	2	0%	3.37	4.04	3.71	0.47	2	0%	2.89	4.04	3.57	0.55	4	0%
Mono	PCB 2	0.531	0.731	pg/L	1.67	1.76	1.72	0.06	2	0%	1.83	1.86	1.85	0.02	2	0%	1.67	1.86	1.78	0.08	4	0%
Mono	PCB 3	0.587	0.838	pg/L	2.68	3.45	3.07	0.54	2	0%	2.79	3.38	3.09	0.42	2	0%	2.68	3.45	3.08	0.4	4	0%
Di	PCB 4	1.89	3.75	pg/L	10.2	37.8	24	19.5	2	0%	24.6	35.2	29.9	7.5	2	0%	10.2	37.8	27	12.5	4	0%
Di	PCB 5	1.17	2.31	pg/L	<1.17	<2.31	<1.74	<0.81	2	100%	<1.6	<1.79	<1.70	<0.13	2	100%	<1.17	<2.31	<1.72	<0.47	4	100%
Di	PCB 6	1.03	2.02	pg/L	2.13	2.94	2.54	0.57	2	0%	1.90	2.54	2.22	0.45	2	0%	1.90	2.94	2.38	0.46	4	0%
Di	PCB 7	1.05	2.11	pg/L	2.41	5.55	3.98	2.22	2	0%	3.52	7.16	5.34	2.57	2	0%	2.41	7.16	4.66	2.11	4	0%
Di	PCB 8	0.961	1.9	pg/L	7.88	10.9	9.39	2.14	2	0%	7.63	9.63	8.63	1.41	2	0%	7.63	10.9	9.01	1.54	4	0%
Di	PCB 9	1.04	2.06	pg/L	<1.04	<2.06	<1.55	<0.72	2	100%	<1.43	<1.6	<1.52	<0.12	2	100%	<1.04	<2.06	<1.53	<0.42	4	100%
Di	PCB 10	1.08	2.1	pg/L	<1.08	<2.1	<1.59	<0.72	2	100%	<1.45	<1.63	<1.54	<0.13	2	100%	<1.08	<2.1	<1.57	<0.42	4	100%
Di	PCB 11	1.14	2.25	pg/L	24.3	32.8	28.6	6	2	0%	28.5	29.8	29.2	0.9	2	0%	24.3	32.8	28.9	3.5	4	0%
Di	PCB 12/13	1.14	2.25	pg/L	<1.14	<2.25	<1.70	<0.78	2	100%	<1.74	1.77	<1.76	<0.02	2	50%	<1.14	<2.25	<1.73	<0.45	4	75%
Di	PCB 14	1.05	2.09	pg/L	<1.05	<2.09	<1.57	<0.74	2	100%	<1.44	<1.62	<1.53	<0.13	2	100%	<1.05	<2.09	<1.55	<0.43	4	100%
Di	PCB 15	1.28	2.58	pg/L	7.88	8.34	8.11	0.33	2	0%	7.61	9.92	8.77	1.63	2	0%	7.61	9.92	8.44	1.03	4	0%
Tri	PCB 16	0.531	1.25	pg/L	6.52	7.45	6.99	0.66	2	0%	7.41	10.4	8.91	2.11	2	0%	6.52	10.4	7.95	1.69	4	0%
Tri	PCB 17	0.531	1.08	pg/L	7.94	10.6	9.27	1.88	2	0%	8.78	11.1	9.94	1.64	2	0%	7.94	11.1	9.61	1.49	4	0%
Tri	PCB 18/30	0.531	0.92	pg/L	13	18.7	15.9	4	2	0%	17.7	20	18.9	1.6	2	0%	13	20	17	3	4	0%
Tri	PCB 19	0.61	1.6	pg/L	5.47	5.9	5.69	0.3	2	0%	7.16	7.8	7.48	0.45	2	0%	5.47	7.8	6.58	1.08	4	0%
Tri	PCB 20/28	0.53	0.564	pg/L	18.8	27.1	23	5.9	2	0%	27.1	30	28.6	2.1	2	0%	18.8	30	25.8	4.8	4	0%
Tri	PCB 21/33	0.53	0.548	pg/L	5.60	5.93	5.77	0.23	2	0%	6.45	7.01	6.73	0.40	2	0%	5.60	7.01	6.25	0.62	4	0%
Tri	PCB 22	0.53	0.605	pg/L	3.79	4.46	4.13	0.47	2	0%	6.96	7.1	7.03	0.1	2	0%	3.79	7.1	5.58	1.7	4	0%
Tri	PCB 23	0.53	0.593	pg/L	<0.531	<0.593	<0.562	<0.044	2	100%	<0.53	<0.58	<0.56	<0.04	2	100%	<0.53	<0.593	<0.559	<0.033	4	100%
Tri	PCB 24	0.528	0.815	pg/L	0.733	<0.815	<0.774	<0.058	2	50%	<0.528	<0.53	<0.529	<0.001	2	100%	<0.528	<0.815	<0.652	<0.145	4	75%
Tri	PCB 25	0.523	0.531	pg/L	0.928	1.52	1.224	0.419	2	0%	1.78	2.06	1.92	0.2	2	0%	0.928	2.06	1.572	0.483	4	0%
Tri	PCB 26/29	0.53	0.565	pg/L	2.77	3.71	3.24	0.66	2	0%	3.91	4.70	4.31	0.56	2	0%	2.77	4.70	3.77	0.79	4	0%
Tri	PCB 27	0.528	0.774	pg/L	2.01	2.23	2.12	0.16	2	0%	1.91	1.96	1.94	0.04	2	0%	1.91	2.23	2.03	0.14	4	0%
Tri	PCB 31	0.528	0.538	pg/L	12.4	13.4	12.9	0.7	2	0%	22.8	23.1	23	0.2	2	0%	12.4	23.1	17.9	5.8	4	0%
Tri	PCB 32	0.53	0.56	pg/L	5.17	6.74	5.96	1.11	2	0%	5.69	8.07	6.88	1.68	2	0%	5.17	8.07	6.42	1.28	4	0%
Tri	PCB 34	0.53	0.584	pg/L	<0.531	<0.584	<0.558	<0.037	2	100%	<0.53	<0.571	<0.551	<0.029	2	100%	<0.53	<0.584	<0.554	<0.028	4	100%
Tri	PCB 35	0.53	0.601	pg/L	0.74	1.57	1.16	0.59	2	0%	1.49	1.93	1.71	0.31	2	0%	0.74	1.93	1.43	0.50	4	0%
Tri	PCB 36	0.53	0.565	pg/L	<0.531	0.95	<0.739	<0.293	2	50%	<0.53	<0.553	<0.542	<0.016	2	100%	<0.53	0.95	<0.640	<0.204	4	75%
Tri	PCB 37	0.534	0.684	pg/L	5.09	8.13	6.61	2.15	2	0%	7.46	7.70	7.58	0.17	2	0%	5.09	8.13	7.10	1.37	4	0%
Tri	PCB 38	0.53	0.573	pg/L	<0.531	<0.573	<0.552	<0.030	2	100%	<0.53	<0.56	<0.55	<0.02	2	100%	<0.53	<0.573	<0.549	<0.021	4	100%
Tri	PCB 39	0.53	0.544	pg/L	<0.531	<0.544	<0.538	<0.009	2	100%	<0.53	<0.532	<0.531	<0.001	2	100%	<0.53	<0.544	<0.534	<0.007	4	100%
Tetra	PCB 40/41/71	0.531	1.17	pg/L	11	13.60	12.3	1.8	2	0%	15.5	16.90	16.2	1	2	0%	11	16.90	14.3	2.6	4	0%
Tetra	PCB 42	0.531	1.22	pg/L	3.38	6.3	4.84	2.06	2	0%	7.84	7.87	7.86	0.02	2	0%	3.38	7.87	6.35	2.11	4	0%
Tetra	PCB 43	0.531	1.33	pg/L	<0.531	<1.33	<0.931	<0.565	2	100%	0.83	1.14	0.99	0.22	2	0%	<0.531	<1.33	<0.958	<0.351	4	50%
Tetra	PCB 44/47/65	0.531	1.09	pg/L	49.1	60.5	54.8	8.1	2	0%	69.6	69.7	69.7	0.1	2	0%	49.1	69.7	62.2	9.8	4	0%
Tetra	PCB 45/51	0.531	1.2	pg/L	7.98	7.98	7.98	0	2	0%	9.62	10	9.81	0.27	2	0%	7.98	10	8.9	1.07	4	0%
Tetra	PCB 46	0.531	1.37	pg/L	1.53	1.78	1.66	0.18	2	0%	2.04	2.41	2.23	0.26	2	0%	1.53	2.41	1.94	0.38	4	0%
Tetra	PCB 48	0.531	1.18	pg/L	3.26	5.87	4.57	1.85	2	0%	5.90	6.99	6.45	0.77	2	0%	3.26	6.99	5.51	1.58	4	0%
Tetra	PCB 49/69	0.531	1	pg/L	11.3	18.8	15.1	5.3	2	0%	18.7	21.7	20.2	2.1	2	0%	11.3	21.7	17.6	4.4	4	0%

< Results reported less than detection limit

1 Range, mean, standard deviation, and number of samples (N) are provided. When results are less than the detection limit, the detection limit was used to calculate each statistical value

2 Solid and aqueous fractions of the samples were analyzed separately, results are presented as a total of both solid and aqueous fractions

3 Percent of samples with result less than detection limit

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]																	
					Combined Fractions [2]																	
					Grab						Composite						Total					
					Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]
Polychlorinated biphenyls (PCBs)																						
Tetra	PCB 57	0.605	1.01	pg/L	<0.908	<1.01	<0.959	<0.072	2	100%	<0.605	<0.813	<0.709	<0.147	2	100%	<0.605	<1.01	<0.834	<0.173	4	100%
Tetra	PCB 58	0.635	1.05	pg/L	<0.953	<1.05	<1.002	<0.069	2	100%	<0.635	<0.853	<0.744	<0.154	2	100%	<0.635	<1.05	<0.873	<0.178	4	100%
Tetra	PCB 59/62/75	0.528	0.884	pg/L	0.932	1.81	1.371	0.621	2	0%	2.2	3.33	2.77	0.8	2	0%	0.932	3.33	2.068	0.995	4	0%
Tetra	PCB 60	0.651	1.06	pg/L	4.17	4.23	4.20	0.04	2	0%	6.82	6.98	6.90	0.11	2	0%	4.17	6.98	5.55	1.56	4	0%
Tetra	PCB 61/70/74/76	0.616	1.01	pg/L	34.60	43.80	39.20	6.50	2	0%	57.00	63.30	60.20	4.50	2	0%	34.60	63.30	49.70	12.90	4	0%
Tetra	PCB 63	0.602	0.971	pg/L	<0.904	<0.971	<0.938	<0.047	2	100%	0.93	0.94	0.94	0.01	2	0%	<0.904	<0.971	<0.936	<0.028	4	50%
Tetra	PCB 64	0.528	0.845	pg/L	8.94	10.5	9.72	1.1	2	0%	13	15.3	14.2	1.6	2	0%	8.94	15.3	11.94	2.8	4	0%
Tetra	PCB 66	0.612	0.991	pg/L	12.90	17.20	15.10	3.00	2	0%	23.70	25.60	24.70	1.30	2	0%	12.90	25.60	19.90	5.90	4	0%
Tetra	PCB 67	0.536	0.884	pg/L	<0.805	<0.884	<0.845	<0.056	2	100%	0.611	<0.721	<0.666	<0.078	2	50%	0.611	<0.884	<0.755	<0.117	4	75%
Tetra	PCB 68	0.593	0.961	pg/L	2.32	2.70	2.51	0.27	2	0%	3.20	3.72	3.46	0.37	2	0%	2.32	3.72	2.99	0.61	4	0%
Tetra	PCB 72	0.594	0.958	pg/L	<0.891	<0.958	<0.925	<0.047	2	100%	<0.594	<0.798	<0.696	<0.144	2	100%	<0.594	<0.958	<0.810	<0.158	4	100%
Tetra	PCB 73	0.531	0.936	pg/L	<0.531	<0.936	<0.734	<0.286	2	100%	<0.537	<0.682	<0.610	<0.103	2	100%	<0.531	<0.936	<0.672	<0.190	4	100%
Tetra	PCB 77	0.662	1.05	pg/L	2.00	2.22	2.11	0.16	2	0%	2.67	2.77	2.72	0.07	2	0%	2.00	2.77	2.42	0.37	4	0%
Tetra	PCB 78	0.647	1.01	pg/L	<0.97	<1.01	<0.99	<0.03	2	100%	<0.647	<0.869	<0.758	<0.157	2	100%	<0.647	<1.01	<0.874	<0.163	4	100%
Tetra	PCB 79	0.542	0.851	pg/L	<0.813	1.43	<1.122	<0.436	2	50%	<0.542	<0.728	<0.635	<0.132	2	100%	<0.542	1.43	<0.878	<0.385	4	75%
Tetra	PCB 80	0.576	0.925	pg/L	<0.864	<0.925	<0.895	<0.043	2	100%	<0.576	<0.774	<0.675	<0.140	2	100%	<0.576	<0.925	<0.785	<0.152	4	100%
Tetra	PCB 81	0.68	1.02	pg/L	<0.999	<1.02	<1.010	<0.015	2	100%	<0.68	<0.907	<0.794	<0.161	2	100%	<0.68	<1.02	<0.902	<0.156	4	100%
Penta	PCB 82	0.648	1.34	pg/L	4.19	8.63	6.41	3.14	2	0%	6.51	7.73	7.12	0.86	2	0%	4.19	8.63	6.77	1.92	4	0%
Penta	PCB 83/99	0.584	1.25	pg/L	23.00	37.90	30.50	10.50	2	0%	32.00	37.30	34.70	3.70	2	0%	23.00	37.90	32.60	6.90	4	0%
Penta	PCB 84	0.671	1.37	pg/L	11	18.6	14.8	5.4	2	0%	16.1	16.3	16.2	0.1	2	0%	11	18.6	15.5	3.2	4	0%
Penta	PCB 85/116/117	0.531	0.993	pg/L	7.66	11.3	9.48	2.57	2	0%	10.6	12.3	11.5	1.2	2	0%	7.66	12.3	10.47	2	4	0%
Penta	PCB 86/87/97/109/119/125	0.531	1.07	pg/L	28.7	52.8	40.8	17	2	0%	46.3	46.9	46.6	0.4	2	0%	28.7	52.8	43.7	10.4	4	0%
Penta	PCB 88/91	0.596	1.22	pg/L	4.43	7.89	6.16	2.45	2	0%	7.68	8.77	8.23	0.77	2	0%	4.43	8.77	7.19	1.9	4	0%
Penta	PCB 89	0.628	1.26	pg/L	<0.628	<1.26	<0.944	<0.447	2	100%	<0.711	<0.788	<0.750	<0.054	2	100%	<0.628	<1.26	<0.847	<0.283	4	100%
Penta	PCB 90/101/113	0.531	1.06	pg/L	42.50	73.70	58.10	22.10	2	0%	63.70	64.60	64.20	0.60	2	0%	42.50	73.70	61.10	13.20	4	0%
Penta	PCB 92	0.584	1.2	pg/L	7.80	12.20	10.00	3.10	2	0%	11.20	12.00	11.60	0.60	2	0%	7.80	12.20	10.80	2.00	4	0%
Penta	PCB 93/95/98/100/102	0.578	1.19	pg/L	33	61.6	47.3	20.2	2	0%	51.4	54.3	52.9	2.1	2	0%	33	61.6	50.1	12.2	4	0%
Penta	PCB 94	0.646	1.32	pg/L	<0.646	<1.32	<0.983	<0.477	2	100%	<0.748	<0.828	<0.788	<0.057	2	100%	<0.646	<1.32	<0.886	<0.299	4	100%
Penta	PCB 96	0.528	0.699	pg/L	<0.531	<0.699	<0.615	<0.119	2	100%	<0.528	<0.6	<0.564	<0.051	2	100%	<0.528	<0.699	<0.590	<0.080	4	100%
Penta	PCB 103	0.531	1.06	pg/L	<0.531	<1.06	<0.796	<0.374	2	100%	<0.6	<0.664	<0.632	<0.045	2	100%	<0.531	<1.06	<0.714	<0.237	4	100%
Penta	PCB 104	0.531	0.856	pg/L	<0.531	<0.856	<0.694	<0.230	2	100%	<0.624	<0.785	<0.705	<0.114	2	100%	<0.531	<0.856	<0.699	<0.148	4	100%
Penta	PCB 105	0.556	0.982	pg/L	14.00	26.50	20.30	8.80	2	0%	23.60	24.40	24.00	0.60	2	0%	14.00	26.50	22.10	5.60	4	0%
Penta	PCB 106	0.531	0.914	pg/L	<0.531	<0.914	<0.723	<0.271	2	100%	<0.692	<0.724	<0.708	<0.023	2	100%	<0.531	<0.914	<0.715	<0.157	4	100%
Penta	PCB 107	0.531	0.813	pg/L	1.03	4.19	2.61	2.23	2	0%	2.77	3.33	3.05	0.4	2	0%	1.03	4.19	2.83	1.33	4	0%
Penta	PCB 108/124	0.571	0.955	pg/L	1.38	3.03	2.21	1.17	2	0%	2.59	2.63	2.61	0.03	2	0%	1.38	3.03	2.41	0.71	4	0%
Penta	PCB 110/115	0.528	0.909	pg/L	45.7	78.1	61.9	22.9	2	0%	69.8	70.1	70	0.2	2	0%	45.7	78.1	65.9	14	4	0%
Penta	PCB 111	0.528	0.901	pg/L	<0.531	<0.901	<0.716	<0.262	2	100%	<0.528	<0.564	<0.546	<0.025	2	100%	<0.528	<0.901	<0.631	<0.181	4	100%
Penta	PCB 112	0.528	0.835	pg/L	<0.531	<0.835	<0.683	<0.215	2	100%	<0.528	<0.53	<0.529	<0.001	2	100%	<0.528	<0.835	<0.606	<0.153	4	100%
Penta	PCB 114	0.582	1.04	pg/L	<1.04	1.95	<1.50	<0.64	2	50%	1.34	1.59	1.47	0.18	2	0%	<1.04	1.95	<1.48	<0.39	4	25%
Penta	PCB 118	0.596	1.01	pg/L	37.5	64	50.8	18.7	2	0%	59.1	60.8	60	1.2	2	0%	37.5	64	55.4	12.1	4	0%
Penta	PCB 120	0.528	0.839	pg/L	<0.531	<0.839	<0.685	<0.218	2	100%	<0.528	<0.53	<0.529	<0.001	2	100%	<0.528	<0.839	<0.607	<0.155	4	100%
Penta	PCB 121	0.528	0.905	pg/L	<0.531	<0.905	<0.718	<0.264	2	100%	<0.567	0.809	<0.688	<0.171	2	50%	<0.531	<0.905	<0.703	<0.183	4	75%
Penta	PCB 122	0.61	0.986	pg/L	0.701	<0.986	<0.844	<0.202	2	50%	0.774	<0.782	<0.778	<0.006	2	50%	0.701	<0.986	<0.811	<0.122	4	50%

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3 Percent of samples with result less than detection limit

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]																	
					Combined Fractions [2]																	
					Grab						Composite						Total					
					Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]
Polychlorinated biphenyls (PCBs)																						
Hexa	PCB 130	0.874	1.42	pg/L	3.31	4.61	3.96	0.92	2	0%	3.24	3.56	3.4	0.23	2	0%	3.24	4.61	3.68	0.64	4	0%
Hexa	PCB 131	0.862	1.4	pg/L	1.3	<1.4	<1.4	<0.1	2	50%	<0.862	<0.995	<0.929	<0.094	2	100%	<0.862	<1.4	<1.139	<0.253	4	75%
Hexa	PCB 132	0.882	1.43	pg/L	12.40	22.90	17.70	7.40	2	0%	19.70	20.10	19.90	0.30	2	0%	12.40	22.90	18.80	4.50	4	0%
Hexa	PCB 133	0.825	1.34	pg/L	<1.34	1.43	<1.39	<0.06	2	50%	<0.825	1.29	<1.058	<0.329	2	50%	<0.825	1.43	<1.221	<0.270	4	50%
Hexa	PCB 134/143	0.84	1.37	pg/L	1.66	3.56	2.61	1.34	2	0%	2.61	3.17	2.89	0.4	2	0%	1.66	3.56	2.75	0.82	4	0%
Hexa	PCB 135/151/154	0.531	0.947	pg/L	13	17.9	15.5	3.5	2	0%	18.5	21.4	20	2.1	2	0%	13	21.4	17.7	3.5	4	0%
Hexa	PCB 136	0.528	0.741	pg/L	3.83	8.14	5.99	3.05	2	0%	7.01	7.14	7.08	0.09	2	0%	3.83	8.14	6.53	1.87	4	0%
Hexa	PCB 137	0.857	1.39	pg/L	3.05	3.14	3.1	0.06	2	0%	3.11	4.16	3.64	0.74	2	0%	3.05	4.16	3.37	0.53	4	0%
Hexa	PCB 139/140	0.753	1.22	pg/L	<1.22	1.28	<1.25	<0.04	2	50%	0.95	1.41	1.18	0.33	2	0%	0.95	1.41	<1.214	<0.196	4	25%
Hexa	PCB 141	0.764	1.24	pg/L	7.46	14.80	11.13	5.19	2	0%	10.10	10.70	10.40	0.40	2	0%	7.46	14.80	10.77	3.04	4	0%
Hexa	PCB 142	0.864	1.4	pg/L	<1.18	<1.4	<1.29	<0.16	2	100%	<0.864	<0.997	<0.931	<0.094	2	100%	<0.864	<1.4	<1.110	<0.233	4	100%
Hexa	PCB 144	0.531	0.956	pg/L	1.8	4.2	3	1.7	2	0%	3.02	3.07	3.05	0.04	2	0%	1.8	4.2	3.02	0.98	4	0%
Hexa	PCB 145	0.528	0.784	pg/L	<0.531	<0.784	<0.658	<0.179	2	100%	<0.528	<0.541	<0.535	<0.009	2	100%	<0.528	<0.784	<0.596	<0.125	4	100%
Hexa	PCB 146	0.707	1.15	pg/L	5.58	8.66	7.12	2.18	2	0%	6.65	10.2	8.43	2.51	2	0%	5.58	10.2	7.77	2.06	4	0%
Hexa	PCB 147/149	0.749	1.22	pg/L	30.2	49	39.6	13.3	2	0%	43.5	45.2	44.4	1.2	2	0%	30.2	49	42	8.2	4	0%
Hexa	PCB 148	0.531	0.98	pg/L	<0.531	<0.98	<0.756	<0.317	2	100%	<0.597	<0.676	<0.637	<0.056	2	100%	<0.531	<0.98	<0.696	<0.198	4	100%
Hexa	PCB 150	0.528	0.744	pg/L	<0.531	<0.744	<0.638	<0.151	2	100%	<0.53	0.53	<0.53	<0.00	2	50%	<0.53	<0.744	<0.584	<0.107	4	75%
Hexa	PCB 152	0.528	0.716	pg/L	<0.531	<0.716	<0.624	<0.131	2	100%	<0.528	<0.53	<0.529	<0.001	2	100%	<0.528	<0.716	<0.576	<0.093	4	100%
Hexa	PCB 153/168	0.631	1.02	pg/L	34.7	62.4	48.6	19.6	2	0%	56.6	82.6	69.6	18.4	2	0%	34.7	82.6	59.1	19.7	4	0%
Hexa	PCB 155	0.528	0.792	pg/L	2.4	2.55	2.48	0.11	2	0%	3.39	4.24	3.82	0.6	2	0%	2.4	4.24	3.15	0.85	4	0%
Hexa	PCB 156/157	0.777	1.29	pg/L	6.86	12.6	9.73	4.06	2	0%	8.28	9.9	9.09	1.15	2	0%	6.86	12.6	9.41	2.46	4	0%
Hexa	PCB 158	0.544	0.884	pg/L	2.94	8.11	5.53	3.66	2	0%	6.57	6.81	6.69	0.17	2	0%	2.94	8.11	6.11	2.22	4	0%
Hexa	PCB 159	0.57	0.926	pg/L	<0.775	<0.926	<0.851	<0.107	2	100%	<0.57	<0.658	<0.614	<0.062	2	100%	<0.57	<0.926	<0.732	<0.154	4	100%
Hexa	PCB 161	0.585	0.95	pg/L	<0.782	<0.95	<0.866	<0.119	2	100%	<0.585	<0.675	<0.630	<0.064	2	100%	<0.585	<0.95	<0.748	<0.157	4	100%
Hexa	PCB 162	0.576	0.936	pg/L	<0.799	<0.936	<0.868	<0.097	2	100%	<0.576	<0.665	<0.621	<0.063	2	100%	<0.576	<0.936	<0.744	<0.157	4	100%
Hexa	PCB 164	0.561	0.911	pg/L	2.99	6.28	4.64	2.33	2	0%	3.42	4.38	3.9	0.68	2	0%	2.99	6.28	4.27	1.46	4	0%
Hexa	PCB 165	0.657	1.07	pg/L	<0.902	<1.07	<0.986	<0.119	2	100%	<0.657	<0.758	<0.708	<0.071	2	100%	<0.657	<1.07	<0.847	<0.180	4	100%
Hexa	PCB 167	0.614	1	pg/L	1.27	3.54	2.41	1.61	2	0%	2.19	2.45	2.32	0.18	2	0%	1.27	3.54	2.36	0.93	4	0%
Hexa	PCB 169	0.632	1.01	pg/L	<0.816	<1.01	<0.913	<0.137	2	100%	<0.632	<0.71	<0.671	<0.055	2	100%	<0.632	<1.01	<0.792	<0.164	4	100%
Hepta	PCB 170	0.548	1.14	pg/L	6.13	13.60	9.87	5.28	2	0%	11.80	14.10	13.00	1.60	2	0%	6.13	14.10	11.41	3.65	4	0%
Hepta	PCB 171/173	0.531	1.26	pg/L	2.22	5.19	3.71	2.10	2	0%	3.86	4.09	3.98	0.16	2	0%	2.22	5.19	3.84	1.23	4	0%
Hepta	PCB 172	0.531	1.25	pg/L	<1.25	2.43	<1.84	<0.83	2	50%	1.48	1.52	1.5	0.03	2	0%	<1.25	2.43	<1.67	<0.52	4	25%
Hepta	PCB 174	0.531	1.13	pg/L	6.72	10.4	8.56	2.6	2	0%	10.9	11.7	11.3	0.6	2	0%	6.72	11.7	9.93	2.21	4	0%
Hepta	PCB 175	0.531	1.11	pg/L	0.594	<1.11	<0.852	<0.365	2	50%	<0.666	<0.718	<0.692	<0.037	2	100%	0.594	<1.11	<0.772	<0.231	4	75%
Hepta	PCB 176	0.528	0.857	pg/L	0.893	1.4	1.147	0.359	2	0%	2.1	2.31	2.21	0.15	2	0%	0.893	2.31	1.676	0.651	4	0%
Hepta	PCB 177	0.531	1.22	pg/L	5.04	6.4	5.72	0.96	2	0%	6.52	7.65	7.09	0.8	2	0%	5.04	7.65	6.4	1.07	4	0%

< Results reported less than detection limit

1 Range, mean, standard deviation, and number of samples (N) are provided. When results are less than the detection limit, the detection limit was used to calculate each statistical value

2 Solid and aqueous fractions of the samples were analyzed separately, results are presented as a total of both solid and aqueous fractions

3 Percent of samples with result less than detection limit

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]																	
					Combined Fractions [2]																	
					Grab						Composite						Total					
					Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]
Polychlorinated biphenyls (PCBs)																						
Hepta	PCB 183/185	0.531	1.1	pg/L	6.36	6.71	6.54	0.25	2	0%	8.14	10.9	9.52	1.95	2	0%	6.36	10.9	8.03	2.06	4	0%
Hepta	PCB 184	0.528	0.844	pg/L	2.32	4.00	3.16	1.19	2	0%	4.50	7.00	5.80	1.80	2	0%	2.32	7.00	4.46	1.94	4	0%
Hepta	PCB 186	0.531	0.934	pg/L	<0.531	<0.934	<0.733	<0.285	2	100%	<0.558	<0.602	<0.580	<0.031	2	100%	<0.531	<0.934	<0.656	<0.187	4	100%
Hepta	PCB 187	0.531	1.09	pg/L	11.8	13.8	12.8	1.4	2	0%	18.6	23.3	21	3.3	2	0%	11.8	23.3	16.9	5.1	4	0%
Hepta	PCB 188	0.531	0.918	pg/L	<0.531	<0.918	<0.725	<0.274	2	100%	<0.553	<0.6	<0.577	<0.033	2	100%	<0.531	<0.918	<0.651	<0.181	4	100%
Hepta	PCB 189	0.531	0.815	pg/L	<0.531	<0.815	<0.673	<0.201	2	100%	0.575	<0.61	<0.593	<0.025	2	50%	<0.531	<0.815	<0.633	<0.126	4	75%
Hepta	PCB 190	0.531	0.924	pg/L	2.22	2.36	2.29	0.10	2	0%	<0.596	2.90	<1.748	<1.629	2	50%	<0.596	2.90	<2.019	<0.993	4	25%
Hepta	PCB 191	0.53	0.887	pg/L	<0.531	<0.887	<0.709	<0.252	2	100%	<0.53	<0.572	<0.551	<0.030	2	100%	<0.53	<0.887	<0.630	<0.172	4	100%
Hepta	PCB 192	0.531	0.971	pg/L	<0.531	<0.971	<0.751	<0.311	2	100%	<0.58	<0.626	<0.603	<0.033	2	100%	<0.531	<0.971	<0.677	<0.200	4	100%
Octa	PCB 194	0.531	0.923	pg/L	2.89	4.74	3.82	1.31	2	0%	4.68	5.7	5.19	0.72	2	0%	2.89	5.7	4.5	1.17	4	0%
Octa	PCB 195	0.531	0.96	pg/L	1.19	1.39	1.29	0.14	2	0%	1.64	2.54	2.09	0.64	2	0%	1.19	2.54	1.69	0.60	4	0%
Octa	PCB 196	0.531	0.96	pg/L	0.828	1.21	1.019	0.27	2	0%	2.86	2.9	2.88	0.03	2	0%	0.828	2.9	1.95	1.086	4	0%
Octa	PCB 197/200	0.528	0.721	pg/L	0.57	0.76	0.66	0.13	2	0%	0.95	1.05	1.00	0.07	2	0%	0.57	1.05	0.83	0.21	4	0%
Octa	PCB 198/199	0.531	1.02	pg/L	4.12	5.07	4.60	0.67	2	0%	6.01	6.50	6.26	0.35	2	0%	4.12	6.50	5.43	1.05	4	0%
Octa	PCB 201	0.528	0.704	pg/L	<0.531	0.77	<0.649	<0.166	2	50%	0.63	0.91	0.77	0.20	2	0%	<0.531	0.91	<0.709	<0.164	4	25%
Octa	PCB 202	0.531	0.816	pg/L	0.98	1.19	1.08	0.15	2	0%	2.18	2.34	2.26	0.11	2	0%	0.98	2.34	1.67	0.69	4	0%
Octa	PCB 203	0.531	0.924	pg/L	1.4	3.4	2.4	1.5	2	0%	3.8	4.4	4.1	0.4	2	0%	1.4	4.4	3.2	1.3	4	0%
Octa	PCB 204	0.528	0.712	pg/L	<0.531	<0.712	<0.622	<0.128	2	100%	<0.528	<0.556	<0.542	<0.020	2		<0.528	<0.712	<0.582	<0.088	4	100%
Octa	PCB 205	0.531	0.793	pg/L	<0.531	<0.793	<0.662	<0.185	2	100%	<0.575	0.62	<0.596	<0.030	2	50%	<0.531	<0.793	<0.629	<0.115	4	75%
Nona	PCB 206	2.46	4.97	pg/L	3.54	<4.97	<4.26	<1.01	2	50%	<2.46	3.27	<2.87	<0.57	2	50%	<2.46	<4.97	<3.56	<1.05	4	50%
Nona	PCB 207	1.67	3.41	pg/L	<1.94	<3.41	<2.68	<1.04	2	100%	<1.67	<2.12	<1.90	<0.32	2	100%	<1.67	<3.41	<2.29	<0.77	4	100%
Nona	PCB 208	1.75	3.57	pg/L	<2.06	<3.57	<2.82	<1.07	2	100%	<1.75	<2.27	<2.01	<0.37	2	100%	<1.75	<3.57	<2.41	<0.80	4	100%
Deca	PCB 209	0.531	1.4	pg/L	3.87	3.92	3.9	0.04	2	0%	2.14	3.04	2.59	0.64	2	0%	2.14	3.92	3.24	0.84	4	0%

< Results reported less than detection limit

1 Range, mean, standard deviation, and number of samples (N) are provided. When results are less than the detection limit, the detection limit was used to calculate each statistical value

2 Solid and aqueous fractions of the samples were analyzed separately, results are presented as a total of both solid and aqueous fractions

3 Percent of samples with result less than detection limit

Analyte	Detection Limit	Units	Descriptive Statistics [1]																	
			Grab						Composite						Total [3]					
			Range		Mean	Stdev	N	%ND[2]	Range		Mean	Stdev	N	%ND[2]	Range		Mean	Stdev	N	%ND[2]
Pharmaceuticals																				
Acetaminophen	3	ng/L	12200	12200	12200	0	1	0%	20,700	20,700	20,700	0	1	0%	12,200	20,700	16,450	6,010	2	0%
Bisphenol A	5	ng/L	36.9	36.9	36.9	0	1	0%	25	25	25	0	1	0%	24.8	36.9	31	9	2	0%
Caffeine	100	ng/L	12600	12600	12600	0	1	0%	25,000	25,000	25,000	0	1	0%	12,600	25,000	18,800	8,768	2	0%
Clopidogrel	5	ng/L	14.1	14.1	14.1	0	1	0%	22.7	22.7	22.7	0	1	0%	14.1	22.7	18.4	6.1	2	0%
Diclofenac	1	ng/L	241	241	241	0	1	0%	368	368	368	0	1	0%	241	368	305	90	2	0%
Fluoxetine	20	ng/L	<20.0	<20.0	<20.0	<0.0	1	100%	<20.0	<20.0	<20.0	<0.0	1	100%	<20.0	<20.0	<20.0	<0.0	2	100%
Gemfibrozil	2	ng/L	4.4	4.4	4.4	0	1	0%	22.2	22.2	22.2	0	1	0%	4.4	22.2	13.3	12.6	2	0%
Ibuprofen	5	ng/L	905	905	905	0	1	0%	1760	1760	1760	0	1	0%	905	1760	1333	605	2	0%
Naproxen	5	ng/L	580	580	580	0	1	0%	1080	1080	1080	0	1	0%	580	1080	830	354	2	0%
Primidone	2	ng/L	10.3	10.3	10.3	0	1	0%	16.7	16.7	16.7	0	1	0%	10.3	16.7	13.5	4.5	2	0%
Sulfamethoxazole	1	ng/L	22.7	22.7	22.7	0	1	0%	42.6	42.6	42.6	0	1	0%	22.7	42.6	32.7	14.1	2	0%
Triclosan	20	ng/L	<20.0	<20.0	<20.0	<0.0	1	100%	46.4	46.4	46.4	0	1	0%	<20.0	46.4	<33.2	<18.7	2	50%
Trimethoprim	1	ng/L	22.8	22.8	22.8	0	1	0%	41.7	41.7	41.7	0	1	0%	22.8	41.7	32.3	13.4	2	0%
Organic Compounds																				
6PPD-Quinone	0.002	µg/L	0.0118	0.0118	0.0118	**	1	0%	**	**	**	**	**	**	**	**	**	**	**	**

** Not applicable
< Results reported less than detection limit

1 Range, mean, standard deviation, and number of samples (N) are provided. When results are less than the detection limit, the detection limit was used to calculate each statistical value

2 Percent of samples with result less than detection limit
3 Total includes both grab and composite

Analyte	Detection Limit	Units	Descriptive Statistics [1]																	
			Grab						Composite						Total [4]					
			Range		Mean	Stdev	N	%ND[3]	Range		Mean	Stdev	N	%ND[3]	Range		Mean	Stdev	N	%ND[3]
Microbiology [2]																				
Ecoli	1800-18000	MPN/100mls	232,000	567,000	358,000	142,000	4	0%	490,000	1,300,000	655,000	353,000	5	0%	232,000	1,300,000	501,000	318,000	9	0%
Enterococci	10-100	MPN/100mls	88,000	488,000	178,000	188,000	4	0%	33,000	579,000	150,000	211,000	5	0%	33,000	579,000	162,000	188,000	9	0%
Fecal Coliform	1800-18000	MPN/100mls	320,000	711,000	521,000	176,000	4	0%	490,000	4,347,000	1,064,000	1,609,000	5	0%	320,000	4,347,000	775,000	1,246,000	9	0%
Inorganic Chemistry and Physical																				
Biochemical Oxygen Demand	10	mg/L	28	41	36	6.0	4	0%	31	141	67	44	5	0%	28	141	53	35	9	0%
Chemical Oxygen Demand	20	mg/L	70	119	88	21	4	0%	76	338	184	103	5	0%	70	338	141	90	9	0%
Conductivity	1	µmho/cm	95	142	114	20	4	0%	109	179	146	26	5	0%	95	179	132	28	9	0%
Hardness as CACO3	0.2	mg/L	19.6	32.7	27.3	5.5	4	0%	25.6	39.7	31.9	5.9	5	0%	19.6	39.7	29.8	5.9	9	0%
Nitrogen - Ammonia as N	0.2	mg/L	1.7	2.8	2.30	0.50	4	0%	1.6	5.9	3.90	1.7	5	0%	1.6	5.9	3.2	1.5	9	0%
Nitrogen - Nitrate as N	0.01	mg/L	0.37	1.09	0.72	0.30	4	0%	<0.01	1.04	<0.53	<0.38	5	20%	<0.01	1.09	<0.61	<0.34	9	11%
Nitrogen - Nitrite as N	0.01	mg/L	0.02	0.03	0.03	0.01	4	0%	<0.01	0.06	<0.03	<0.02	5	20%	<0.01	0.06	<0.03	<0.02	9	11%
pH	0.1	PH	6.8	7.1	7.0	0.1	4	0%	7.1	7.2	7.1	0.1	5	0%	6.8	7.2	7.1	0.1	9	0%
Total Suspended Solids	3-10	mg/L	40	69	50	13	4	0%	35	232	127	85	5	0%	35	232	93	73	9	0%
Volatile Suspended Solids	3-10	mg/L	36	50	40	7	4	0%	32	214	111	82	5	0%	32	214	80	69	9	0%
Toxicity [5]																				
LC50 Rainbow Trout 96-h	**	%vol/vol	100	100	100	**	4	**	**	**	**	**	**	**	**	**	**	**	**	**
Total Metals																				
Aluminum Total	5	µg/L	170	708	360	238	4	0%	144	1030	579	319	5	0%	144	1030	481	292	9	0%
Arsenic Total	0.5	µg/L	<0.5	0.7	<0.7	<0.1	4	25%	<0.5	1.9	<1.4	<0.5	5	20%	<0.5	1.9	<1.0	<0.5	9	22%
Barium Total	0.5	µg/L	10.4	13.1	11.6	1.1	4	0%	14	19.1	16.4	1.8	5	0%	10.4	19.1	14.3	2.9	9	0%
Boron Total	10-100	µg/L	13	19	15	3	4	0%	14	130	45	49	5	0%	13	130	32	38	9	0%
Cadmium Total	0.2	µg/L	<0.2	<0.2	<0.2	<0.0	4	100%	<0.2	<0.2	<0.2	<0.0	5	100%	<0.2	<0.2	<0.2	<0.0	9	100%
Calcium Total	20-200	µg/L	6610	11300	9373	1976	4	0%	8630	13800	10754	2070	5	0%	6610	13800	10140	2034	9	0%
Chromium Total	0.5	µg/L	<0.5	1.2	<0.8	<0.3	4	25%	0.6	3.4	2.1	1.2	5	0%	<0.5	3.4	<1.5	<1.1	9	11%
Cobalt Total	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	4	100%	<0.5	<0.5	<0.5	<0.0	5	100%	<0.5	<0.5	<0.5	<0.0	9	100%
Copper Total	0.5	µg/L	10.3	15.2	12.9	2.0	4	0%	12.4	38.2	27.5	9.7	5	0%	10.3	38.2	21.0	10.4	9	0%
Iron Total	5	µg/L	164	649	351	209	4	0%	138	1180	671	370	5	0%	138	1180	529	337	9	0%
Lead Total	0.5	µg/L	0.7	1.3	1.0	0.3	4	0%	0.5	5.1	2.6	1.6	5	0%	0.5	5.1	1.9	1.4	9	0%
Magnesium Total	10	µg/L	756	1080	933	134	4	0%	971	1600	1226	259	5	0%	756	1600	1096	253	9	0%
Manganese Total	0.5	µg/L	11.2	16.4	13.6	2.3	4	0%	11.3	34	28.1	9.5	5	0%	11.2	34	21.7	10.3	9	0%
Mercury Total	0.05	µg/L	<0.05	<0.05	<0.05	<0.00	4	100%	<0.05	0.13	<0.08	<0.04	5	60%	<0.05	0.13	<0.06	<0.03	9	78%
Molybdenum Total	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	4	100%	<0.5	0.7	<0.6	<0.1	5	40%	<0.5	0.7	<0.5	<0.1	9	67%
Nickel Total	0.5	µg/L	<0.5	0.9	<0.7	<0.2	4	25%	0.6	1.8	1.2	0.4	5	0%	<0.5	1.8	<1.0	<0.4	9	11%
Phosphorus Total	20	µg/L	684	982	869	139	4	0%	554	2350	1377	722	5	0%	554	2350	1151	583	9	0%
Selenium Total	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	4	100%	<0.5	<0.5	<0.5	<0.0	5	100%	<0.5	<0.5	<0.5	<0.0	9	100%
Silver Total	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	4	100%	<0.5	<0.5	<0.5	<0.0	5	100%	<0.5	<0.5	<0.5	<0.0	9	100%
Sodium Total	50-500	µg/L	6120	9610	8240	1594	4	0%	7320	12500	10174	2107	5	0%	6120	12500	9314	2052	9	0%
Zinc Total	3	µg/L	22	29	25	3	4	0%	19	58	45	16	5	0%	19	58	36	15	9	0%
Dissolved Metals																				
Aluminium Dissolved	5	µg/L	20	27	24	3	4	0%	16	30	22	6	5	0%	16	30	23	5	9	0%
Arsenic Dissolved	0.5	µg/L	<0.5	0.6	<0.5	<0.1	4	75%	<0.5	1.4	<1.1	<0.4	5	20%	<0.5	1.4	<0.9	<0.4	9	44%
Barium Dissolved	0.5	µg/L	5.1	9.3	7.6	1.8	4	0%	6.0	12.1	8.4	2.3	5	0%	5.1	12.1	8.0	2.0	9	0%
Boron Dissolved	10-100	µg/L	13	20	16	3	4	0%	13	132	44	50	5	0%	13	132	32	38	9	0%
Cadmium Dissolved	0.2	µg/L	<0.2	<0.2	<0.2	<0.0	4	100%	<0.2	<0.2	<0.2	<0.0	5	100%	<0.2	<0.2	<0.2	<0.0	9	100%
Calcium Dissolved	20-200	µg/L	5700	10200	8475	1935	4	0%	7030	12900	9246	2358	5	0%	5700	12900	8903	2085	9	0%
Chromium Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	4	100%	<0.5	1	<0.7	<0.2	5	20%	<0.5	1	<0.6	<0.2	9	56%
Cobalt Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	4	100%	<0.5	<0.5	<0.5	<0.0	5	100%	<0.5	<0.5	<0.5	<0.0	9	100%
Copper Dissolved	0.5	µg/L	5.4	6.3	5.9	0.4	4	0%	7.6	10	8.7	1.2	5	0%	5.4	10	7.5	1.7	9	0%
Iron Dissolved	5	µg/L	26	33	28	3	4	0%	29	61	45	15	5	0%	26	61	37	14	9	0%
Lead Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	4	100%	<0.5	<0.5	<0.5	<0.0	5	100%	<0.5	<0.5	<0.5	<0.0	9	100%
Magnesium Dissolved	10	µg/L	540	984	795	185	4	0%	567	1220	919	288	5	0%	540	1220	864	242	9	0%
Manganese Dissolved	0.5	µg/L	6.1	9	7.3	1.2	4	0%	8.7	17.2	12.8	4.0	5	0%	6.1	17.2	10.3	4.1	9	0%
Molybdenum Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	4	100%	<0.5	0.6	<0.5	<0.0	5	80%	<0.5	0.6	<0.5	<0.0	9	89%
Nickel Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	4	100%	<0.5	0.6	<0.5	<0.0	5	60%	<0.5	0.6	<0.5	<0.0	9	78%
Phosphorus Dissolved	20	µg/L	361	543	465	83	4	0%	305	673	428	147	5	0%	305	673	444	117	9	0%
Selenium Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	4	100%	<0.5	<0.5	<0.5	<0.0	5	100%	<0.5	<0.5	<0.5	<0.0	9	100%
Silver Dissolved	0.5	µg/L	<0.5	<0.5	<0.5	<0.0	4	100%	<0.5	<0.5	<0.5	<0.0	5	100%	<0.5	<0.5	<0.5	<0.0	9	100%
Sodium Dissolved	50	µg/L	7310	9290	8398	1028	4	0%	6840	11900	9732	2078	5	0%	6840	11900	9139	1746	9	0%
Zinc Dissolved	3	µg/L	12	15	13	1	4	0%	12	27	18	6	5	0%	12	27	16	5	9	0%

** Not applicable

< Results reported less than detection limit

1 Range, mean (geomean for microbiology), standard deviation, and number of samples (N) are provided. When results are less than (greater than for microbiology) the detection limit, the detection limit was used to calculate each statistical value

2 Every sample for microbiology was collected with a duplicate, the result reported is the geomean of duplicates

3 Percent of samples with result less than detection limit

4 Total includes both grab and composite

5 LC50 results represent % survival, results show 0% mortality throughout test

Analyte	Detection Limit	Units	Descriptive Statistics [1]					
			Grab					
			Range		Mean	Stdev	N	%ND [2]
Volatile petroleum hydrocarbons								
1,1,1,2-Tetrachloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	4	100%
1,1,1-Trichloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	4	100%
1,1,2,2-Tetrachloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	4	100%
1,1,2-Trichloro/1,2,2-Trifluoroethane	2.0	µg/L	<2.0	<2.0	<2.0	**	4	100%
1,1,2-Trichloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	4	100%
1,1-Dichloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	4	100%
1,1-Dichloroethylene	0.50	µg/L	<0.50	<0.50	<0.50	**	4	100%
1,2,3-Trichlorobenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	4	100%
1,2,4-Trichlorobenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	4	100%
1,2-Dibromoethane	0.20	µg/L	<0.20	<0.20	<0.20	**	4	100%
1,2-Dichlorobenzene	0.50	µg/L	<0.50	<0.50	<0.50	**	4	100%
1,2-Dichloroethane	0.50	µg/L	<0.50	<0.50	<0.50	**	4	100%
1,2-Dichloropropane	0.50	µg/L	<0.50	<0.50	<0.50	**	4	100%
1,3,5-Trimethylbenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	4	100%
1,3-Butadiene	0.50	µg/L	<0.50	<0.50	<0.50	**	4	100%
1,3-Dichlorobenzene	0.50	µg/L	<0.50	<0.50	<0.50	**	4	100%
1,3-Dichloropropane	1.0	µg/L	<1.0	<1.0	<1.0	**	4	100%
1,4-Dichlorobenzene	0.50	µg/L	<0.50	<0.50	<0.50	**	4	100%
Benzene	0.40	µg/L	<0.40	<0.40	<0.40	**	4	100%
Bromobenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	4	100%
Bromodichloromethane	1.0	µg/L	<1.0	<1.0	<1.0	**	4	100%
Bromoform	1.0	µg/L	<1.0	<1.0	<1.0	**	4	100%
Bromomethane	1.0	µg/L	<1.0	<1.0	<1.0	**	4	100%
Carbon Tetrachloride	0.50	µg/L	<0.50	<0.50	<0.50	**	4	100%
Chlorobenzene	0.50	µg/L	<0.50	<0.50	<0.50	**	4	100%
Chloroethane	1.0	µg/L	<1.0	<1.0	<1.0	**	4	100%
Chloroform	1.0	µg/L	1.3	1.7	1.5	**	4	0%
Chloromethane	1.0	µg/L	<1.0	<1.0	<1.0	**	4	100%
cis-1,2-Dichloroethylene	1.0	µg/L	<1.0	<1.0	<1.0	**	4	100%
cis-1,3-Dichloropropylene	1.0	µg/L	<1.0	<1.0	<1.0	**	4	100%
Dibromochloromethane	1.0	µg/L	<1.0	<1.0	<1.0	**	4	100%
Dichlorodifluoromethane	2.0	µg/L	<2.0	<2.0	<2.0	**	4	100%
Dichloromethane	2.0	µg/L	<2.0	<2.0	<2.0	**	4	100%
Ethylbenzene	0.40	µg/L	<0.40	<0.40	<0.40	**	4	100%
Hexachlorobutadiene	0.50	µg/L	<0.50	<0.50	<0.50	**	4	100%
Isopropylbenzene	2.0	µg/L	<2.0	<2.0	<2.0	**	4	100%
m- & p-Xylene	0.40	µg/L	<0.40	<0.40	<0.40	**	4	100%
Methyl t-butyl ether (MTBE)	4.0	µg/L	<4.0	<4.0	<4.0	**	4	100%
o-Xylene	0.40	µg/L	<0.40	<0.40	<0.40	**	4	100%
Styrene	0.50	µg/L	<0.50	<0.50	<0.50	**	4	100%
Tetrachloroethylene	0.50	µg/L	<0.50	<0.50	<0.50	**	4	100%
Toluene	0.40	µg/L	<0.40	<0.40	<0.40	**	4	100%
trans-1,2-Dichloroethylene	1.0	µg/L	<1.0	<1.0	<1.0	**	4	100%
trans-1,3-Dichloropropylene	1.0	µg/L	<1.0	<1.0	<1.0	**	4	100%
Trichloroethylene	0.50	µg/L	<0.50	<0.50	<0.50	**	4	100%
Trichlorofluoromethane	4.0	µg/L	<4.0	<4.0	<4.0	**	4	100%
VH (C6-C10) [3]	300	µg/L	<300	<300	<300	**	4	100%
Vinyl Chloride	0.50	µg/L	<0.50	<0.50	<0.50	**	4	100%
VPH (C6-10) - BTEX [4]	300	µg/L	<300	<300	<300	**	4	100%
Xylenes	0.40	µg/L	<0.40	<0.40	<0.40	**	4	100%

Analyte		Detection Limit	Units	Descriptive Statistics [1]					
				Grab					
				Range		Mean	Stdev	N	%ND [2]
Extractable petroleum hydrocarbons									
LEPH (C10-C19 less PAH) [5]		0.20	mg/L	<0.20	<0.20	<0.20	**	3	100%
HEPH (C19-C32 less PAH) [6]		0.20	mg/L	0.57	0.90	0.73	0.17	3	0%
EPH (C10-C19)		0.20	mg/L	<0.20	<0.20	<0.20	**	3	100%
EPH (C19-C32)		0.20	mg/L	0.57	0.90	0.73	0.17	3	0%
Polycyclic aromatic hydrocarbons (PAH)									
Low molecular weight PAHs (LPAH)	2-Methylnaphthalene [7]	0.10	µg/L	<0.10	<0.10	<0.10	**	4	100%
	Phenanthrene	0.020	µg/L	<0.020	<0.020	<0.020	**	4	100%
	Acenaphthene	0.050	µg/L	<0.050	<0.050	<0.050	**	4	100%
	Acenaphthylene	0.050	µg/L	<0.050	<0.050	<0.050	**	4	100%
	Anthracene	0.010	µg/L	<0.010	<0.010	<0.010	**	4	100%
	Acridine [8]	0.050	µg/L	<0.050	<0.050	<0.050	**	4	100%
	Fluorene	0.050	µg/L	<0.050	<0.050	<0.050	**	4	100%
	Naphthalene	0.10	µg/L	<0.10	<0.10	<0.10	**	4	100%
	Quinoline [8]	0.050	µg/L	<0.050	<0.050	<0.050	**	4	100%
	Total LPAHs	0.10	µg/L	<0.10	<0.10	<0.10	**	4	100%
High molecular weight PAHs (HPAH)	Benz[a]anthracene	0.010	µg/L	<0.010	<0.010	<0.010	**	4	100%
	Benzo[a]pyrene	0.0050	µg/L	<0.0050	<0.0050	<0.0050	**	4	100%
	Benzo[b+j]fluoranthene	0.030	µg/L	<0.030	<0.030	<0.030	**	4	100%
	Benzo[g,h,i]perylene	0.050	µg/L	<0.050	<0.050	<0.050	**	4	100%
	Benzo[k]fluoranthene	0.050	µg/L	<0.050	<0.050	<0.050	**	4	100%
	Chrysene	0.020	µg/L	<0.020	<0.020	<0.020	**	4	100%
	Dibenz[a,h]anthracene	0.0030	µg/L	<0.0030	0.005	<0.0035	**	4	75%
	Fluoranthene	0.020	µg/L	<0.020	<0.020	<0.020	**	4	100%
	Indeno[1,2,3-c,d]pyrene	0.050	µg/L	<0.050	<0.050	<0.050	**	4	100%
	Pyrene	0.020	µg/L	<0.020	<0.020	<0.020	**	4	100%
	Total HPAHs	0.050	µg/L	<0.050	<0.050	<0.050	**	4	100%
Total PAH = LPAH + HPAH		0.10	µg/L	<0.10	<0.10	<0.10	**	4	100%

** Not applicable
< Results reported less than detection limit
1 Range, mean (geomean for microbiology), standard deviation, and number of samples (N) are provided. When results are less than (greater than for microbiology) the detection limit, the detection limit was used to caculate each statistical value
2 Percent of samples with result less than detection limit
3 Volatile Hydrocarbons containing all petroleum hydrocarbons in the carbon range of C6-C10, including BTEX and Styrene
4 Volatile Petroleum Hydrocarbons containing all pretroleum hydrocarbons in the carbon range of C6-C10 minus BTEX
5 LEPH = Light Extractable Petroleum Hydrocarbons
6 HEPH = Heavy Extractable Petroleum Hydrocarbons
7 Alkylated Low Molecular Weight PAHs
8 N-Heterocycle Low Molecular Weight PAHs

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]																	
					Combined Fractions [2]																	
					Grab						Composite						Total					
					Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]
Polybrominated diphenyl ethers (PBDEs)																						
Di	PBDE 7	1.04	1.59	pg/L	<1.04	<1.04	<1.04	**	1	100%	<1.04	<1.59	<1.22	<0.32	3	100%	<1.04	<1.59	<1.18	<0.28	4	100%
Di	PBDE 8/11	1.04	1.25	pg/L	1.48	1.48	1.48	**	1	0%	1.39	3.21	2.17	0.94	3	0%	1.39	3.21	2	0.84	4	0%
Di	PBDE 10	1.04	1.83	pg/L	<1.04	<1.04	<1.04	**	1	100%	<1.04	<1.83	<1.30	<0.46	3	100%	<1.04	<1.83	<1.24	<0.40	4	100%
Di	PBDE 12/13	1.04	1.05	pg/L	1.89	1.89	1.89	**	1	0%	1.64	2.34	1.94	0.36	3	0%	1.64	2.34	1.93	0.29	4	0%
Di	PBDE 15	1.04	1.04	pg/L	5.88	5.88	5.88	**	1	0%	7.2	13.5	9.43	3.53	3	0%	5.88	13.5	8.54	3.39	4	0%
Tri	PBDE 17/25	1.04	2.38	pg/L	33.80	33.80	33.80	**	1	0%	32.30	61.10	42.50	16.10	3	0%	32.30	61.10	40.30	13.90	4	0%
Tri	PBDE 28/33	1.04	2.3	pg/L	95.50	95.50	95.50	**	1	0%	76.70	170.00	108.40	53.40	3	0%	76.70	170.00	105.20	44.10	4	0%
Tri	PBDE 30	1.04	2.54	pg/L	<1.04	<1.04	<1.04	**	1	100%	<1.04	<2.54	<1.63	<0.80	3	100%	<1.04	<2.54	<1.49	<0.72	4	100%
Tri	PBDE 32	1.04	1.96	pg/L	<1.04	<1.04	<1.04	**	1	100%	<1.04	<1.96	<1.35	<0.53	3	100%	<1.04	<1.96	<1.27	<0.46	4	100%
Tri	PBDE 35	1.04	1.71	pg/L	1.34	1.34	1.34	**	1	0%	1.82	2.82	2.3	0.5	3	0%	1.34	2.82	2.06	0.63	4	0%
Tri	PBDE 37	1.04	1.62	pg/L	5.75	5.75	5.75	**	1	0%	5.88	7.42	6.8	0.81	3	0%	5.75	7.42	6.54	0.85	4	0%
Tetra	PBDE 47	1.04	1.04	pg/L	4960.00	4960.00	4960.00	**	1	0%	3170.00	6310.00	4503.00	1623.00	3	0%	3170.00	6310.00	4618.00	1344.00	4	0%
Tetra	PBDE 49	1.29	1.59	pg/L	156.00	156.00	156.00	**	1	0%	106.00	219.00	149.00	61.00	3	0%	106.00	219.00	151.00	50.00	4	0%
Tetra	PBDE 51	1.04	1.16	pg/L	25.6	25.60	25.6	**	1	0%	12.7	25.50	17.6	6.9	3	0%	12.7	25.60	19.6	6.9	4	0%
Tetra	PBDE 66	1.32	1.96	pg/L	106	106	106	**	1	0%	72.6	120	103.9	27.1	3	0%	72.6	120	104.4	22.1	4	0%
Tetra	PBDE 71	1.33	1.51	pg/L	16.7	16.7	16.7	**	1	0%	11.8	22.8	15.7	6.1	3	0%	11.8	22.8	16	5	4	0%
Tetra	PBDE 75	1.04	1.19	pg/L	9.53	9.53	9.53	**	1	0%	4.02	10.5	7.54	3.28	3	0%	4.02	10.5	8.04	2.85	4	0%
Tetra	PBDE 77	1.04	1.1	pg/L	1.42	1.42	1.42	**	1	0%	<1.1	2.27	<1.61	<0.60	3	33%	<1.1	2.27	<1.57	<0.50	4	25%
Tetra	PBDE 79	1.04	1.21	pg/L	5.93	5.93	5.93	**	1	0%	4.6	36.5	15.46	18.22	3	0%	4.6	36.5	13.08	15.62	4	0%
Penta	PBDE 85	3.93	79.1	pg/L	219.00	219.00	219.00	**	1	0%	131.00	242.00	189.00	56.00	3	0%	131.00	242.00	197.00	48.00	4	0%
Penta	PBDE 99	3.06	59.1	pg/L	5290	5290	5290	**	1	0%	2950	5850	4733	1561	3	0%	2950	5850	4873	1304	4	0%
Penta	PBDE 100	2.27	40.9	pg/L	1070	1070	1070	**	1	0%	601	1170	930	295	3	0%	601	1170	965	251	4	0%
Penta	PBDE 105	5.14	100	pg/L	<5.14	<5.14	<5.14	**	1	100%	<8.32	<100	<41.77	<50.61	3	100%	<5.14	<100	<32.62	<45.20	4	100%
Penta	PBDE 116	7.13	128	pg/L	35.1	35.1	35.1	**	1	0%	91.1	254	<157.7	<85.4	3	33%	35.1	254	<127.1	<92.9	4	25%
Penta	PBDE 119/120	4.84	92	pg/L	10.70	10.70	10.70	**	1	0%	16.60	<92	<48.2	<39.2	3	33%	10.70	<92	<38.8	<37.1	4	25%
Penta	PBDE 126	2.57	62.2	pg/L	<2.57	<2.57	<2.57	**	1	100%	<4.6	<62.2	<25.3	<32.0	3	100%	<2.57	<62.2	<19.62	<28.52	4	100%
Hexa	PBDE 128	4.56	57.3	pg/L	<18.7	<18.7	<18.7	**	1	100%	<4.56	<57.3	<23.83	<29.10	3	100%	<4.56	<57.3	<22.55	<23.90	4	100%
Hexa	PBDE 138/166	4.35	8.2	pg/L	63.7	63.70	63.7	**	1	0%	35.3	63.80	53.5	15.8	3	0%	35.3	63.80	56.1	13.9	4	0%
Hexa	PBDE 140	3.55	6.71	pg/L	17.3	17.3	17.3	**	1	0%	13.5	28.4	20.7	7.5	3	0%	13.5	28.4	19.8	6.3	4	0%
Hexa	PBDE 153	3.58	6.65	pg/L	455.00	455.00	455.00	**	1	0%	266.00	572.00	466.00	173.00	3	0%	266.00	572.00	463.00	141.00	4	0%
Hexa	PBDE 154	3.1	7.61	pg/L	336.00	336.00	336.00	**	1	0%	182.00	369.00	303.00	105.00	3	0%	182.00	369.00	312.00	87.00	4	0%
Hexa	PBDE 155	2.6	4.91	pg/L	40.90	40.90	40.90	**	1	0%	16.40	33.60	26.00	8.80	3	0%	16.40	40.90	29.70	10.30	4	0%
Hepta	PBDE 181	2.18	16.9	pg/L	<2.18	<2.18	<2.18	**	1	100%	<5.82	<16.9	<11.84	<5.60	3	100%	<2.18	<16.9	<9.43	<6.65	4	100%
Hepta	PBDE 183	1.48	12.6	pg/L	78.20	78.20	78.20	**	1	0%	100.00	524.00	300.00	213.00	3	0%	78.20	524.00	244.30	206.20	4	0%
Hepta	PBDE 190	3.58	27	pg/L	5.28	5.28	5.28	**	1	0%	11.8	42.4	27.3	15.3	3	0%	5.28	42.4	21.82	16.67	4	0%
Octa	PBDE 203	7.88	66.2	pg/L	34.30	34.30	34.30	**	1	0%	116.00	301.00	178.00	107.00	3	0%	34.30	301.00	141.80	112.90	4	0%
Nona	PBDE 206	6.34	32.4	pg/L	302.00	302.00	302.00	**	1	0%	599.00	3870.00	1785.00	1811.00	3	0%	302.00	3870.00	1415.00	1654.00	4	0%
Nona	PBDE 207	9.23	47.1	pg/L	325.00	325.00	325.00	**	1	0%	886.00	2580.00	1489.00	947.00	3	0%	325.00	2580.00	1198.00	968.00	4	0%
Nona	PBDE 208	9.35	47.7	pg/L	198.00	198.00	198.00	**	1	0%	456.00	1580.00	882.00	609.00	3	0%	198.00	1580.00	711.00	604.00	4	0%
Deca	PBDE 209	51.7	114	pg/L	4260.0	4260.0	4260.0	**	1	0%	12500.0	81400.0	39733.0	36648.0	3	0%	4260.0	81400.0	30865.0	34784.0	4	0%

< Results reported less than detection limit

1 Range, mean, standard deviation, and number of samples (N) are provided. When results are less than the detection limit, the detection limit was used to calculate each statistical value

2 Solid and aqueous fractions of the samples were analyzed separately, results are presented as a total of both solid and aqueous fractions

3 Percent of samples with result less than detection limit

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]																	
					Combined Fractions [2]																	
					Grab						Composite						Total					
					Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]
Polychlorinated biphenyls (PCBs)																						
Mono	PCB 1	0.52	0.67	pg/L	3.92	3.92	3.92	**	1	0%	6.6	50.8	23.1	24.1	3	0%	3.92	50.8	18.31	21.92	4	0%
Mono	PCB 2	0.518	0.522	pg/L	3.85	3.85	3.85	**	1	0%	5.01	9.11	7.21	2.07	3	0%	3.85	9.11	6.37	2.38	4	0%
Mono	PCB 3	0.518	0.522	pg/L	5.2	5.2	5.2	**	1	0%	7.29	18.2	11.29	6.01	3	0%	5.2	18.2	9.77	5.77	4	0%
Di	PCB 4	1.79	2.2	pg/L	3.87	3.87	3.87	**	1	0%	6.3	7.56	7.03	0.65	3	0%	3.87	7.56	6.24	1.67	4	0%
Di	PCB 5	1.16	1.47	pg/L	<1.25	<1.25	<1.25	**	1	100%	<1.16	<1.47	<1.30	<0.16	3	100%	<1.16	<1.47	<1.29	<0.13	4	100%
Di	PCB 6	1.01	1.27	pg/L	2.72	2.72	2.72	**	1	0%	4.51	8.09	5.73	2.05	3	0%	2.72	8.09	4.98	2.25	4	0%
Di	PCB 7	1.04	1.3	pg/L	<1.12	<1.12	<1.12	**	1	100%	1.47	3.04	2.33	0.79	3	0%	<1.12	3.04	<2.03	<0.89	4	25%
Di	PCB 8	0.906	1.14	pg/L	7.18	7.18	7.18	**	1	0%	12.7	19.8	15.4	3.9	3	0%	7.18	19.8	13.32	5.17	4	0%
Di	PCB 9	0.967	1.22	pg/L	<1.04	<1.04	<1.04	**	1	100%	1.11	1.48	1.28	0.19	3	0%	<1.04	1.48	<1.22	<0.19	4	25%
Di	PCB 10	0.987	1.24	pg/L	<1.06	<1.06	<1.06	**	1	100%	<0.987	<1.24	<1.102	<0.128	3	100%	<0.987	<1.24	<1.092	<0.107	4	100%
Di	PCB 11	1.1	1.38	pg/L	83.6	83.6	83.6	**	1	0%	150	189	173	20	3	0%	83.6	189	150.4	47.5	4	0%
Di	PCB 12/13	1.06	1.34	pg/L	2.45	2.45	2.45	**	1	0%	4.52	6.13	5.08	0.91	3	0%	2.45	6.13	4.42	1.51	4	0%
Di	PCB 14	1.06	1.33	pg/L	<1.14	<1.14	<1.14	**	1	100%	<1.06	<1.33	<1.18	<0.14	3	100%	<1.06	<1.33	<1.17	<0.11	4	100%
Di	PCB 15	1.13	1.54	pg/L	5.41	5.41	5.41	**	1	0%	9.31	11.70	10.28	1.26	3	0%	5.41	11.70	9.06	2.64	4	0%
Tri	PCB 16	0.518	0.522	pg/L	5.39	5.39	5.39	**	1	0%	7.85	13	9.76	2.82	3	0%	5.39	13	8.67	3.17	4	0%
Tri	PCB 17	0.518	0.522	pg/L	5.02	5.02	5.02	**	1	0%	7.31	12.9	9.61	2.93	3	0%	5.02	12.9	8.46	3.31	4	0%
Tri	PCB 18/30	0.518	0.522	pg/L	11.5	11.5	11.5	**	1	0%	16.6	26.8	20.7	5.4	3	0%	11.5	26.8	18.4	6.4	4	0%
Tri	PCB 19	0.518	0.565	pg/L	2.3	2.3	2.3	**	1	0%	3	4.14	3.5	0.58	3	0%	2.3	4.14	3.2	0.77	4	0%
Tri	PCB 20/28	0.518	0.522	pg/L	21.6	21.6	21.6	**	1	0%	28	53.7	38.6	13.4	3	0%	21.6	53.7	34.3	13.9	4	0%
Tri	PCB 21/33	0.518	0.522	pg/L	11.90	11.90	11.90	**	1	0%	16.60	30.30	21.70	7.50	3	0%	11.90	30.30	19.20	7.80	4	0%
Tri	PCB 22	0.518	0.522	pg/L	8.9	8.9	8.9	**	1	0%	11.8	21	15.4	4.9	3	0%	8.9	21	13.8	5.2	4	0%
Tri	PCB 23	0.518	0.522	pg/L	<0.521	<0.521	<0.521	**	1	100%	<0.518	<0.522	<0.520	<0.002	3	100%	<0.518	<0.522	<0.520	<0.002	4	100%
Tri	PCB 24	0.518	0.522	pg/L	<0.521	<0.521	<0.521	**	1	100%	<0.518	<0.522	<0.520	<0.002	3	100%	<0.518	<0.522	<0.520	<0.002	4	100%
Tri	PCB 25	0.518	0.522	pg/L	1.53	1.53	1.53	**	1	0%	2.14	3.39	2.62	0.68	3	0%	1.53	3.39	2.35	0.77	4	0%
Tri	PCB 26/29	0.518	0.522	pg/L	3.41	3.41	3.41	**	1	0%	4.81	7.25	5.68	1.36	3	0%	3.41	7.25	5.11	1.59	4	0%
Tri	PCB 27	0.518	0.522	pg/L	0.79	0.79	0.79	**	1	0%	1.31	2.23	1.68	0.49	3	0%	0.79	2.23	1.46	0.60	4	0%
Tri	PCB 31	0.518	0.522	pg/L	19.2	19.2	19.2	**	1	0%	23.9	50.6	34.6	14.1	3	0%	19.2	50.6	30.8	13.9	4	0%
Tri	PCB 32	0.518	0.522	pg/L	4.04	4.04	4.04	**	1	0%	4.79	7.93	6.03	1.67	3	0%	4.04	7.93	5.54	1.69	4	0%
Tri	PCB 34	0.518	0.522	pg/L	<0.521	<0.521	<0.521	**	1	100%	<0.518	<0.522	<0.520	<0.002	3	100%	<0.518	<0.522	<0.520	<0.002	4	100%
Tri	PCB 35	0.518	0.522	pg/L	2.89	2.89	2.89	**	1	0%	5.79	7.72	7.02	1.07	3	0%	2.89	7.72	5.99	2.24	4	0%
Tri	PCB 36	0.518	0.522	pg/L	0.72	0.72	0.72	**	1	0%	1.45	1.86	1.64	0.21	3	0%	0.72	1.86	1.41	0.49	4	0%
Tri	PCB 37	0.518	0.522	pg/L	6.91	6.91	6.91	**	1	0%	9.99	13.80	11.50	2.03	3	0%	6.91	13.80	10.35	2.83	4	0%
Tri	PCB 38	0.518	0.522	pg/L	<0.521	<0.521	<0.521	**	1	100%	<0.518	<0.522	<0.520	<0.002	3	100%	<0.518	<0.522	<0.520	<0.002	4	100%
Tri	PCB 39	0.518	0.522	pg/L	<0.521	<0.521	<0.521	**	1	100%	<0.518	0.56	<0.533	<0.025	3	67%	<0.518	0.56	<0.530	<0.021	4	75%
Tetra	PCB 40/41/71	0.518	0.522	pg/L	11.8	11.80	11.8	**	1	0%	17.4	31.40	23.6	7.1	3	0%	11.8	31.40	20.7	8.3	4	0%
Tetra	PCB 42	0.518	0.522	pg/L	5.12	5.12	5.12	**	1	0%	7.67	13.3	10.11	2.89	3	0%	5.12	13.3	8.86	3.43	4	0%
Tetra	PCB 43	0.518	0.522	pg/L	0.858	0.858	0.858	**	1	0%	1.48	2.49	1.87	0.54	3	0%	0.858	2.49	1.617	0.673	4	0%
Tetra	PCB 44/47/65	0.518	0.522	pg/L	37	37	37	**	1	0%	60.8	153	108.6	46.2	3	0%	37	153	91	52	4	0%
Tetra	PCB 45/51	0.518	0.522	pg/L	5.96	5.96	5.96	**	1	0%	8.75	22.9	16.45	7.16	3	0%	5.96	22.9	13.83	7.85	4	0%
Tetra	PCB 46	0.518	0.522	pg/L	1.32	1.32	1.32	**	1	0%	1.61	2.97	2.26	0.68	3	0%	1.32	2.97	2.03	0.73	4	0%
Tetra	PCB 48	0.518	0.522	pg/L	4.76	4.76	4.76	**	1	0%	6.70	11.00	8.51	2.23	3	0%	4.76	11.00	7.57	2.61	4	0%
Tetra	PCB 49/69	0.518	0.522	pg/L	14.6	14.6	14.6	**	1	0%	21.9	36.2	29.3	7.2	3	0%	14.6	36.2	25.6	9.4	4	0%

< Results reported less than detection limit

1 Range, mean, standard deviation, and number of samples (N) are provided. When results are less than the detection limit, the detection limit was used to calculate each statistical value

2 Solid and aqueous fractions of the samples were analyzed separately, results are presented as a total of both solid and aqueous fractions

3 Percent of samples with result less than detection limit

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]																	
					Combined Fractions [2]																	
					Grab						Composite						Total					
					Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]
Polychlorinated biphenyls (PCBs)																						
Tetra	PCB 57	0.52	0.529	pg/L	<0.521	<0.521	<0.521	**	1	100%	<0.52	<0.529	<0.524	<0.005	3	100%	<0.52	<0.529	<0.523	<0.004	4	100%
Tetra	PCB 58	0.52	0.556	pg/L	<0.521	<0.521	<0.521	**	1	100%	<0.52	<0.556	<0.542	<0.019	3	100%	<0.52	<0.556	<0.537	<0.019	4	100%
Tetra	PCB 59/62/75	0.518	0.522	pg/L	1.9	1.9	1.9	**	1	0%	2.94	4.65	3.6	0.92	3	0%	1.9	4.65	3.18	1.13	4	0%
Tetra	PCB 60	0.52	0.583	pg/L	7.32	7.32	7.32	**	1	0%	9.00	15.90	12.30	3.50	3	0%	7.32	15.90	11.08	3.77	4	0%
Tetra	PCB 61/70/74/76	0.518	0.522	pg/L	55.60	55.60	55.60	**	1	0%	77.60	133.00	107.50	28.00	3	0%	55.60	133.00	94.60	34.60	4	0%
Tetra	PCB 63	0.52	0.547	pg/L	1.09	1.09	1.09	**	1	0%	1.31	2.27	1.78	0.48	3	0%	1.09	2.27	1.61	0.52	4	0%
Tetra	PCB 64	0.518	0.522	pg/L	11.7	11.7	11.7	**	1	0%	17.2	28.6	22.6	5.7	3	0%	11.7	28.6	19.9	7.2	4	0%
Tetra	PCB 66	0.52	0.547	pg/L	23.50	23.50	23.50	**	1	0%	30.80	56.00	43.50	12.60	3	0%	23.50	56.00	38.50	14.30	4	0%
Tetra	PCB 67	0.518	0.522	pg/L	0.635	0.635	0.635	**	1	0%	0.836	1.29	1.019	0.239	3	0%	0.635	1.29	0.923	0.274	4	0%
Tetra	PCB 68	0.518	0.523	pg/L	2.62	2.62	2.62	**	1	0%	3.96	27.50	13.76	12.26	3	0%	2.62	27.50	10.97	11.45	4	0%
Tetra	PCB 72	0.518	0.522	pg/L	<0.521	<0.521	<0.521	**	1	100%	<0.518	<0.522	<0.520	<0.002	3	100%	<0.518	<0.522	<0.520	<0.002	4	100%
Tetra	PCB 73	0.518	0.522	pg/L	<0.521	<0.521	<0.521	**	1	100%	<0.518	<0.522	<0.520	<0.002	3	100%	<0.518	<0.522	<0.520	<0.002	4	100%
Tetra	PCB 77	0.52	0.56	pg/L	2.45	2.45	2.45	**	1	0%	4.34	5.23	4.85	0.46	3	0%	2.45	5.23	4.25	1.26	4	0%
Tetra	PCB 78	0.52	0.552	pg/L	<0.521	<0.521	<0.521	**	1	100%	<0.52	<0.552	<0.539	<0.017	3	100%	<0.52	<0.552	<0.535	<0.017	4	100%
Tetra	PCB 79	0.518	0.522	pg/L	0.744	0.744	0.744	**	1	0%	1.35	2.11	1.81	0.41	3	0%	0.744	2.11	1.546	0.629	4	0%
Tetra	PCB 80	0.518	0.522	pg/L	<0.521	<0.521	<0.521	**	1	100%	<0.518	<0.522	<0.520	<0.002	3	100%	<0.518	<0.522	<0.520	<0.002	4	100%
Tetra	PCB 81	0.52	0.555	pg/L	<0.521	<0.521	<0.521	**	1	100%	<0.52	<0.555	<0.536	<0.018	3	100%	<0.52	<0.555	<0.533	<0.016	4	100%
Penta	PCB 82	0.518	1.13	pg/L	8.75	8.75	8.75	**	1	0%	14.50	20.50	18.40	3.40	3	0%	8.75	20.50	16.01	5.58	4	0%
Penta	PCB 83/99	0.518	1.08	pg/L	43.50	43.50	43.50	**	1	0%	72.30	102.00	91.40	16.60	3	0%	43.50	102.00	79.50	27.50	4	0%
Penta	PCB 84	0.518	1.19	pg/L	18	18	18	**	1	0%	34	49.3	43.1	8	3	0%	18	49.3	36.8	14.1	4	0%
Penta	PCB 85/116/117	0.518	0.865	pg/L	14.1	14.1	14.1	**	1	0%	21.4	33.3	28.8	6.5	3	0%	14.1	33.3	25.1	9	4	0%
Penta	PCB 86/87/97/109/119/125	0.518	0.876	pg/L	53.5	53.5	53.5	**	1	0%	91.4	137	119.1	24.3	3	0%	53.5	137	102.7	38.4	4	0%
Penta	PCB 88/91	0.518	1.02	pg/L	8.91	8.91	8.91	**	1	0%	15.3	22.8	20.1	4.1	3	0%	8.91	22.8	17.28	6.52	4	0%
Penta	PCB 89	0.518	1.1	pg/L	<1.03	<1.03	<1.03	**	1	100%	1.1	1.81	1.47	0.36	3	0%	<1.03	1.81	<1.36	<0.36	4	25%
Penta	PCB 90/101/113	0.518	0.872	pg/L	72.80	72.80	72.80	**	1	0%	126.00	187.00	165.00	34.00	3	0%	72.80	187.00	142.00	53.80	4	0%
Penta	PCB 92	0.518	1.07	pg/L	13.70	13.70	13.70	**	1	0%	23.70	35.70	31.10	6.50	3	0%	13.70	35.70	26.80	10.20	4	0%
Penta	PCB 93/95/98/100/102	0.518	1.02	pg/L	63.8	63.8	63.8	**	1	0%	107	164	139	29	3	0%	63.8	164	120	44.3	4	0%
Penta	PCB 94	0.518	1.14	pg/L	<1.06	<1.06	<1.06	**	1	100%	0.547	<1.14	<0.845	<0.297	3	33%	0.547	<1.14	<0.899	<0.265	4	50%
Penta	PCB 96	0.518	0.522	pg/L	0.53	0.53	0.53	**	1	0%	0.764	1.36	1.028	0.304	3	0%	0.53	1.36	0.903	0.351	4	0%
Penta	PCB 103	0.518	0.929	pg/L	<0.868	<0.868	<0.868	**	1	100%	0.64	1.33	1	0.35	3	0%	0.64	1.33	<0.967	<0.290	4	25%
Penta	PCB 104	0.518	0.522	pg/L	<0.521	<0.521	<0.521	**	1	100%	<0.518	0.83	<0.621	<0.177	3	67%	<0.518	0.83	<0.596	<0.153	4	75%
Penta	PCB 105	0.548	1.17	pg/L	25.30	25.30	25.30	**	1	0%	46.20	59.10	54.80	7.40	3	0%	25.30	59.10	47.40	16.00	4	0%
Penta	PCB 106	0.521	1.06	pg/L	0.564	0.56	0.564	**	1	0%	<0.521	<1.06	<0.739	<0.284	3	100%	<0.521	<1.06	<0.695	<0.248	4	75%
Penta	PCB 107	0.52	1.04	pg/L	3.57	3.57	3.57	**	1	0%	6.81	9.13	8.28	1.28	3	0%	3.57	9.13	7.1	2.57	4	0%
Penta	PCB 108/124	0.556	1.15	pg/L	3.02	3.02	3.02	**	1	0%	4.85	6.99	6	1.08	3	0%	3.02	6.99	5.25	1.73	4	0%
Penta	PCB 110/115	0.518	0.757	pg/L	87.9	87.9	87.9	**	1	0%	143	212	187	38	3	0%	87.9	212	162.2	58.6	4	0%
Penta	PCB 111	0.518	0.748	pg/L	<0.7	<0.7	<0.7	**	1	100%	<0.518	<0.748	<0.595	<0.132	3	100%	<0.518	<0.748	<0.622	<0.120	4	100%
Penta	PCB 112	0.518	0.725	pg/L	<0.677	<0.677	<0.677	**	1	100%	<0.518	<0.725	<0.588	<0.119	3	100%	<0.518	<0.725	<0.610	<0.107	4	100%
Penta	PCB 114	0.553	1.15	pg/L	2.02	2.02	2.02	**	1	0%	2.77	4.29	3.48	0.76	3	0%	2.02	4.29	3.12	0.96	4	0%
Penta	PCB 118	0.552	1.17	pg/L	64.3	64.3	64.3	**	1	0%	109	151	135	23	3	0%	64.3	151	117.1	39.7	4	0%
Penta	PCB 120	0.518	0.701	pg/L	<0.655	<0.655	<0.655	**	1	100%	<0.518	<0.701	<0.580	<0.105	3	100%	<0.518	<0.701	<0.599	<0.094	4	100%
Penta	PCB 121	0.518	0.814	pg/L	<0.761	<0.761	<0.761	**	1	100%	0.672	1.51	0.991	0.454	3	0%	0.672	1.51	<0.933	<0.388	4	25%
Penta	PCB 122	0.572	1.18	pg/L	0.911	0.911	0.911	**	1	0%	1.15	2.01	1.57	0.43	3	0%	0.911	2.01	1.405	0.482	4	0%

< Results reported less than detection limit

1 Range, mean, standard deviation, and number of samples (N) are provided. When results are less than the detection limit, the detection limit was used to calculate each statistical value

2 Solid and aqueous fractions of the samples were analyzed separately, results are presented as a total of both solid and aqueous fractions

3 Percent of samples with result less than detection limit

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]																	
					Combined Fractions [2]																	
					Grab						Composite						Total					
					Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]
Polychlorinated biphenyls (PCBs)																						
Hexa	PCB 130	0.713	0.855	pg/L	5.39	5.39	5.39	**	1	0%	9.27	12.3	11.29	1.75	3	0%	5.39	12.3	9.82	3.28	4	0%
Hexa	PCB 131	0.706	0.847	pg/L	1.11	1.11	1.11	**	1	0%	2.73	3.28	3.08	0.3	3	0%	1.11	3.28	2.59	1.01	4	0%
Hexa	PCB 132	0.749	0.897	pg/L	25.60	25.60	25.60	**	1	0%	39.70	66.00	54.30	13.40	3	0%	25.60	66.00	47.10	18.00	4	0%
Hexa	PCB 133	0.634	0.76	pg/L	1.11	1.11	1.11	**	1	0%	1.67	2.51	2.21	0.47	3	0%	1.11	2.51	1.93	0.67	4	0%
Hexa	PCB 134/143	0.701	0.841	pg/L	3.52	3.52	3.52	**	1	0%	8.39	11	10.06	1.45	3	0%	3.52	11	8.43	3.48	4	0%
Hexa	PCB 135/151/154	0.518	0.522	pg/L	28.4	28.4	28.4	**	1	0%	44.5	65.9	52.3	11.8	3	0%	28.4	65.9	46.4	15.4	4	0%
Hexa	PCB 136	0.518	0.522	pg/L	10.2	10.2	10.2	**	1	0%	16.3	27.3	22.1	5.5	3	0%	10.2	27.3	19.2	7.5	4	0%
Hexa	PCB 137	0.702	0.841	pg/L	4.72	4.72	4.72	**	1	0%	8.43	12	10.58	1.89	3	0%	4.72	12	9.11	3.31	4	0%
Hexa	PCB 139/140	0.644	0.772	pg/L	1.93	1.93	1.93	**	1	0%	3.37	4.90	4.33	0.84	3	0%	1.93	4.90	3.73	1.38	4	0%
Hexa	PCB 141	0.596	0.714	pg/L	12.50	12.50	12.50	**	1	0%	21.80	31.50	26.60	4.90	3	0%	12.50	31.50	23.10	8.10	4	0%
Hexa	PCB 142	0.732	0.878	pg/L	<0.732	<0.732	<0.732	**	1	100%	<0.76	<0.878	<0.834	<0.065	3	100%	<0.732	<0.878	<0.809	<0.074	4	100%
Hexa	PCB 144	0.518	0.522	pg/L	3.8	3.8	3.8	**	1	0%	6.63	9.42	8.1	1.4	3	0%	3.8	9.42	7.03	2.44	4	0%
Hexa	PCB 145	0.518	0.522	pg/L	<0.521	<0.521	<0.521	**	1	100%	<0.518	<0.522	<0.520	<0.002	3	100%	<0.518	<0.522	<0.520	<0.002	4	100%
Hexa	PCB 146	0.562	0.674	pg/L	10.1	10.1	10.1	**	1	0%	17.2	22.7	19.2	3.1	3	0%	10.1	22.7	16.9	5.2	4	0%
Hexa	PCB 147/149	0.645	0.773	pg/L	50.7	50.7	50.7	**	1	0%	87.9	135	118.6	26.6	3	0%	50.7	135	101.7	40.3	4	0%
Hexa	PCB 148	0.518	0.522	pg/L	<0.521	<0.521	<0.521	**	1	100%	<0.518	1.14	<0.726	<0.359	3	67%	<0.518	1.14	<0.675	<0.310	4	75%
Hexa	PCB 150	0.518	0.522	pg/L	<0.521	<0.521	<0.521	**	1	100%	0.52	0.89	0.67	0.19	3	0%	<0.521	0.89	<0.633	<0.174	4	25%
Hexa	PCB 152	0.518	0.522	pg/L	<0.521	<0.521	<0.521	**	1	100%	<0.518	<0.522	<0.520	<0.002	3	100%	<0.518	<0.522	<0.520	<0.002	4	100%
Hexa	PCB 153/168	0.52	0.594	pg/L	66.6	66.6	66.6	**	1	0%	107	156	134	25	3	0%	66.6	156	116.9	39.2	4	0%
Hexa	PCB 155	0.518	0.522	pg/L	5.12	5.12	5.12	**	1	0%	4.36	11.1	6.87	3.68	3	0%	4.36	11.1	6.43	3.13	4	0%
Hexa	PCB 156/157	0.548	0.658	pg/L	10	10	10	**	1	0%	18.4	22.7	20.5	2.2	3	0%	10	22.7	17.9	5.5	4	0%
Hexa	PCB 158	0.518	0.522	pg/L	6.93	6.93	6.93	**	1	0%	13.20	18.40	16.40	2.80	3	0%	6.93	18.40	14.06	5.28	4	0%
Hexa	PCB 159	0.518	0.522	pg/L	<0.521	<0.521	<0.521	**	1	100%	<0.518	<0.522	<0.520	<0.002	3	100%	<0.518	<0.522	<0.520	<0.002	4	100%
Hexa	PCB 161	0.52	0.559	pg/L	<0.521	<0.521	<0.521	**	1	100%	<0.52	<0.559	<0.543	<0.021	3	100%	<0.52	<0.559	<0.538	<0.020	4	100%
Hexa	PCB 162	0.518	0.522	pg/L	<0.521	<0.521	<0.521	**	1	100%	<0.518	0.75	<0.596	<0.133	3	67%	<0.518	0.75	<0.577	<0.115	4	75%
Hexa	PCB 164	0.52	0.546	pg/L	4.81	4.81	4.81	**	1	0%	8.91	11.3	10.24	1.22	3	0%	4.81	11.3	8.88	2.89	4	0%
Hexa	PCB 165	0.533	0.639	pg/L	<0.533	<0.533	<0.533	**	1	100%	<0.554	<0.639	<0.608	<0.047	3	100%	<0.533	<0.639	<0.589	<0.053	4	100%
Hexa	PCB 167	0.518	0.522	pg/L	3.01	3.01	3.01	**	1	0%	5.28	7.50	6.49	1.12	3	0%	3.01	7.50	5.62	1.97	4	0%
Hexa	PCB 169	0.52	0.591	pg/L	<0.521	<0.521	<0.521	**	1	100%	<0.52	<0.591	<0.555	<0.036	3	100%	<0.52	<0.591	<0.546	<0.034	4	100%
Hepta	PCB 170	0.518	0.522	pg/L	10.40	10.40	10.40	**	1	0%	19.60	25.00	22.30	2.70	3	0%	10.40	25.00	19.30	6.30	4	0%
Hepta	PCB 171/173	0.518	0.522	pg/L	3.80	3.80	3.80	**	1	0%	7.79	9.19	8.36	0.73	3	0%	3.80	9.19	7.22	2.36	4	0%
Hepta	PCB 172	0.518	0.522	pg/L	1.64	1.64	1.64	**	1	0%	4.35	5.07	4.74	0.36	3	0%	1.64	5.07	3.97	1.58	4	0%
Hepta	PCB 174	0.518	0.522	pg/L	11.7	11.7	11.7	**	1	0%	22.3	33.3	27.4	5.5	3	0%	11.7	33.3	23.5	9.1	4	0%
Hepta	PCB 175	0.518	0.522	pg/L	0.974	0.974	0.974	**	1	0%	1.59	2.13	1.82	0.28	3	0%	0.974	2.13	1.609	0.48	4	0%
Hepta	PCB 176	0.518	0.522	pg/L	2.33	2.33	2.33	**	1	0%	3.53	7.93	5.29	2.33	3	0%	2.33	7.93	4.55	2.41	4	0%
Hepta	PCB 177	0.518	0.522	pg/L	7.53	7.53	7.53	**	1	0%	13.7	19.3	15.6	3.2	3	0%	7.53	19.3	13.61	4.81	4	0%

< Results reported less than detection limit

1 Range, mean, standard deviation, and number of samples (N) are provided. When results are less than the detection limit, the detection limit was used to calculate each statistical value

2 Solid and aqueous fractions of the samples were analyzed separately, results are presented as a total of both solid and aqueous fractions

3 Percent of samples with result less than detection limit

Subclass	Analyte	Detection Limit Range		Units	Descriptive Statistics [1]																	
					Combined Fractions [2]																	
					Grab						Composite						Total					
					Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]	Range		Mean	Stdev	N	%ND [3]
Polychlorinated biphenyls (PCBs)																						
Hepta	PCB 183/185	0.518	0.522	pg/L	10.6	10.6	10.6	**	1	0%	18.2	26.2	21.8	4.1	3	0%	10.6	26.2	19	6.5	4	0%
Hepta	PCB 184	0.518	0.522	pg/L	11.90	11.90	11.90	**	1	0%	10.90	29.40	18.20	9.80	3	0%	10.90	29.40	16.70	8.60	4	0%
Hepta	PCB 186	0.518	0.522	pg/L	<0.521	<0.521	<0.521	**	1	100%	<0.518	<0.522	<0.520	<0.002	3	100%	<0.518	<0.522	<0.520	<0.002	4	100%
Hepta	PCB 187	0.518	0.522	pg/L	21.4	21.4	21.4	**	1	0%	36.1	54.1	42.9	9.8	3	0%	21.4	54.1	37.6	13.4	4	0%
Hepta	PCB 188	0.518	0.522	pg/L	<0.521	<0.521	<0.521	**	1	100%	<0.518	<0.522	<0.520	<0.002	3	100%	<0.518	<0.522	<0.520	<0.002	4	100%
Hepta	PCB 189	0.52	0.64	pg/L	<0.521	<0.521	<0.521	**	1	100%	0.901	1.4	1.134	0.251	3	0%	<0.521	1.4	<0.981	<0.369	4	25%
Hepta	PCB 190	0.518	0.522	pg/L	3.65	3.65	3.65	**	1	0%	5.64	6.21	5.95	0.29	3	0%	3.65	6.21	5.38	1.17	4	0%
Hepta	PCB 191	0.518	0.522	pg/L	<0.521	<0.521	<0.521	**	1	100%	1.04	1.56	1.29	0.26	3	0%	<0.521	1.56	<1.095	<0.438	4	25%
Hepta	PCB 192	0.518	0.522	pg/L	<0.521	<0.521	<0.521	**	1	100%	<0.518	<0.522	<0.520	<0.002	3	100%	<0.518	<0.522	<0.520	<0.002	4	100%
Octa	PCB 194	0.518	0.522	pg/L	3.88	3.88	3.88	**	1	0%	6.87	10.5	9.08	1.94	3	0%	3.88	10.5	7.78	3.04	4	0%
Octa	PCB 195	0.518	0.522	pg/L	1.76	1.76	1.76	**	1	0%	2.58	4.23	3.34	0.83	3	0%	1.76	4.23	2.95	1.04	4	0%
Octa	PCB 196	0.518	0.522	pg/L	3.85	3.85	3.85	**	1	0%	4.97	8.68	6.46	1.96	3	0%	3.85	8.68	5.81	2.06	4	0%
Octa	PCB 197/200	0.518	0.522	pg/L	1.27	1.27	1.27	**	1	0%	1.81	3.52	2.64	0.86	3	0%	1.27	3.52	2.30	0.98	4	0%
Octa	PCB 198/199	0.518	0.522	pg/L	5.95	5.95	5.95	**	1	0%	14.90	20.10	16.90	2.80	3	0%	5.95	20.10	14.16	5.93	4	0%
Octa	PCB 201	0.518	0.522	pg/L	0.86	0.86	0.86	**	1	0%	1.57	2.47	1.89	0.50	3	0%	0.86	2.47	1.63	0.66	4	0%
Octa	PCB 202	0.518	0.522	pg/L	1.50	1.50	1.50	**	1	0%	3.40	4.89	4.08	0.75	3	0%	1.50	4.89	3.43	1.43	4	0%
Octa	PCB 203	0.518	0.522	pg/L	3.9	3.9	3.9	**	1	0%	8.4	11.7	9.8	1.7	3	0%	3.9	11.7	8.4	3.3	4	0%
Octa	PCB 204	0.518	0.522	pg/L	<0.521	<0.521	<0.521	**	1	100%	<0.52	1.28	<0.79	<0.43	3	33%	<0.52	1.28	<0.723	<0.372	4	50%
Octa	PCB 205	0.518	0.522	pg/L	<0.521	<0.521	<0.521	**	1	100%	0.58	0.75	0.69	0.09	3	0%	<0.521	0.75	<0.644	<0.109	4	25%
Nona	PCB 206	1.28	2.17	pg/L	2.28	2.28	2.28	**	1	0%	4.76	11.7	7.57	3.66	3	0%	2.28	11.7	6.25	3.99	4	0%
Nona	PCB 207	0.869	1.49	pg/L	<1.05	<1.05	<1.05	**	1	100%	1.09	<1.49	<1.33	<0.21	3	67%	<1.05	<1.49	<1.26	<0.22	4	75%
Nona	PCB 208	0.891	1.54	pg/L	<1.05	<1.05	<1.05	**	1	100%	2.11	3.35	2.56	0.68	3	0%	<1.05	3.35	<2.19	<0.94	4	25%
Deca	PCB 209	0.518	0.522	pg/L	2.06	2.06	2.06	**	1	0%	3.81	13.9	7.79	5.37	3	0%	2.06	13.9	6.36	5.24	4	0%

< Results reported less than detection limit

1 Range, mean, standard deviation, and number of samples (N) are provided. When results are less than the detection limit, the detection limit was used to calculate each statistical value

2 Solid and aqueous fractions of the samples were analyzed separately, results are presented as a total of both solid and aqueous fractions

3 Percent of samples with result less than detection limit

Analyte	Detection Limit	Units	Descriptive Statistics [1]																	
			Grab						Composite						Total [3]					
			Range		Mean	Stdev	N	%ND[2]	Range		Mean	Stdev	N	%ND[2]	Range		Mean	Stdev	N	%ND[2]
Pharmaceuticals																				
Acetaminophen	30-300	ng/L	9550	26200	16038	7,530	4	0%	9,000	19,600	14,460	4,416	5	0%	9,000	26,200	15,161	5,631	9	0%
Bisphenol A	5	ng/L	13.1	62.3	32.4	21	4	0%	22	73	57	21	5	0%	13	73	46	24	9	0%
Caffeine	100-1000	ng/L	10200	28900	22950	8,731	4	0%	14,800	38,100	24,480	9,594	5	0%	10,200	38,100	23,800	8,675	9	0%
Clopidogrel	5	ng/L	<5.0	77	<30.1	<33.0	4	25%	<5.0	26.7	<11.2	<9.2	5	40%	<5.0	77	<19.6	<23.4	9	33%
Diclofenac	1	ng/L	347	790	506	201	4	0%	103	324	220	106	5	0%	103	790	347	208	9	0%
Fluoxetine	20	ng/L	<20.0	21.4	<20.4	<0.7	4	75%	<20.0	<200	<92.0	<98.6	5	100%	<20.0	<200	<60.2	<79.3	9	89%
Gemfibrozil	2	ng/L	<2.0	27	<11.2	<11.9	4	50%	<2.0	20.3	<8.9	<7.6	5	20%	<2.0	27	<10.0	<9.1	9	33%
Ibuprofen	5	ng/L	1020	1430	1253	193	4	0%	855	3300	1725	933	5	0%	855	3300	1515	715	9	0%
Naproxen	5	ng/L	202	575	362	174	4	0%	314	850	516	210	5	0%	202	850	447	200	9	0%
Primidone	2	ng/L	<2.0	49.2	<13.8	<23.6	4	75%	<2.0	<20.0	<9.2	<9.9	5	100%	<2.0	49.2	<11.2	<16.2	9	89%
Sulfamethoxazole	1	ng/L	5.6	53	28	20	4	0%	5.7	279	114.7	111	5	0%	5.6	279	76.1	91.5	9	0%
Triclosan	20	ng/L	<20.0	43.8	<26.5	<11.6	4	50%	<20.0	<20.0	<20.0	<0.0	5	100%	<20.0	43.8	<22.9	<7.9	9	78%
Trimethoprim	1	ng/L	6.4	102	32.8	46	4	0%	6.5	397	115.4	163	5	0%	6.4	397	78.7	126.4	9	0%
Organic Compounds																				
6PPD-Quinone	0.002	µg/L	0.0069	0.0108	0.0089	0.0028	2	0%	<0.0020	0.0329	<0.0175	<0.0218	2	50%	<0.0020	0.0329	<0.0132	<0.0137	4	25%

** Not applicable

< Results reported less than detection limit

1 Range, mean, standard deviation, and number of samples (N) are provided. When results are less than the detection limit, the detection limit was used to calculate each statistical value

2 Percent of samples with result less than detection limit

3 Total includes both grab and composite

APPENDIX B:
Receiving Water Bacteriological Quality

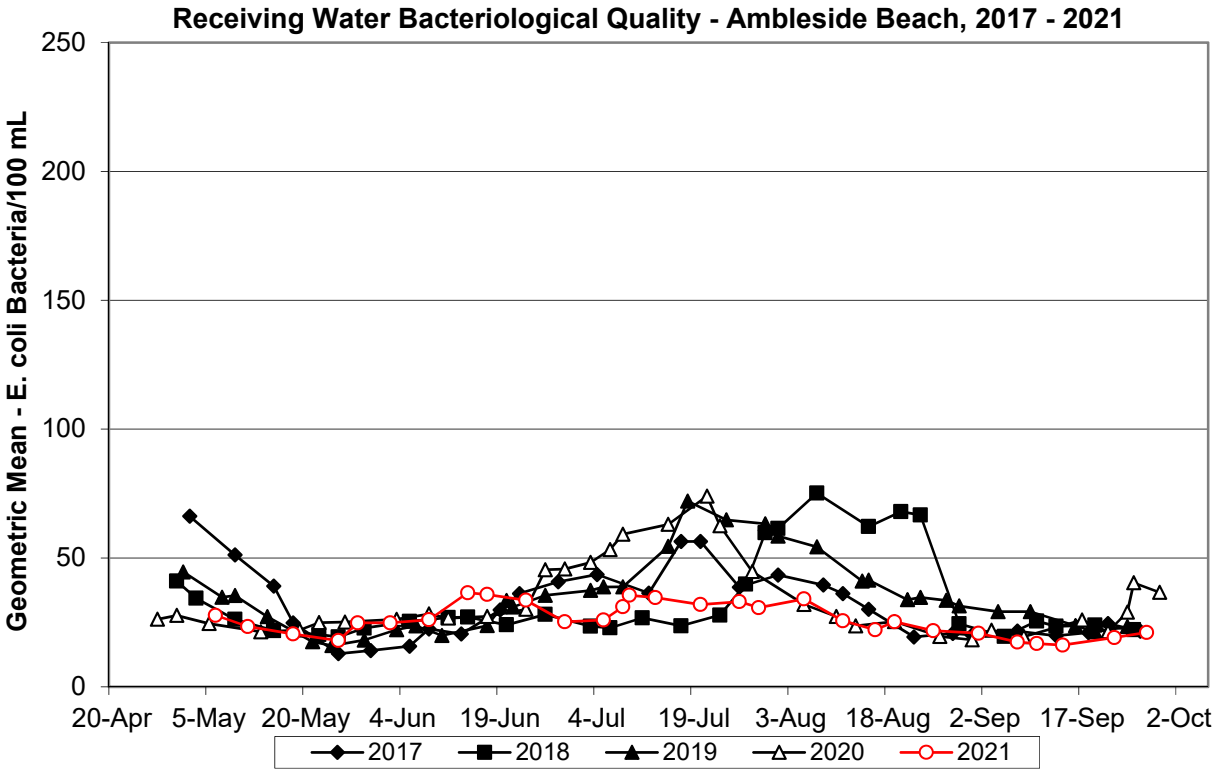
APPENDIX B

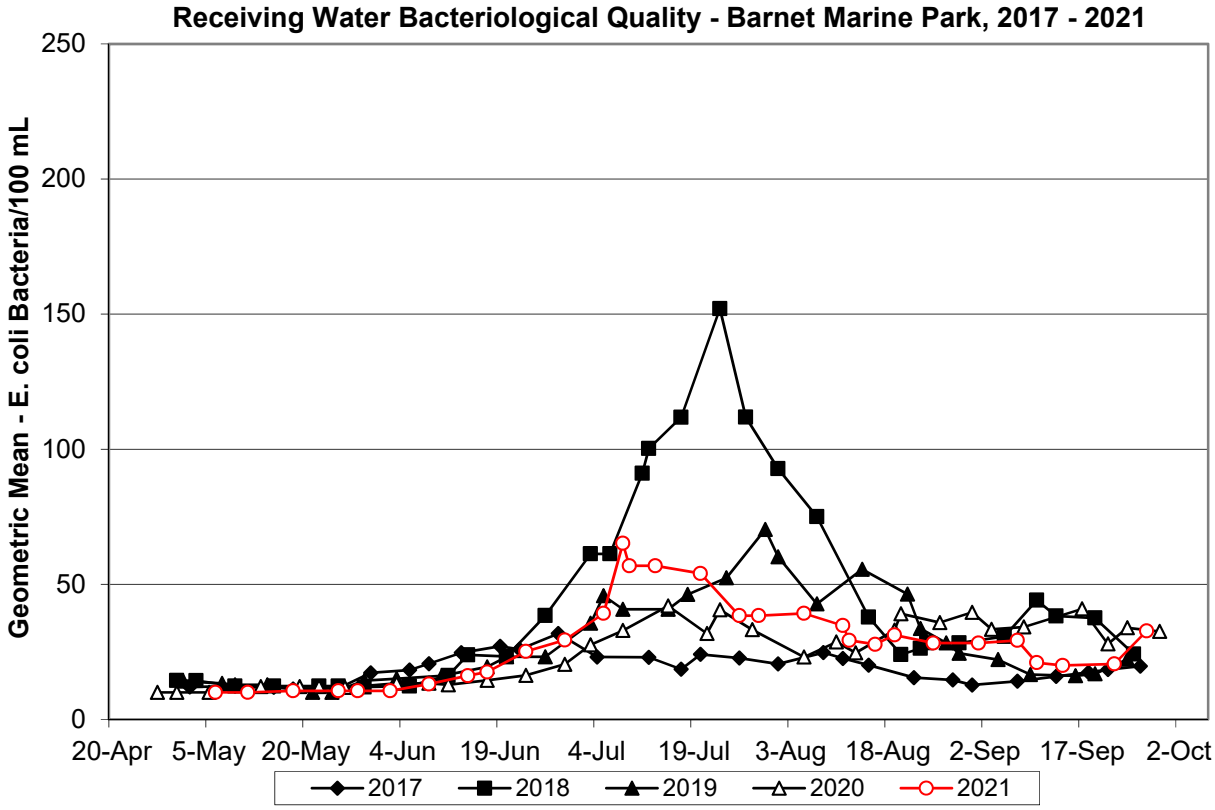
Recreational Water Bacteriological Quality

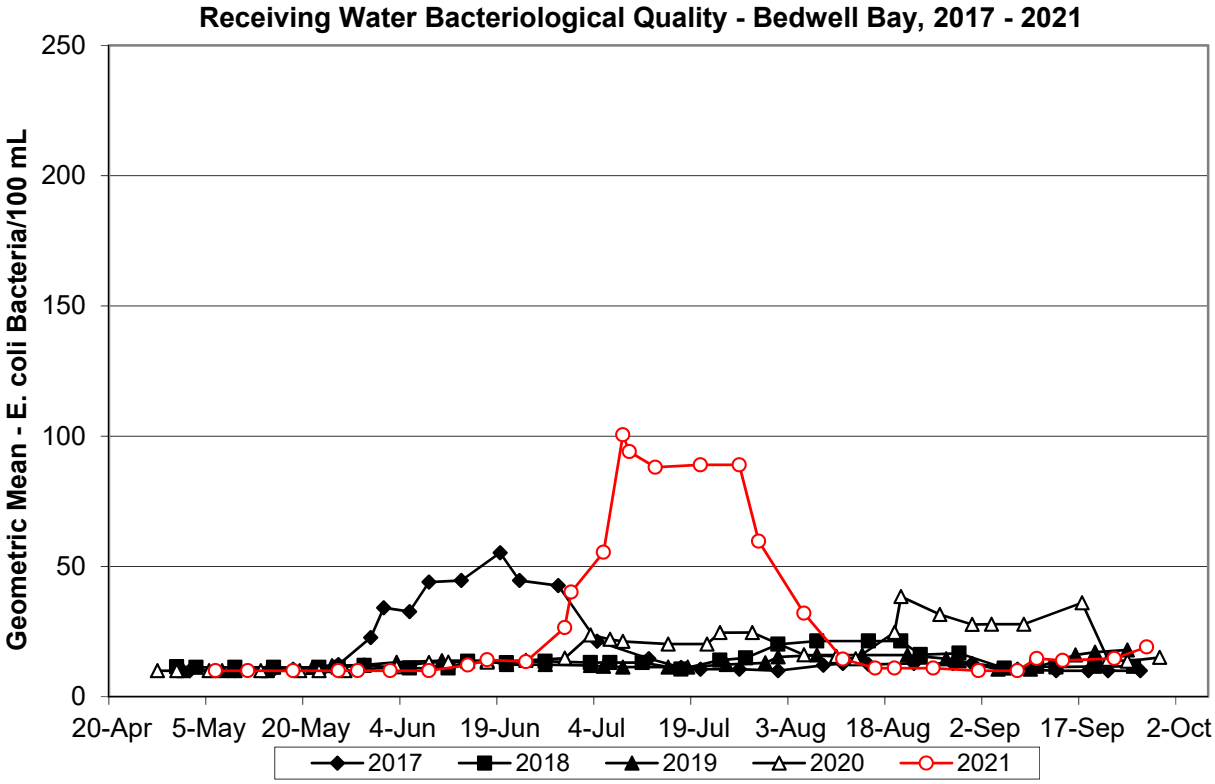
30-Day Geometric Means of *E. coli* Bacteria Levels

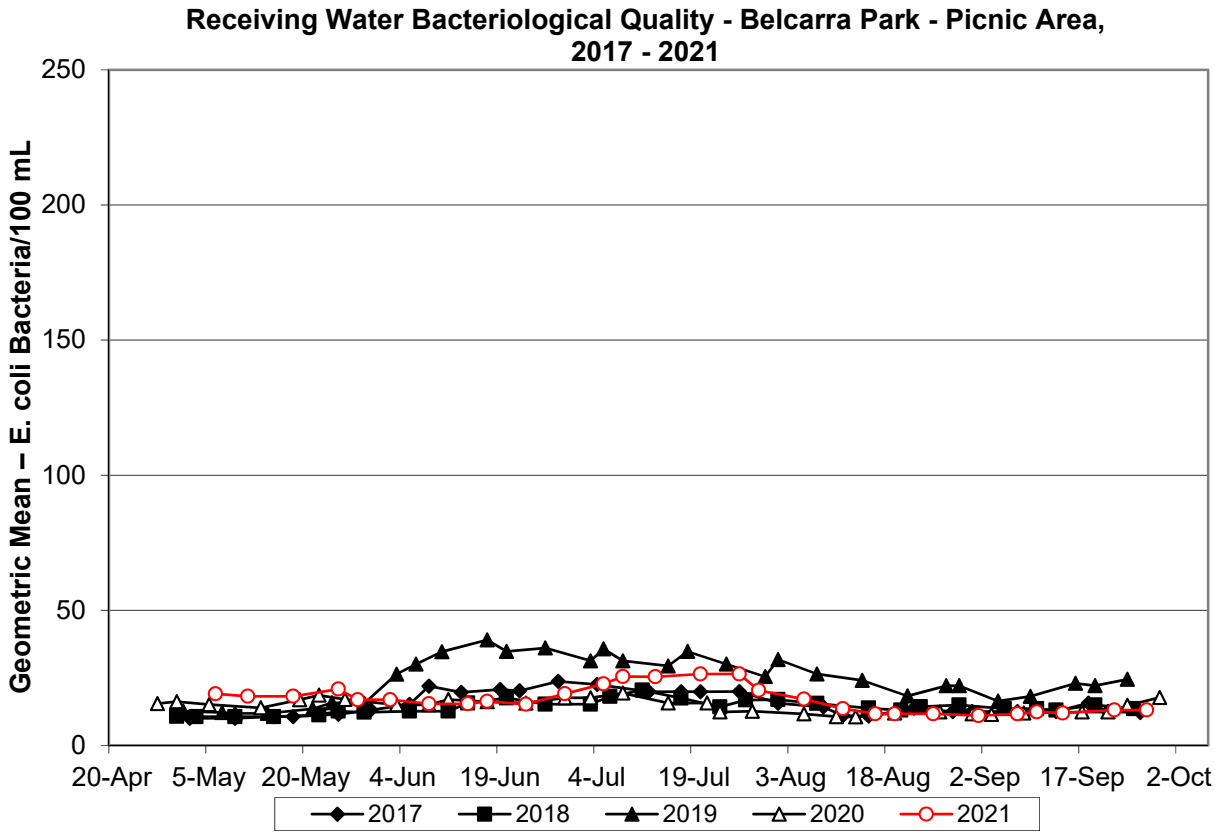
Beaches According to Sewerage Area

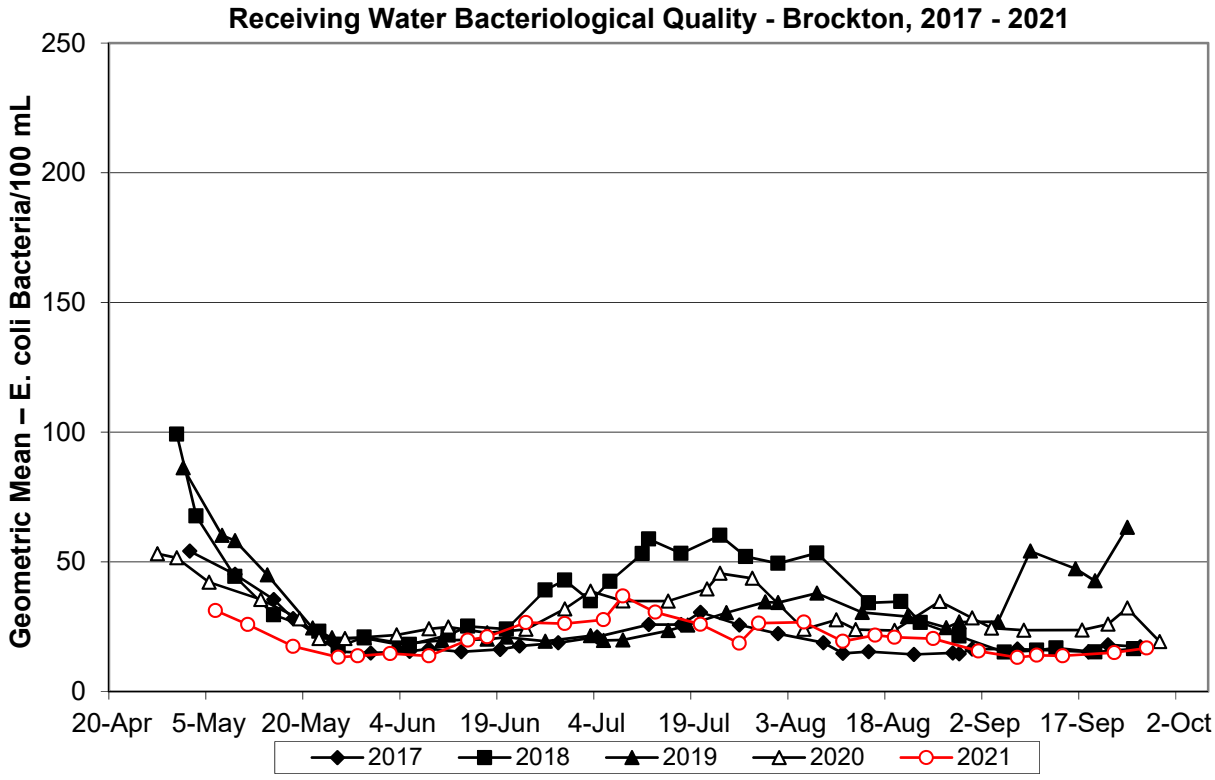
- NSSA
- VSA
- FSA
- LIWSA
- Belcarra

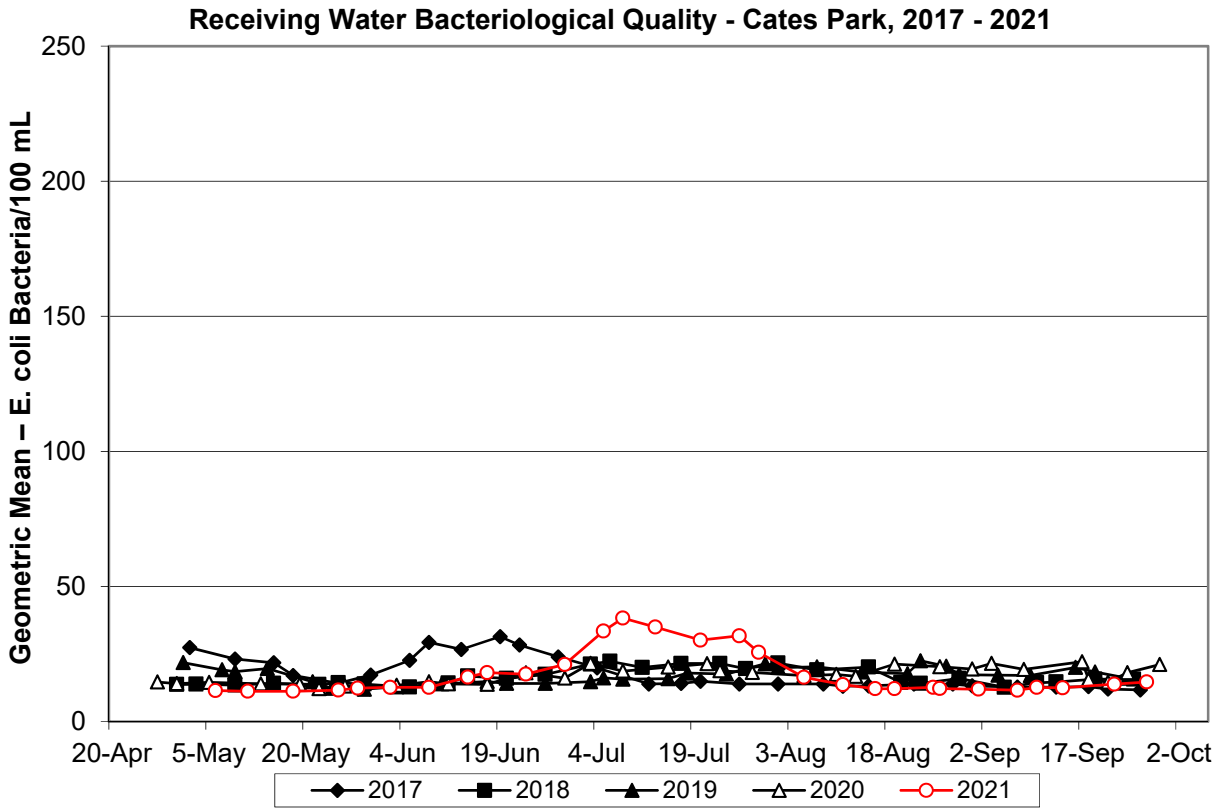

Receiving Water Bacteriological Quality - Ambleside Beach, 2017 - 2021
Geometric Mean - E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

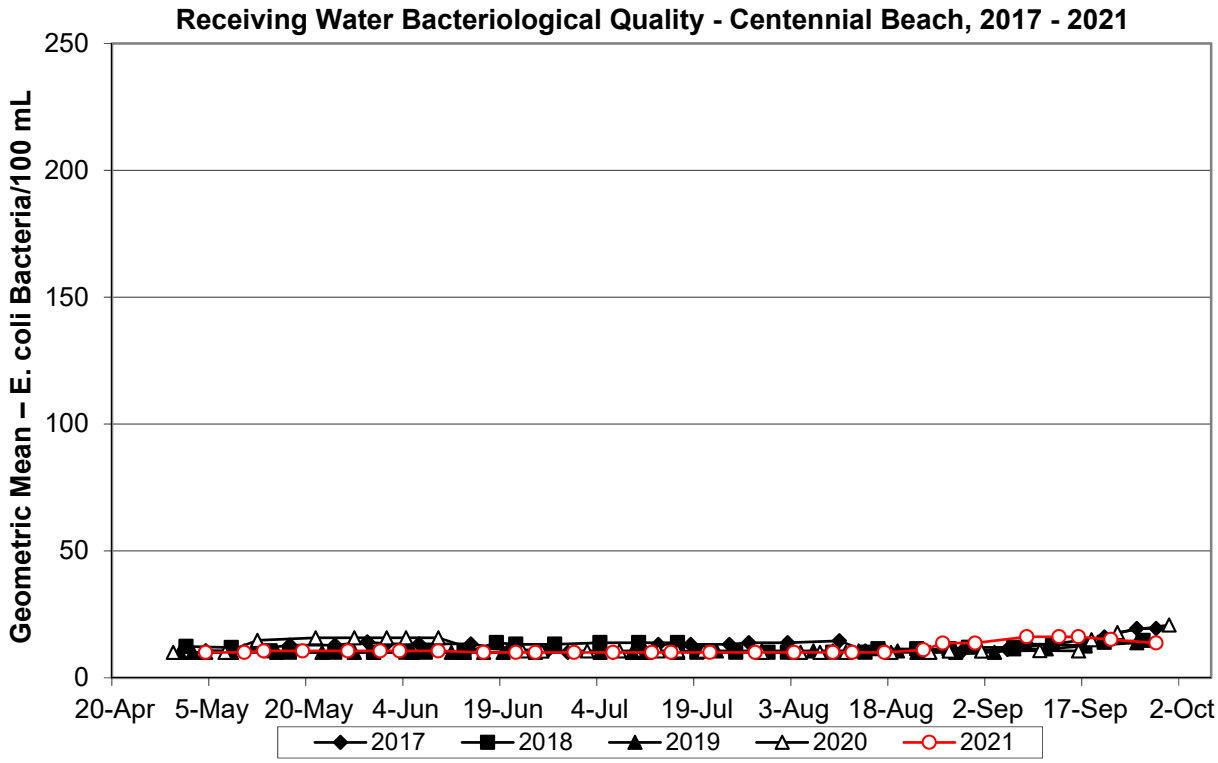

Receiving Water Bacteriological Quality - Barnet Marine Park, 2017 - 2021
Geometric Mean - E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

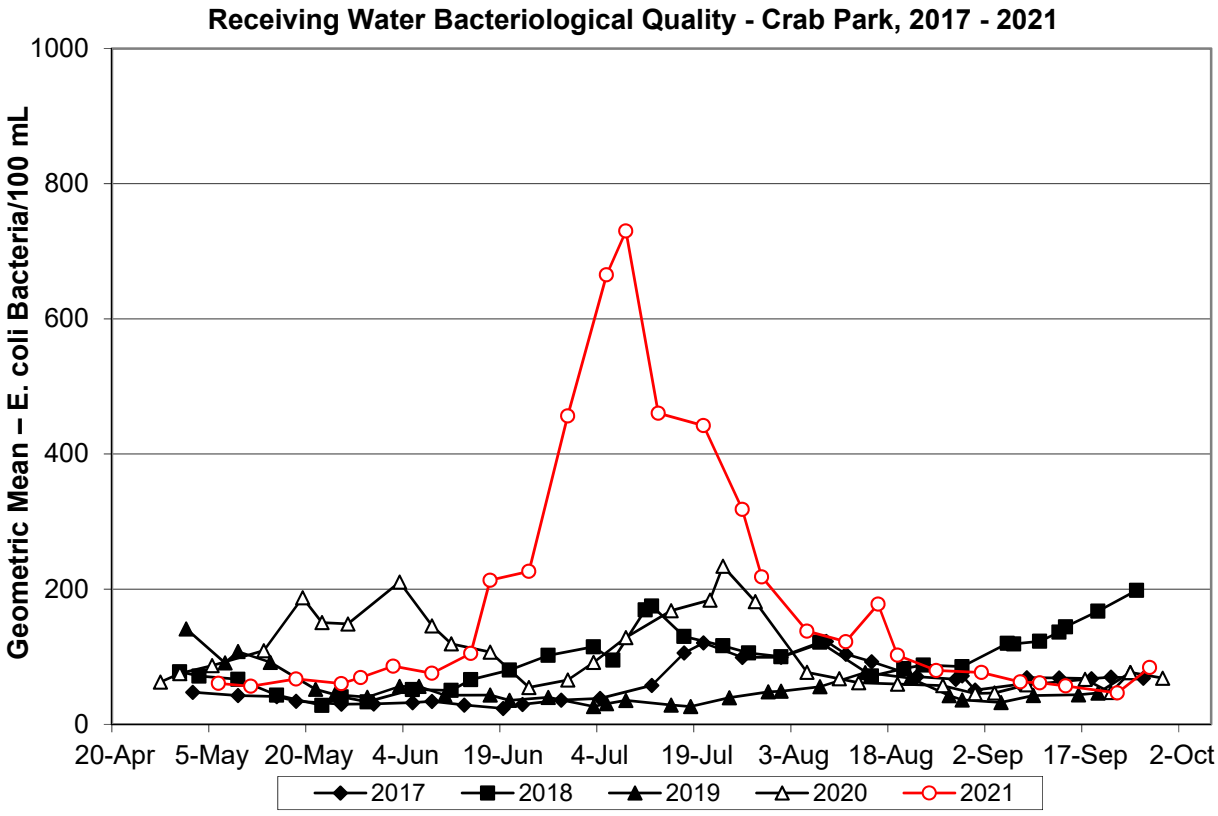

Receiving Water Bacteriological Quality - Bedwell Bay, 2017 - 2021
Geometric Mean - E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

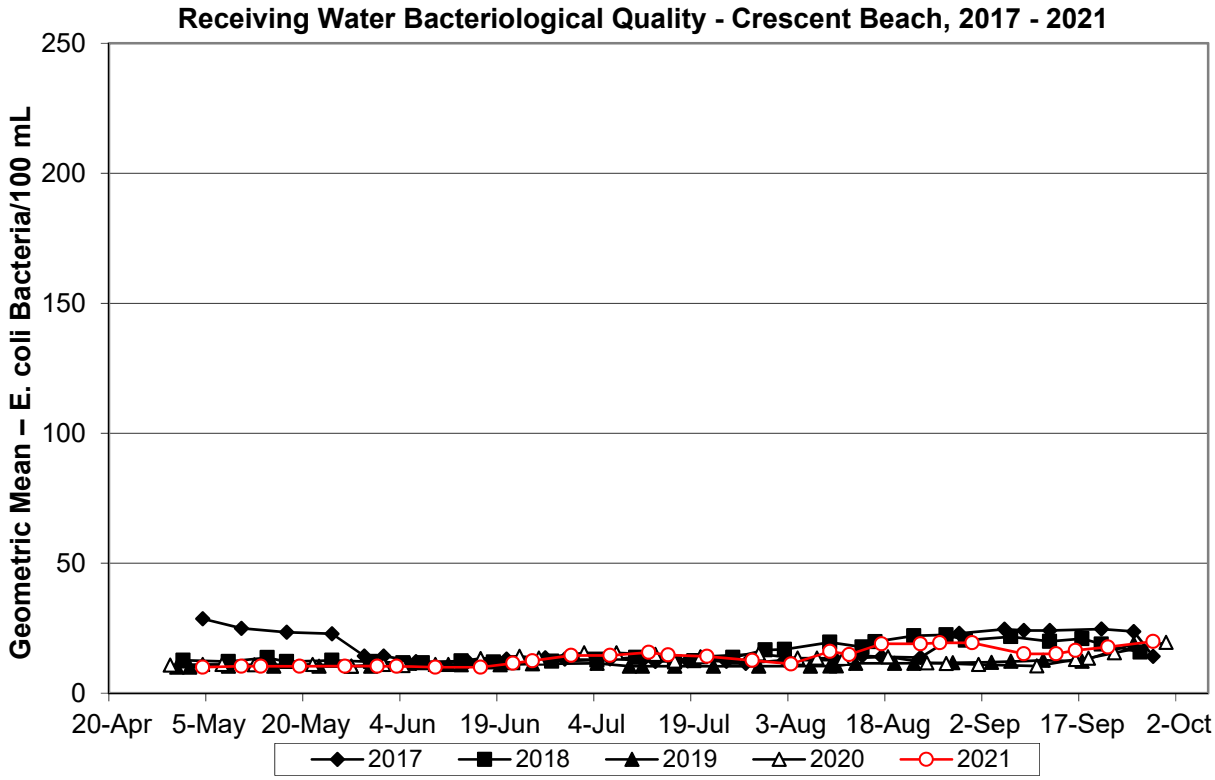

Receiving Water Bacteriological Quality - Belcarra Park - Picnic Area, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

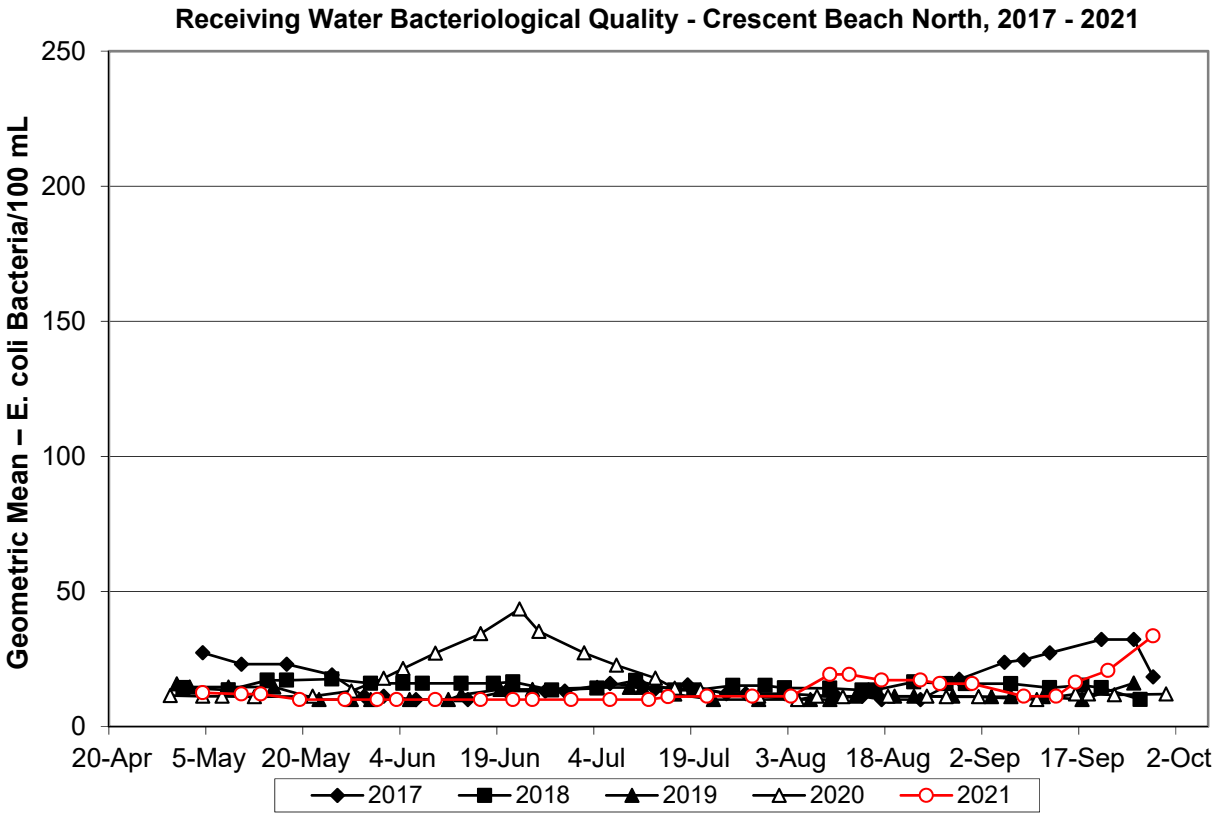

Receiving Water Bacteriological Quality - Brockton, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

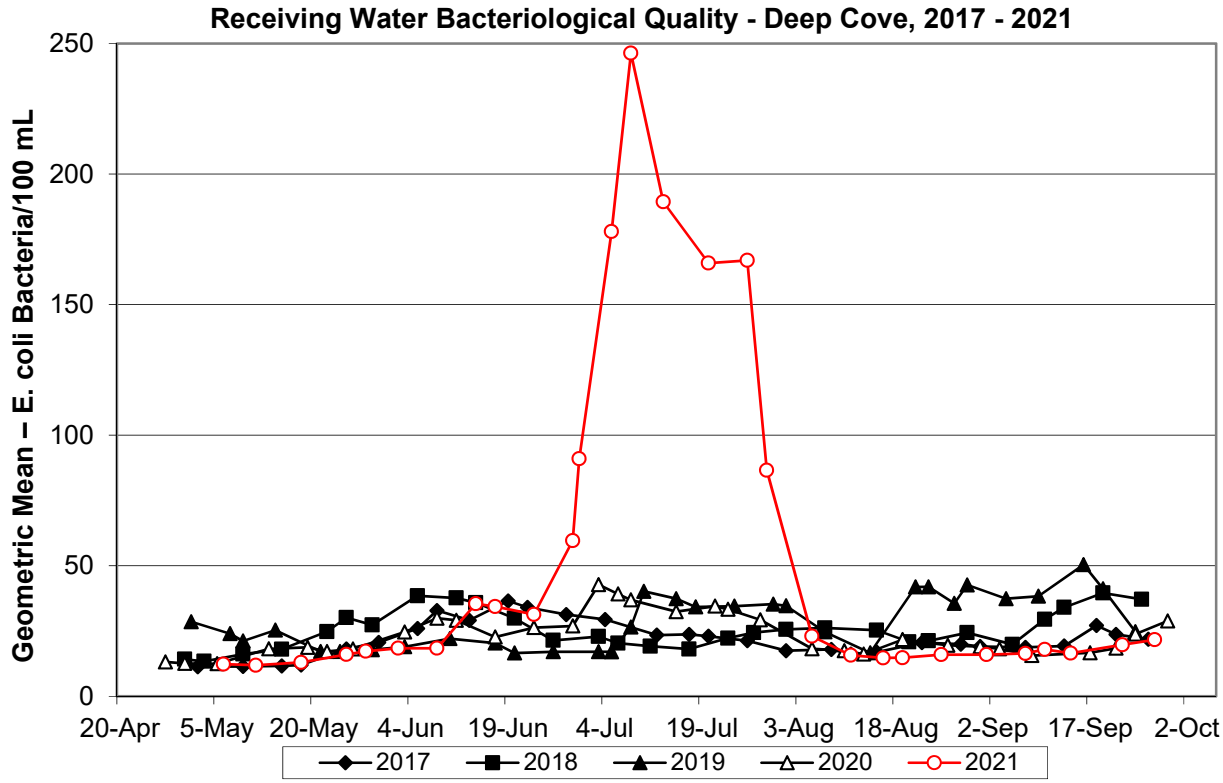

Receiving Water Bacteriological Quality - Cates Park, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

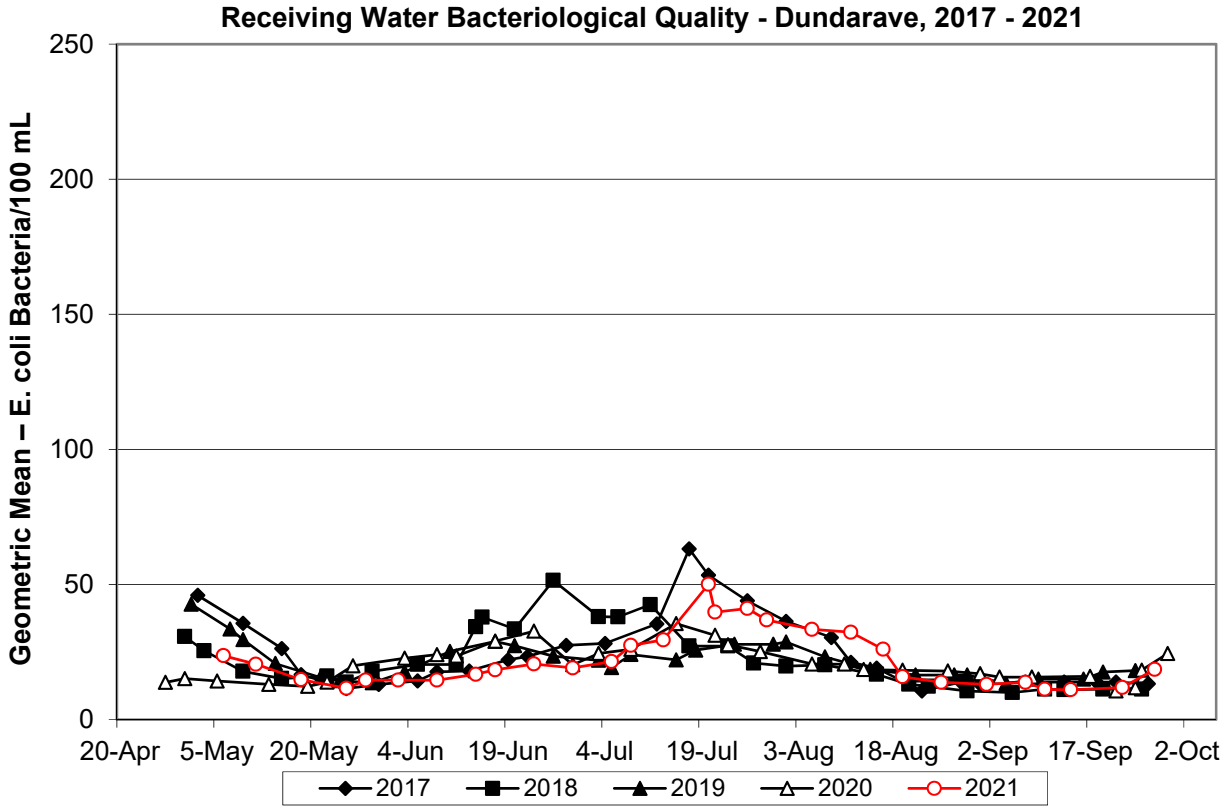

Receiving Water Bacteriological Quality - Centennial Beach, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

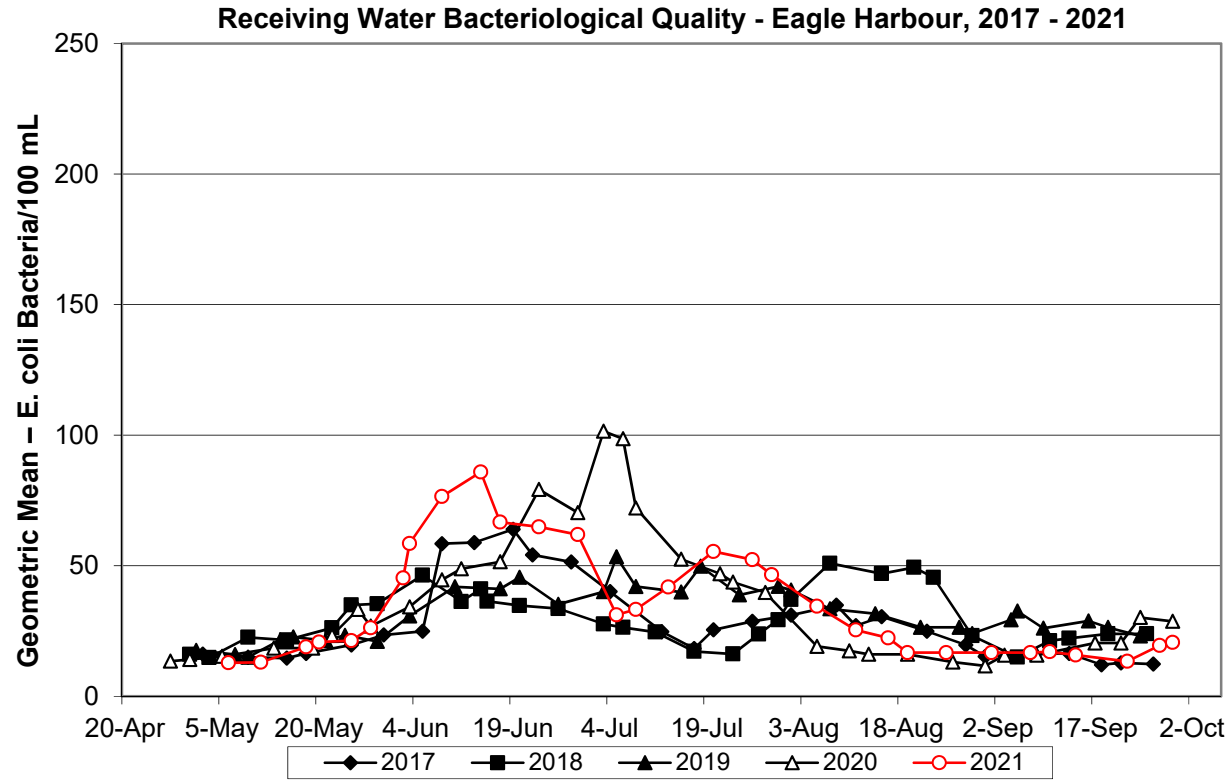

Receiving Water Bacteriological Quality - Crab Park, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
1000
800
600
400
200
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

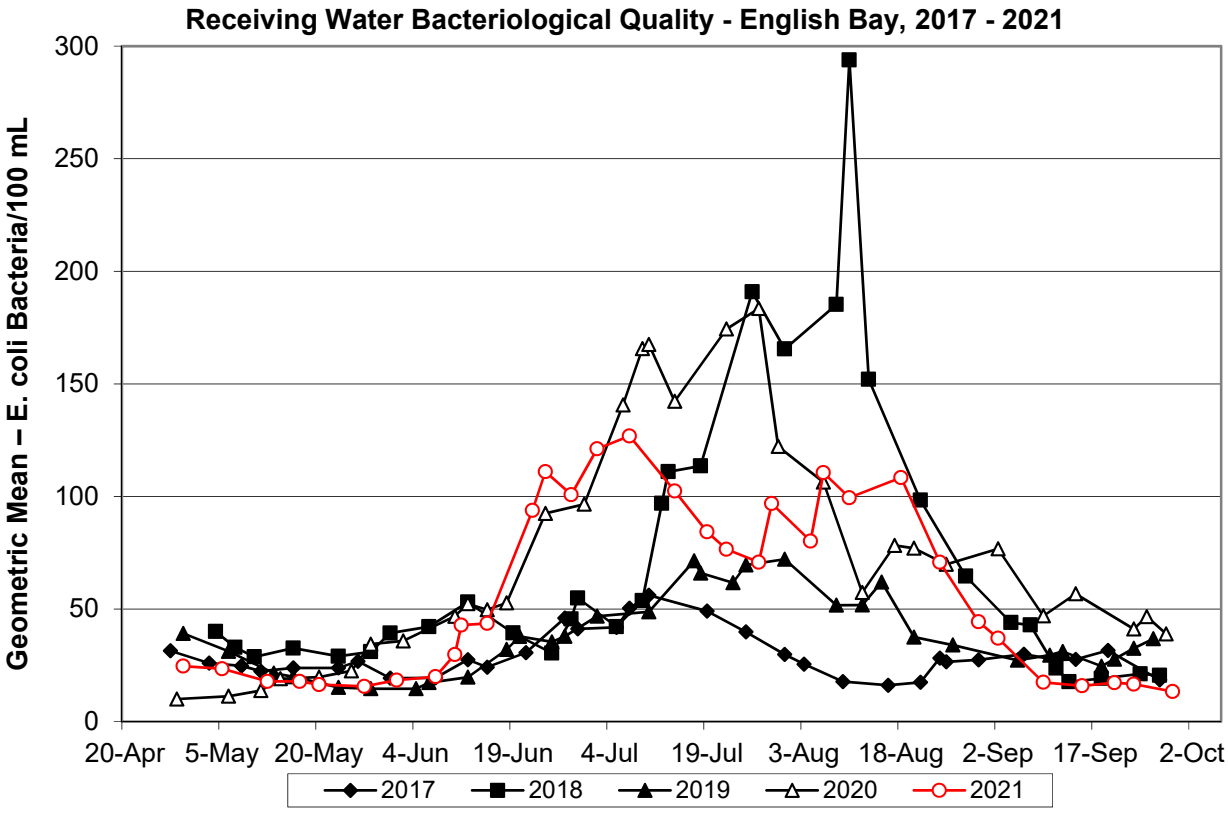

Receiving Water Bacteriological Quality - Crescent Beach, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

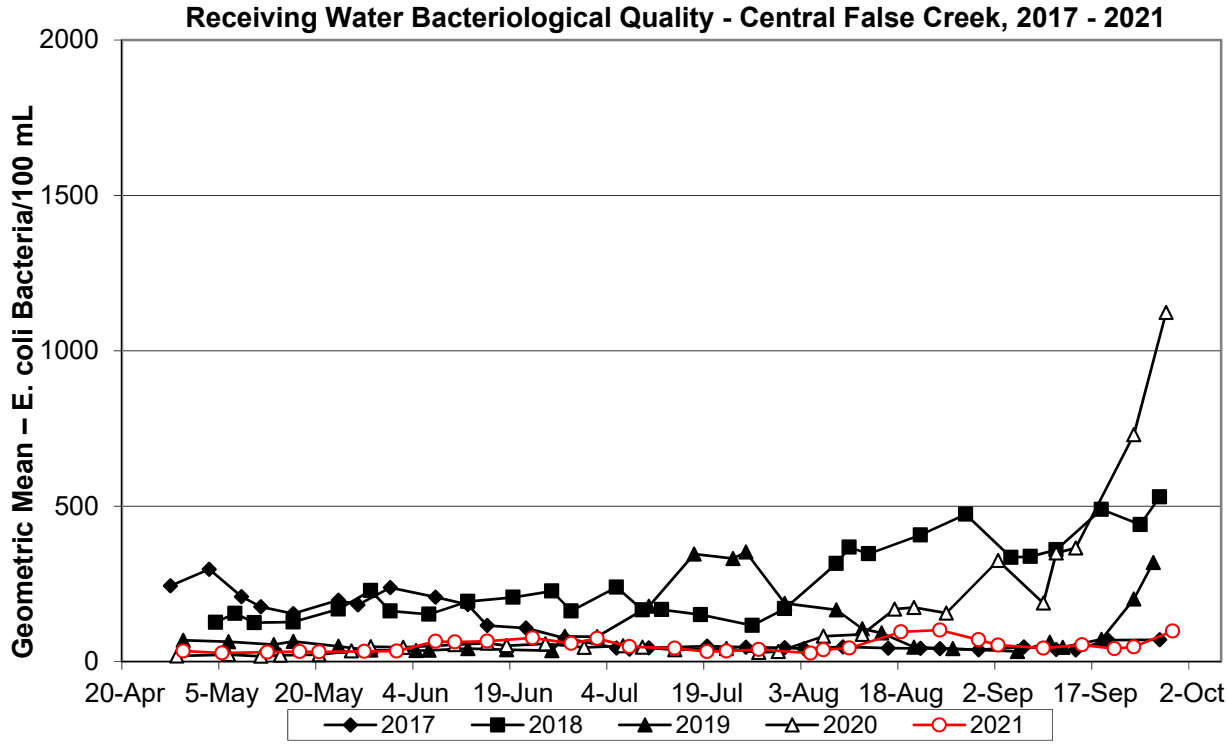

Receiving Water Bacteriological Quality - Crescent Beach North, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

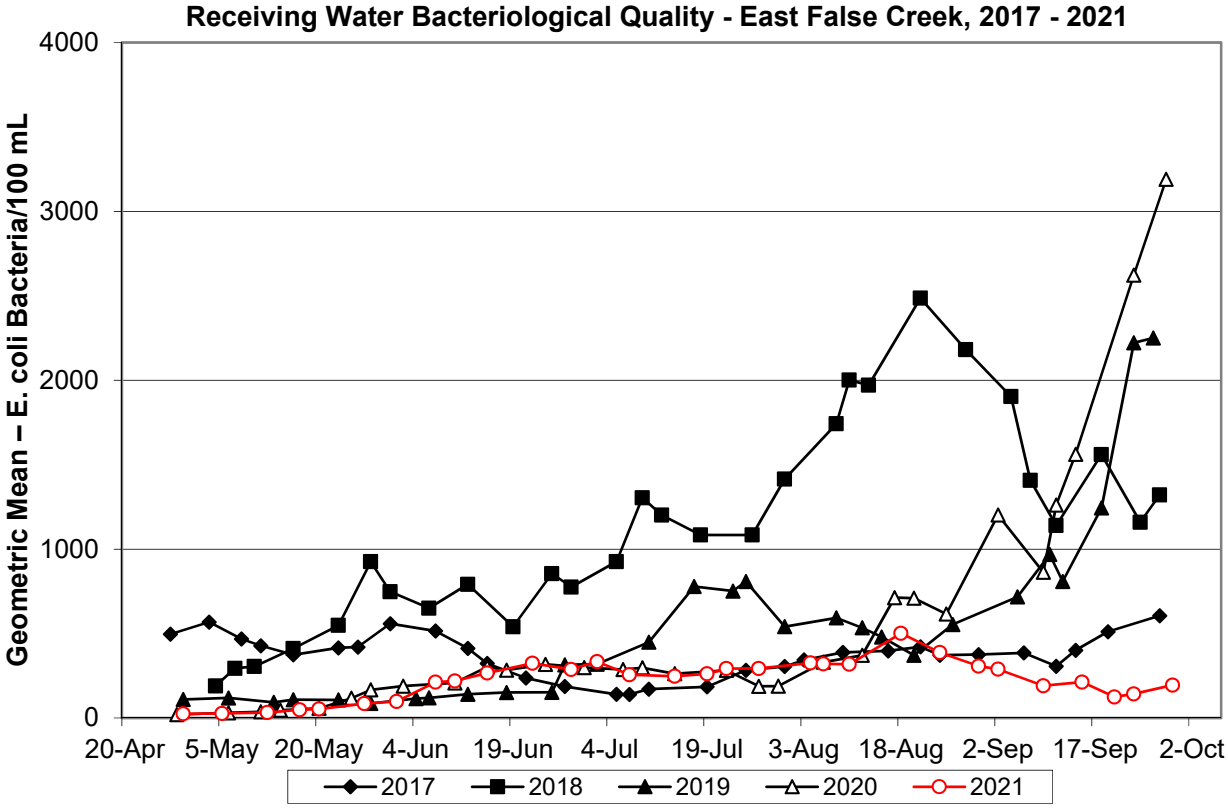

Receiving Water Bacteriological Quality - Deep Cove, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

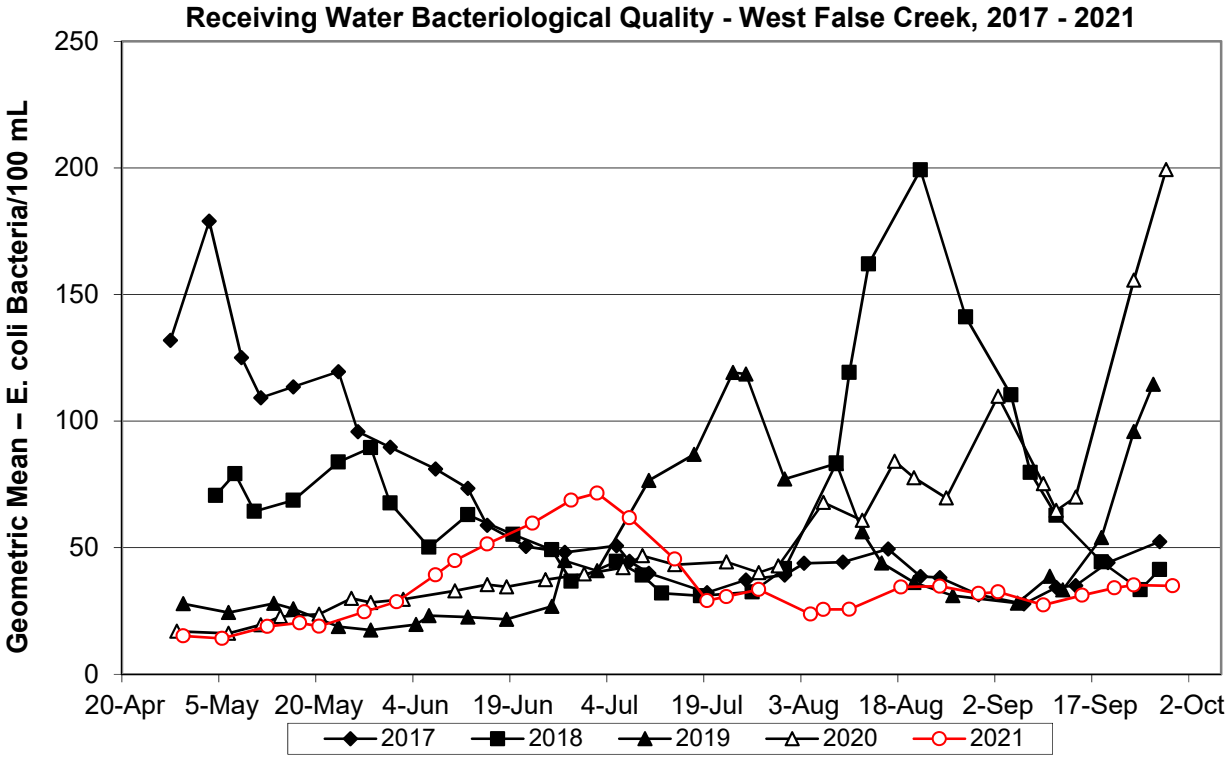

Receiving Water Bacteriological Quality - Dundarave, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

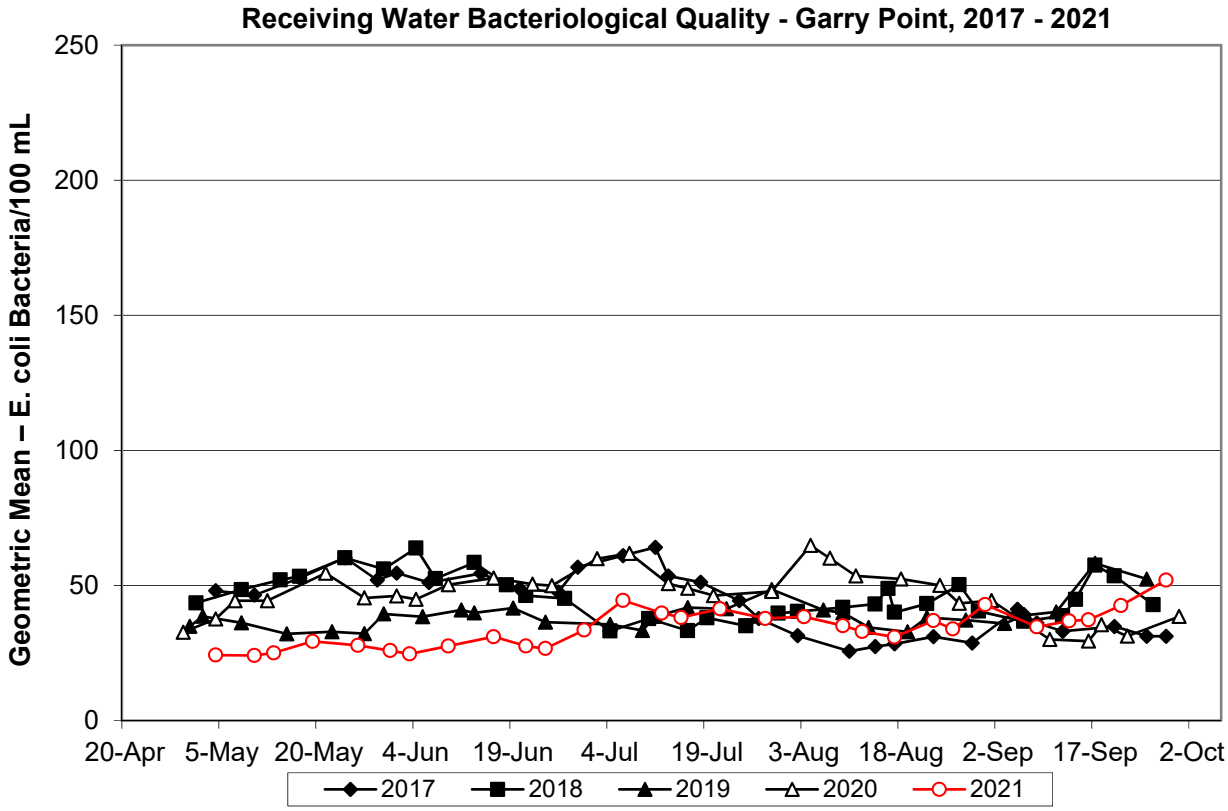

Receiving Water Bacteriological Quality - Eagle Harbour, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

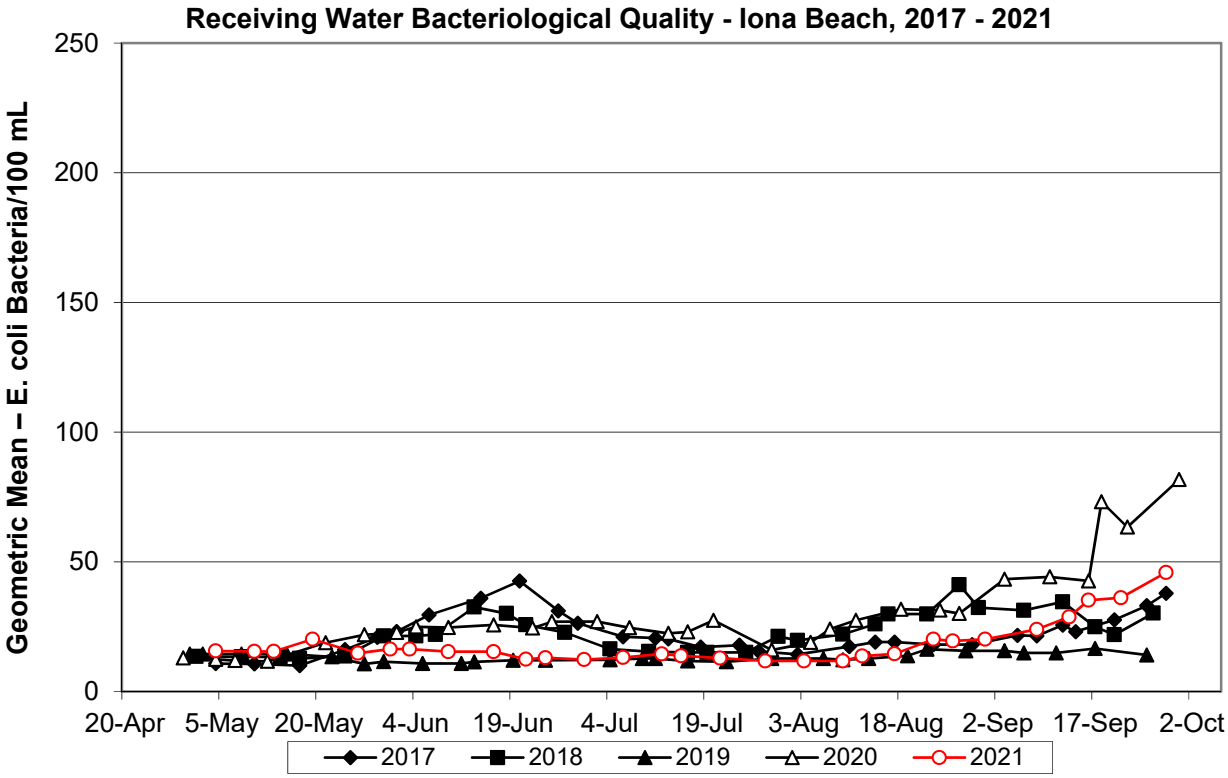

Receiving Water Bacteriological Quality - English Bay, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
300
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

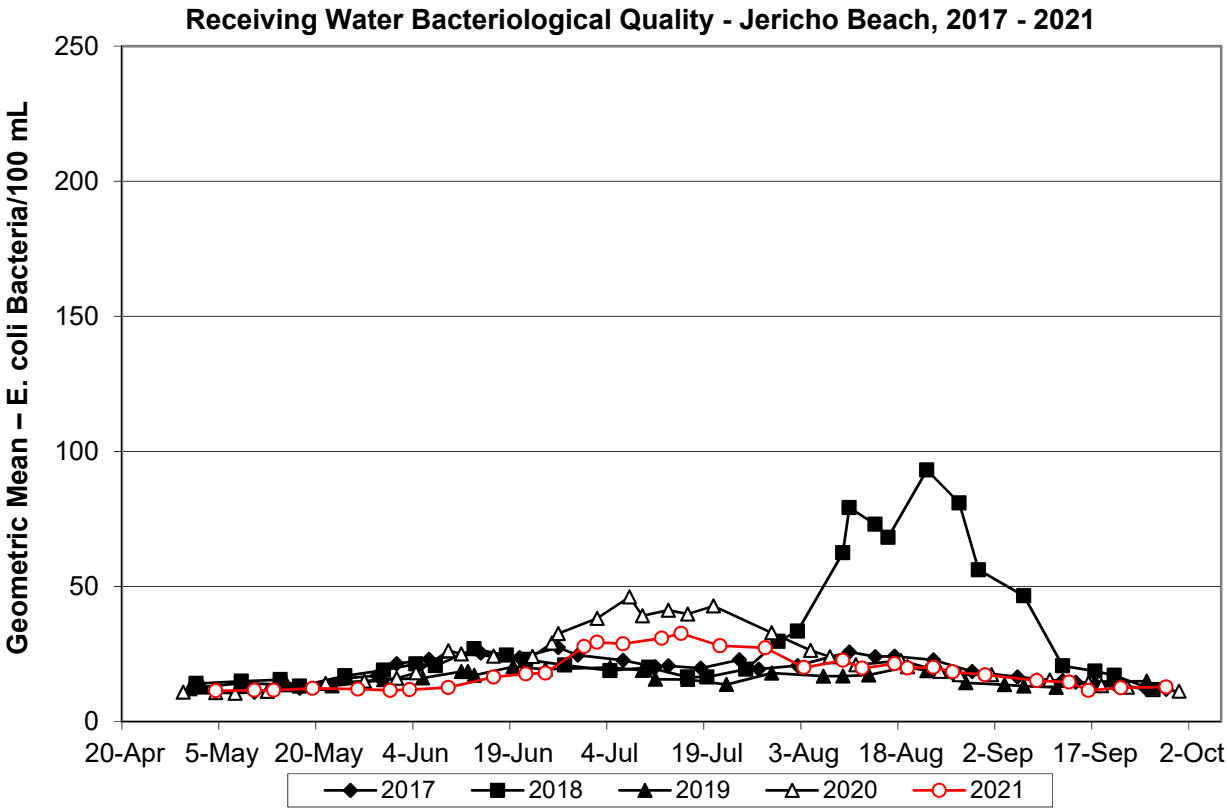

Receiving Water Bacteriological Quality - Central False Creek, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
2000
1500
1000
500
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

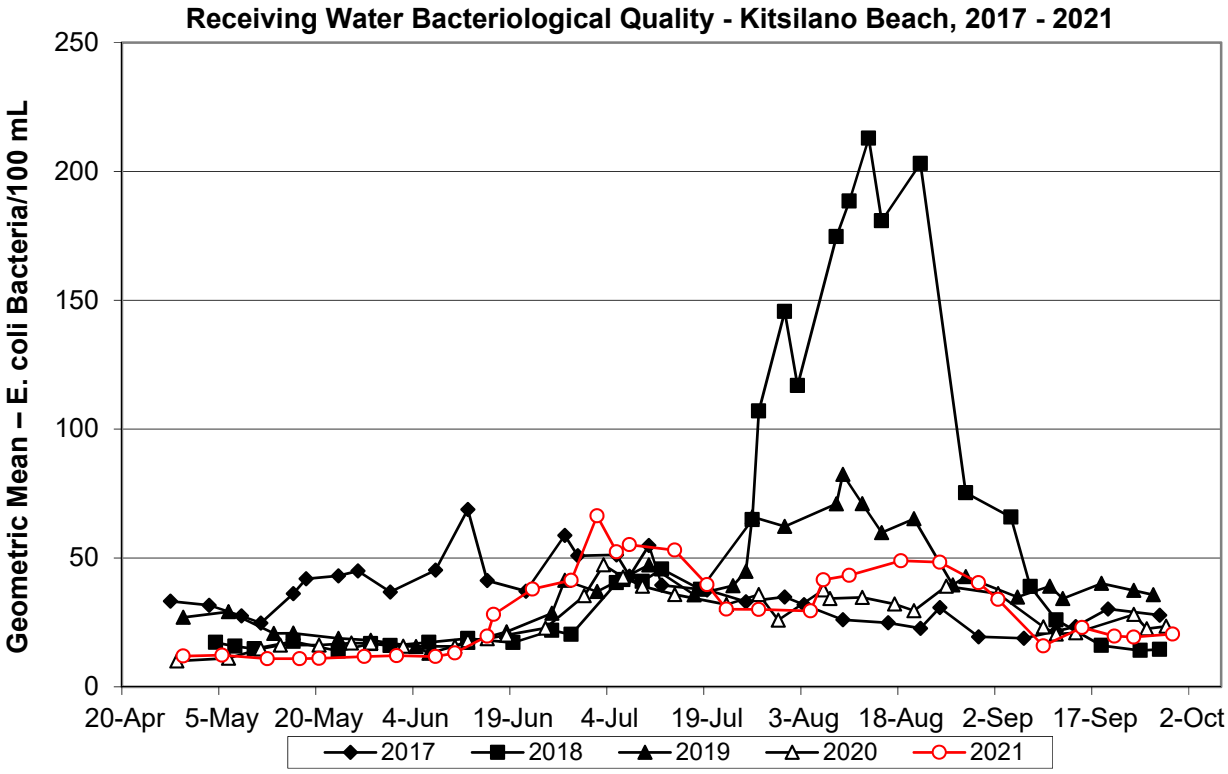

Receiving Water Bacteriological Quality - East False Creek, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
4000
3000
2000
1000
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

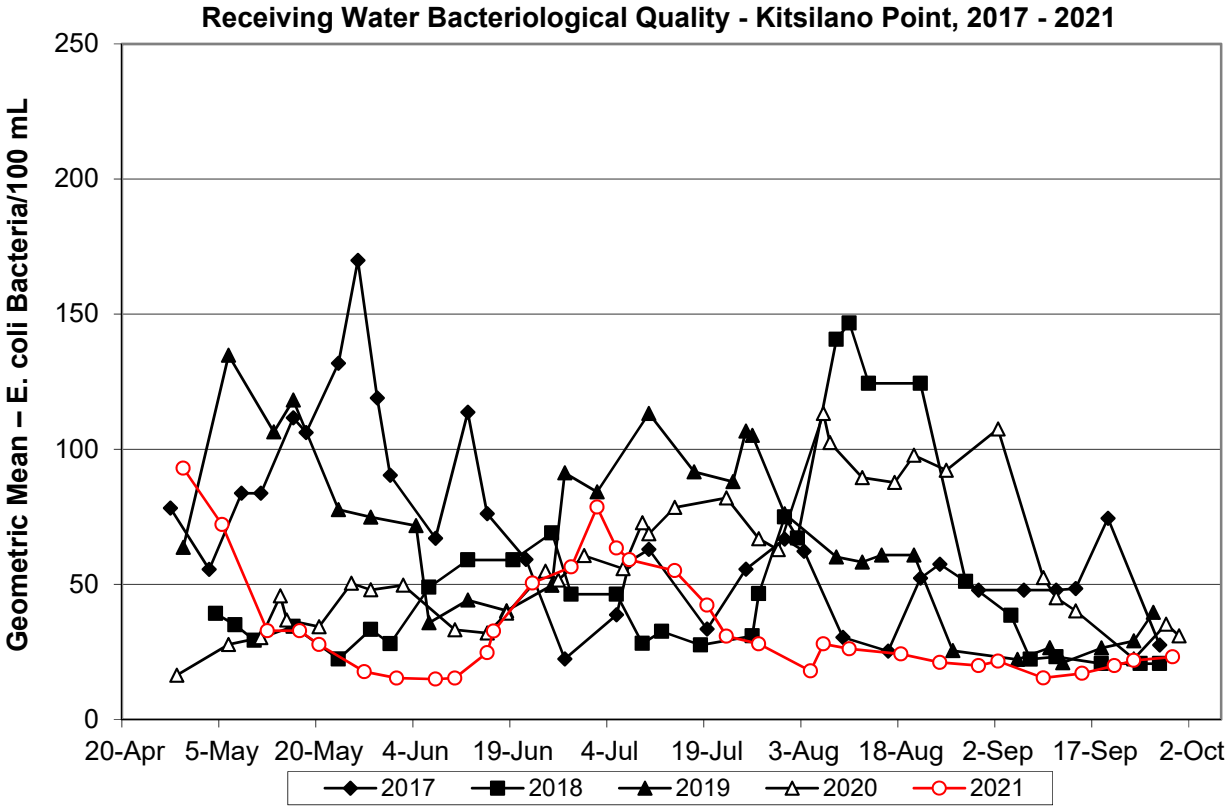

Receiving Water Bacteriological Quality - West False Creek, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

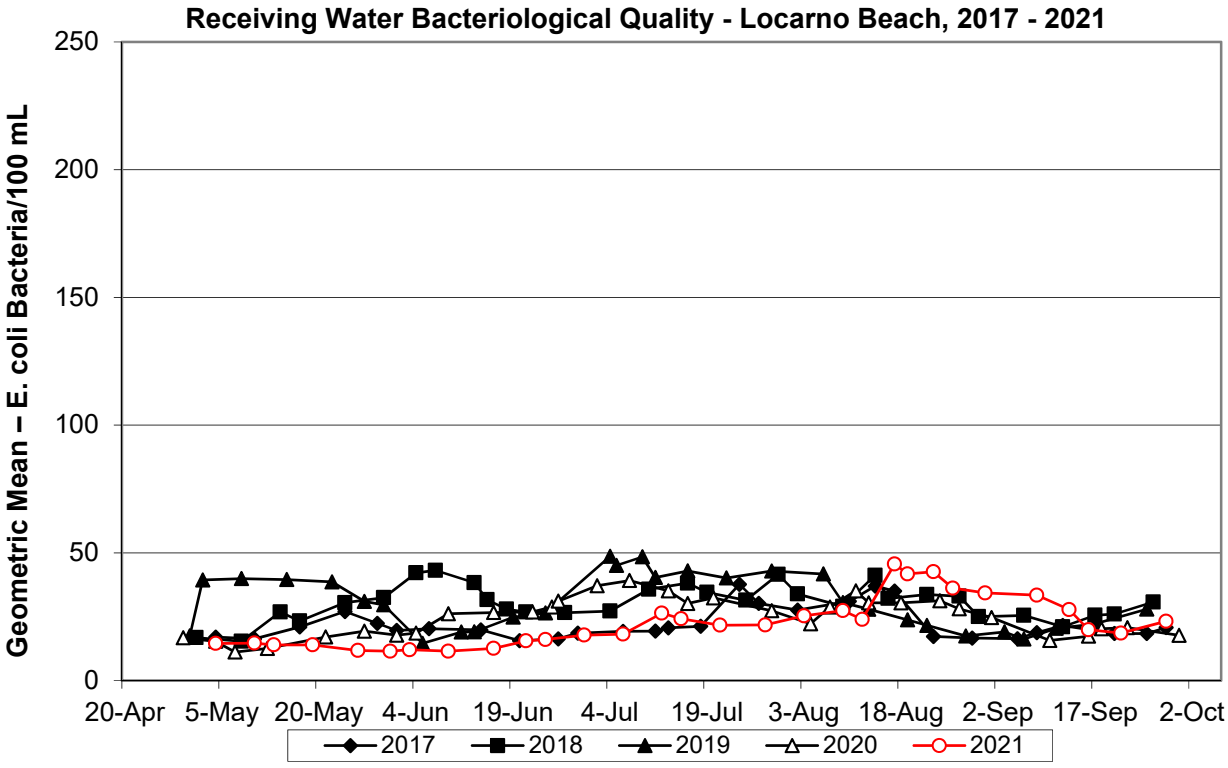

Receiving Water Bacteriological Quality - Garry Point, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

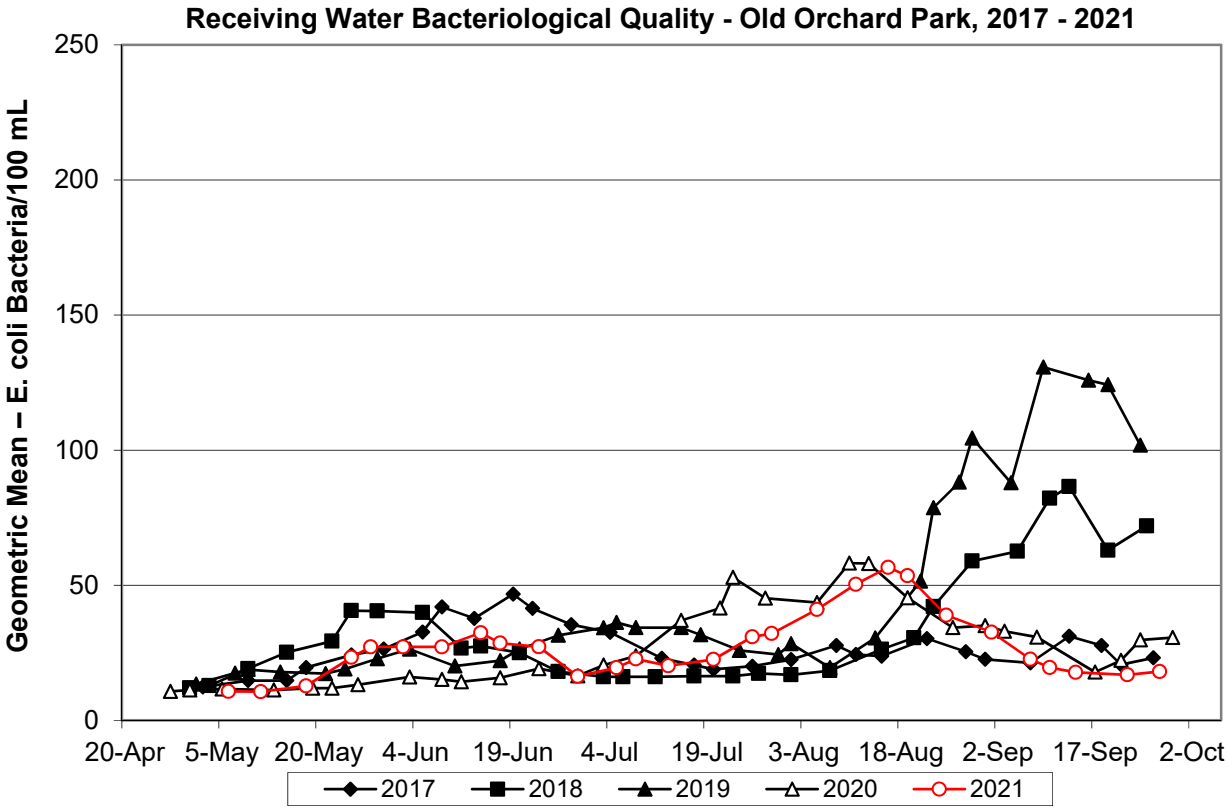

Receiving Water Bacteriological Quality - Iona Beach, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

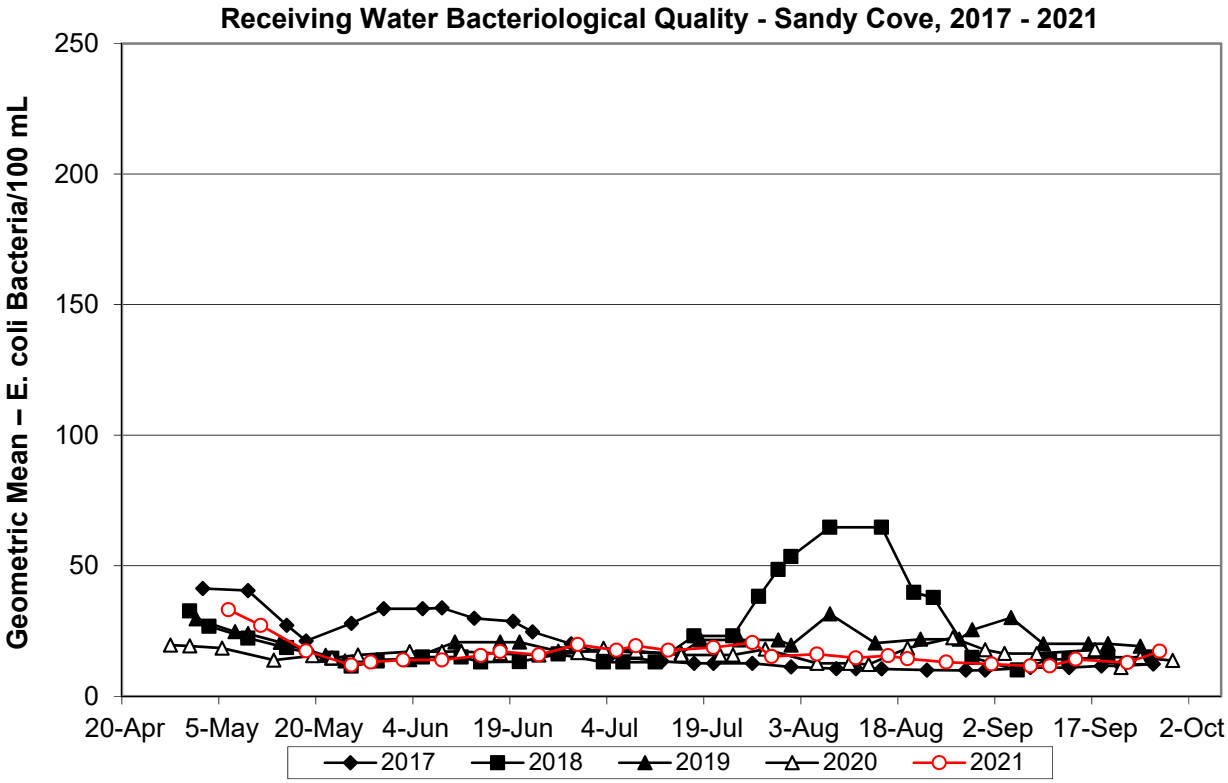

Receiving Water Bacteriological Quality - Jericho Beach, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

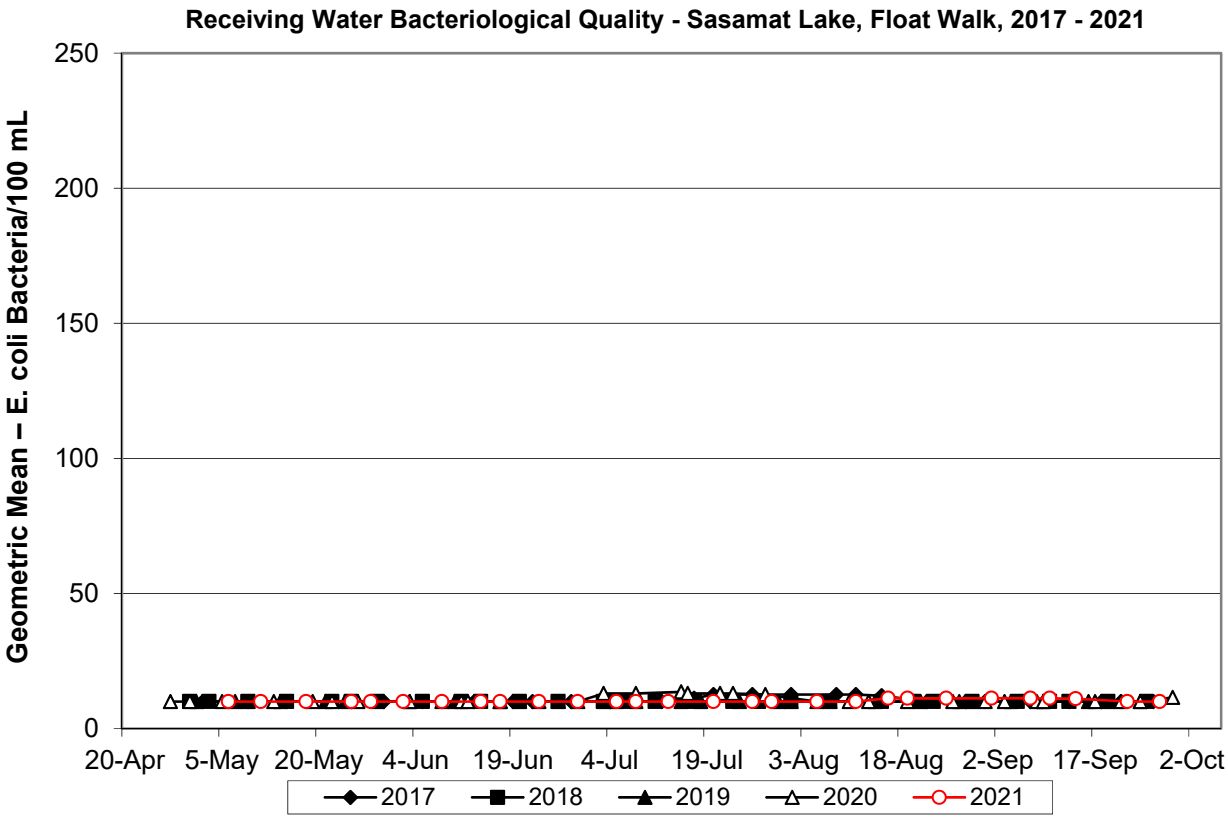

Receiving Water Bacteriological Quality - Kitsilano Beach, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

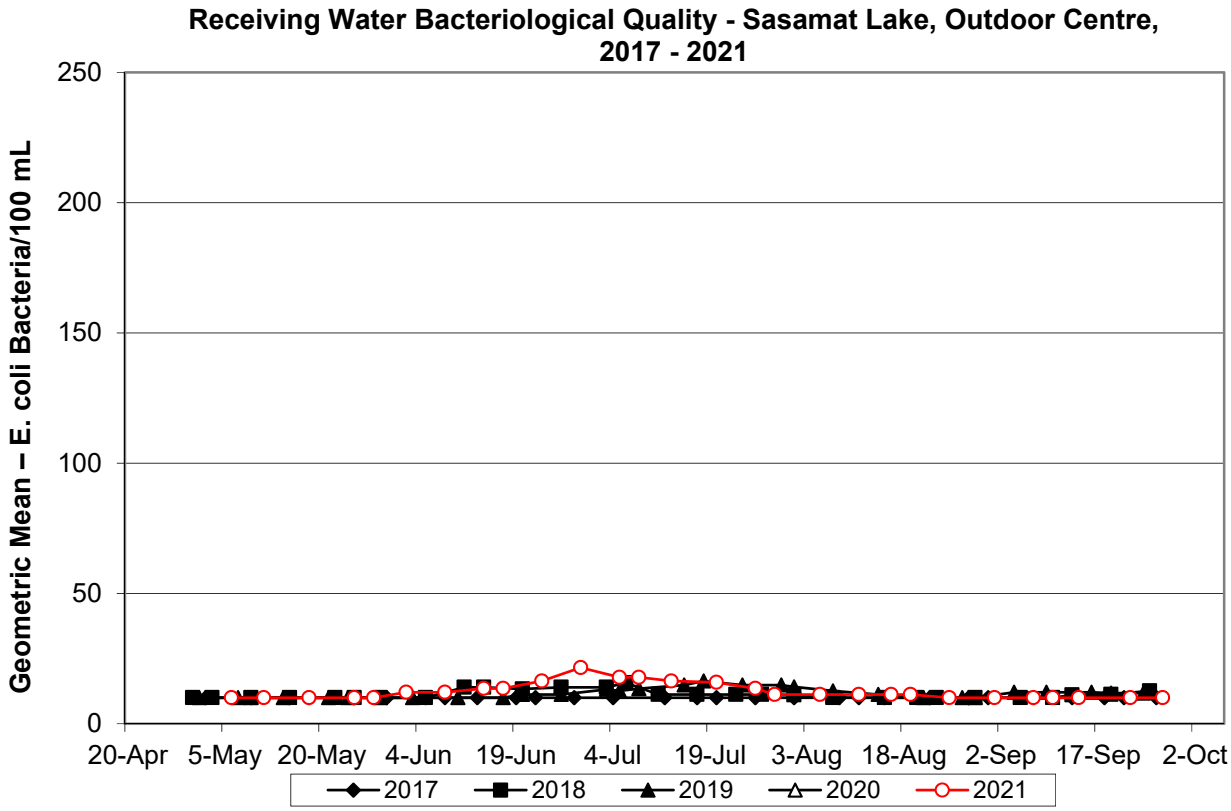

Receiving Water Bacteriological Quality - Kitsilano Point, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

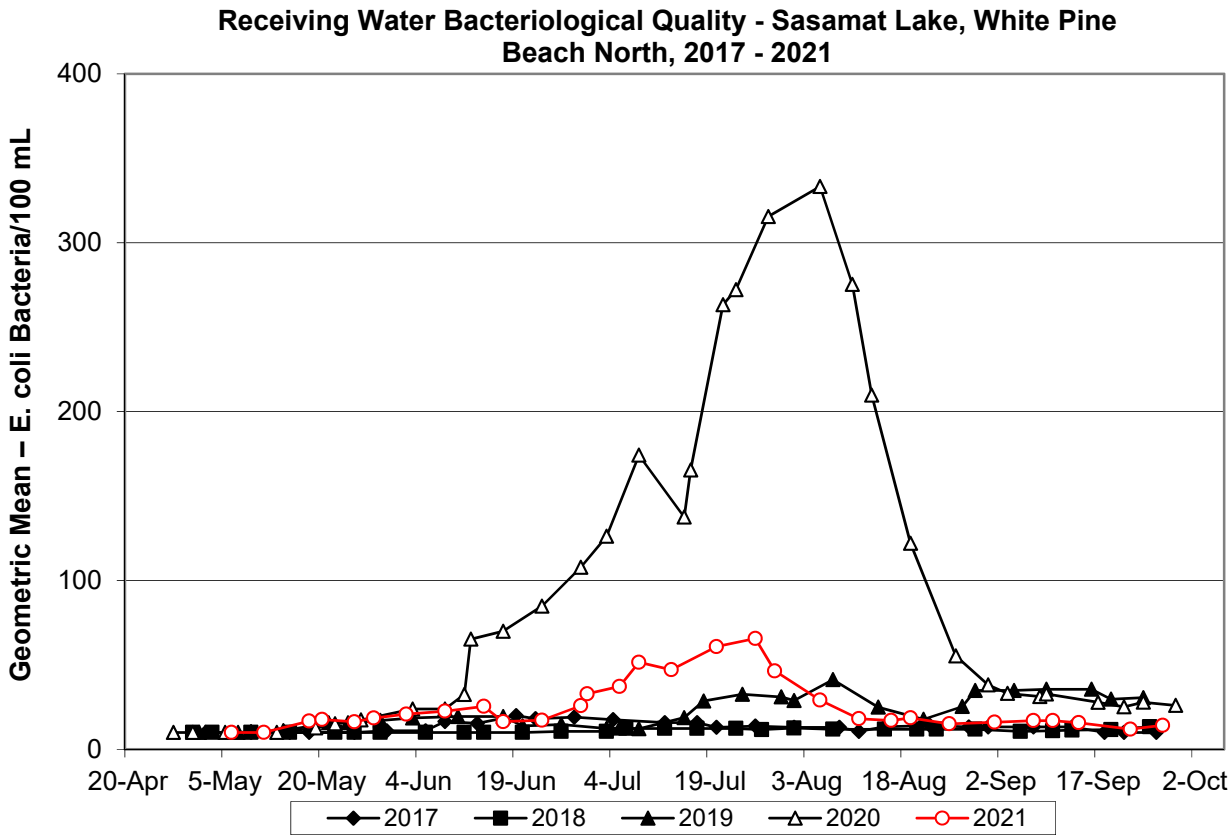

Receiving Water Bacteriological Quality - Locarno Beach, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

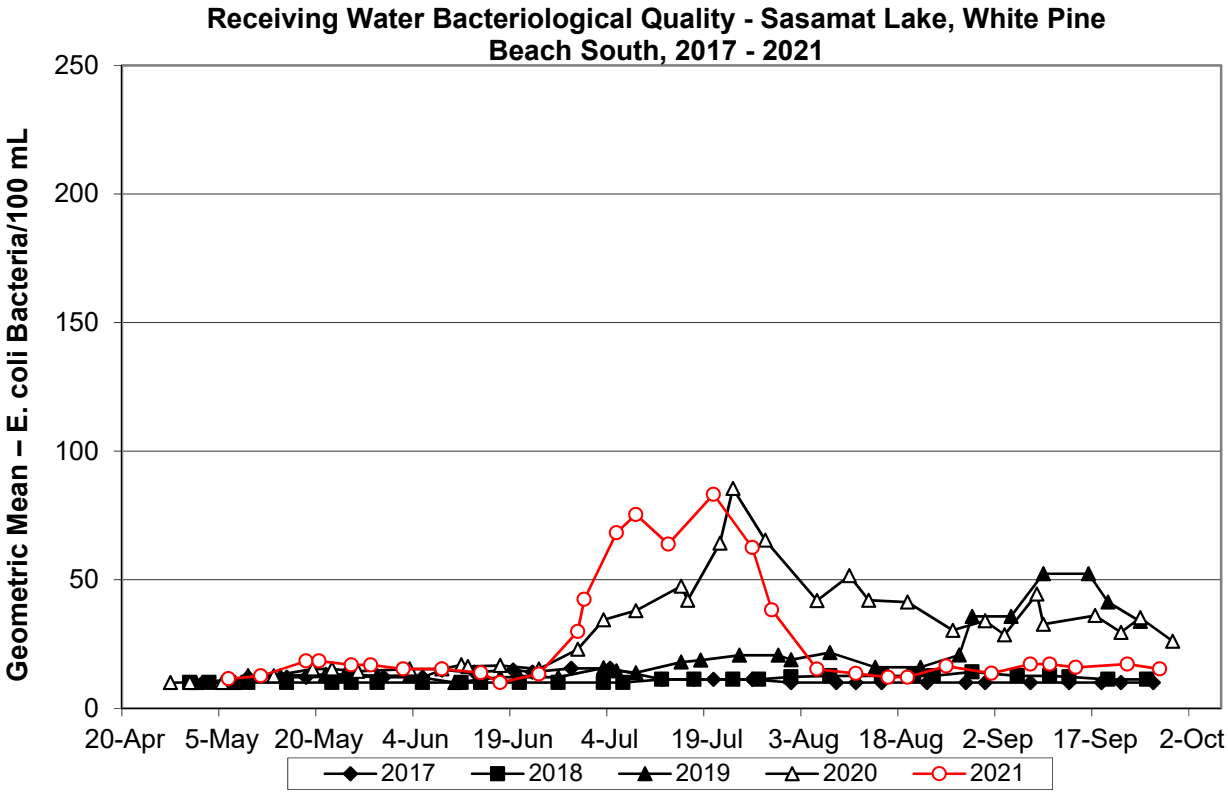

Receiving Water Bacteriological Quality - Old Orchard Park, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

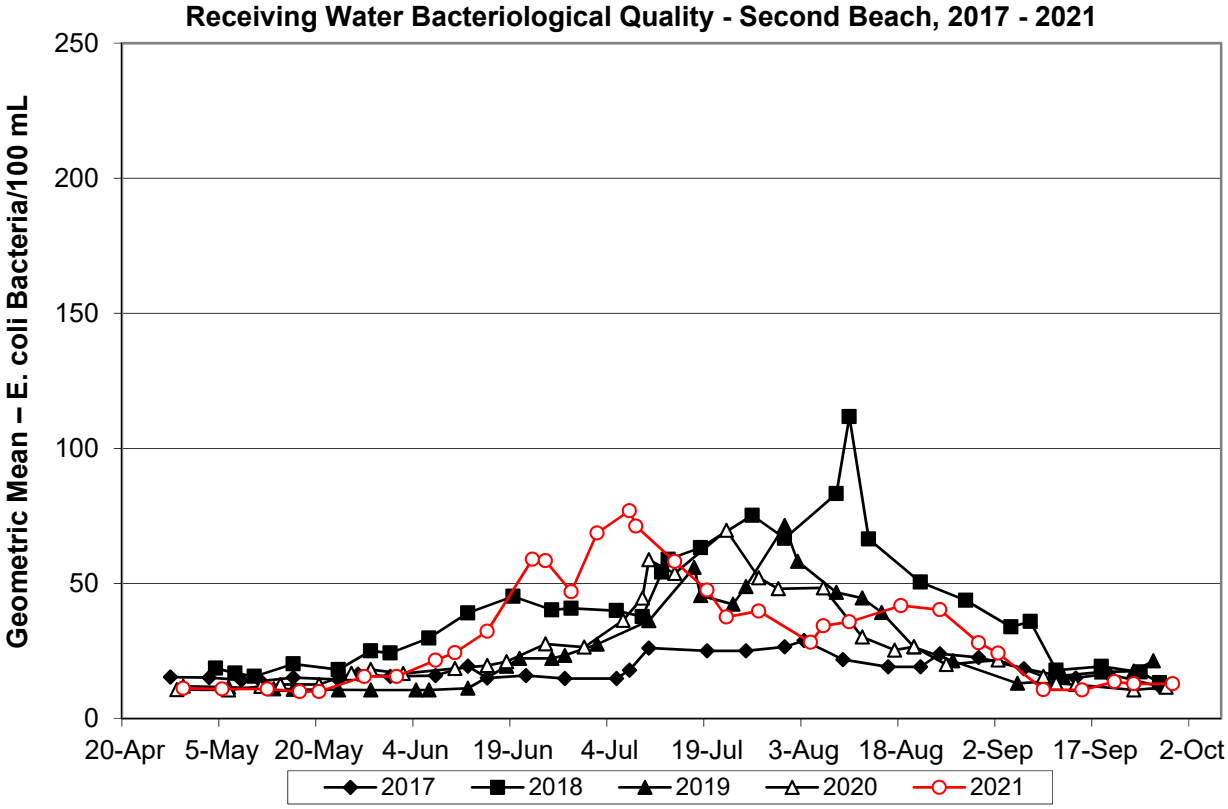

Receiving Water Bacteriological Quality - Sandy Cove, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

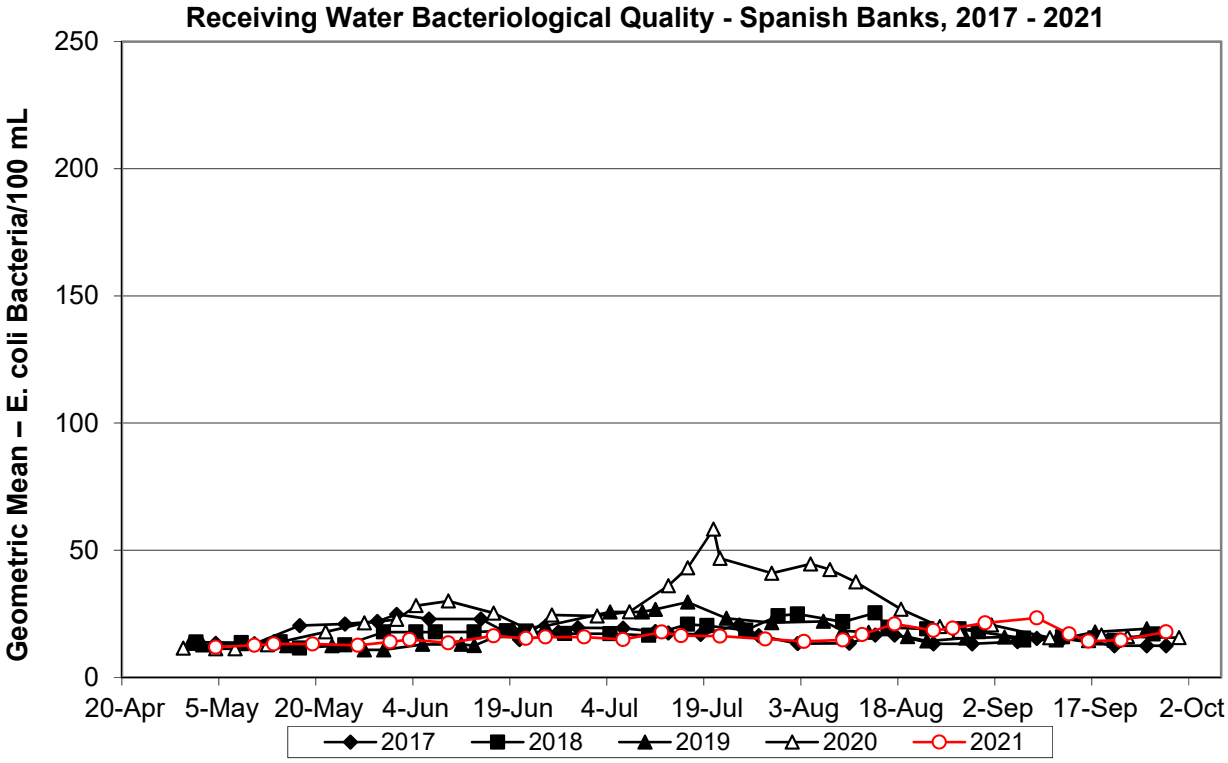

Receiving Water Bacteriological Quality - Sasamat Lake, Float Walk, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

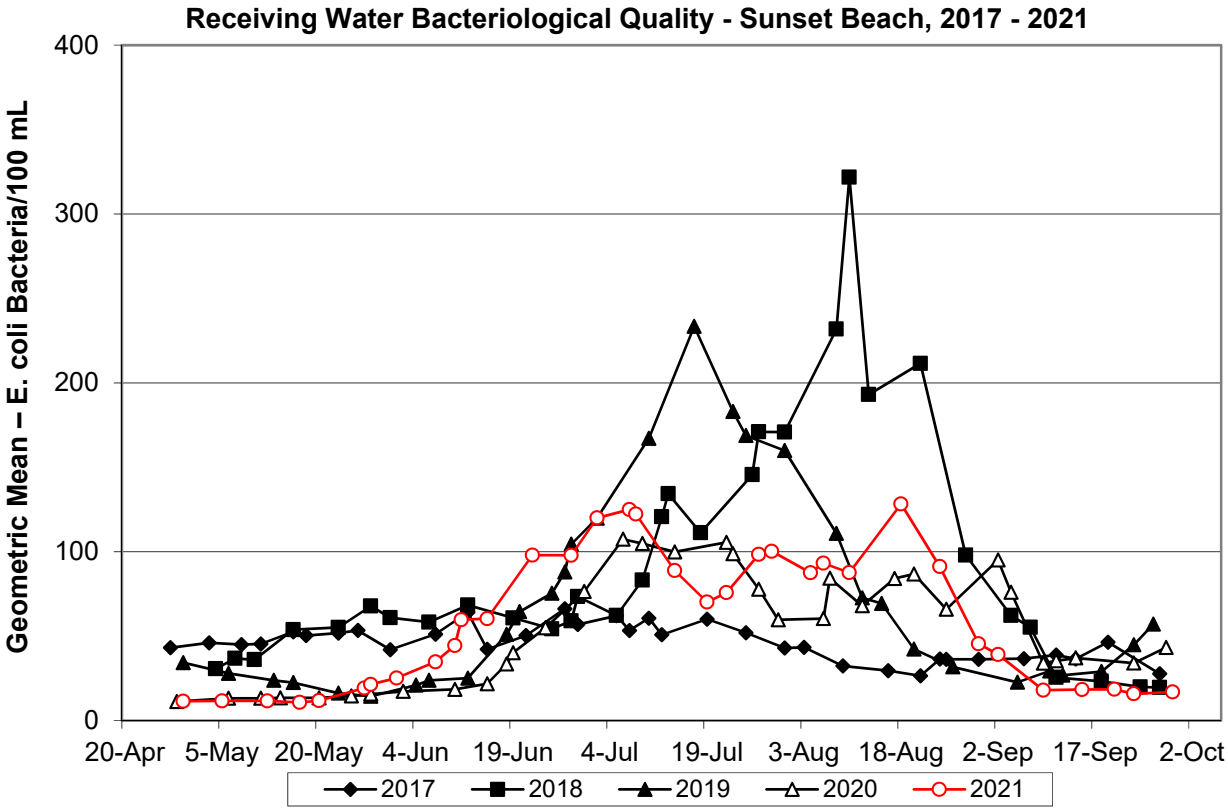

Receiving Water Bacteriological Quality - Sasamat Lake, Outdoor Centre, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

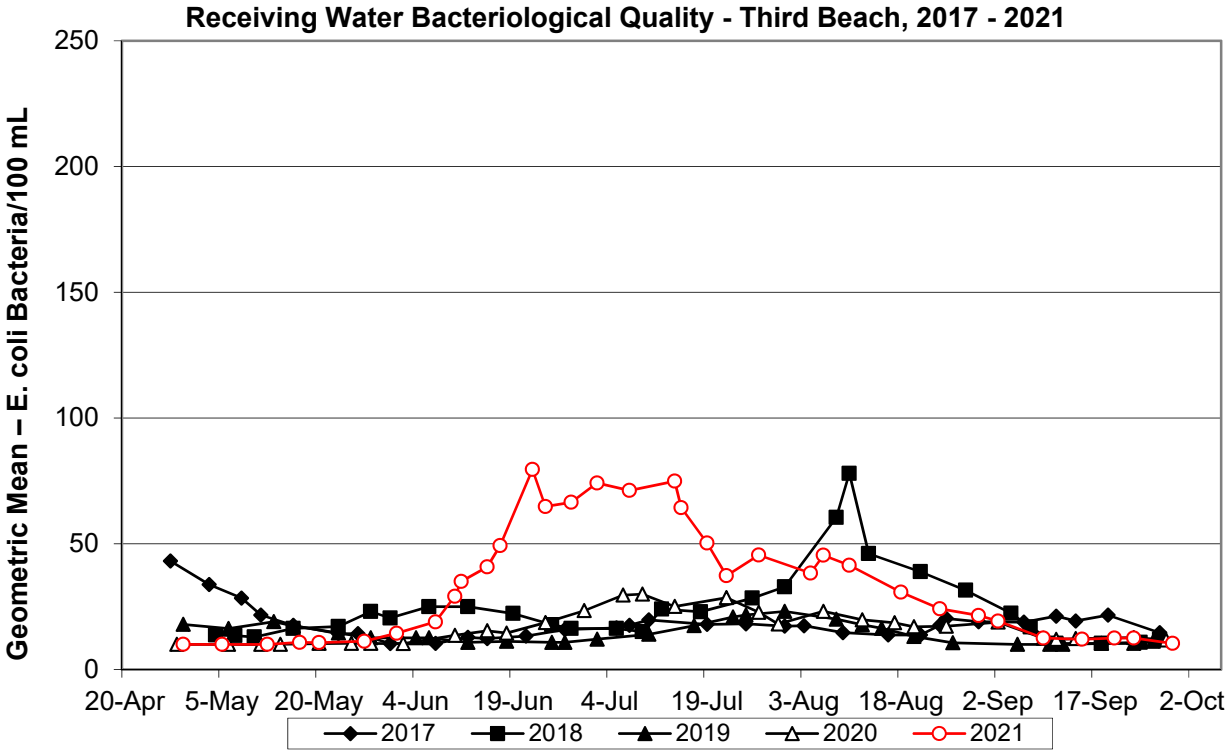

Receiving Water Bacteriological Quality - Sasamat Lake, White Pine Beach North, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
400
300
200
100
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

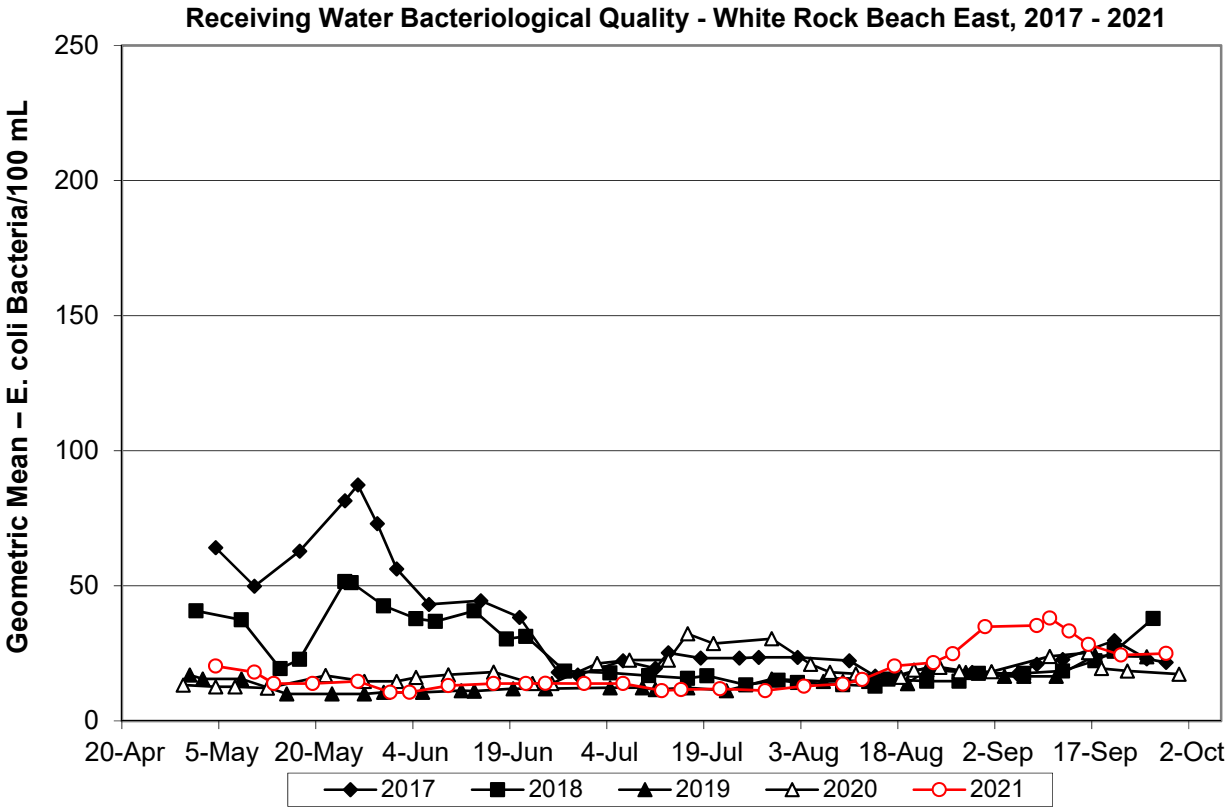

Receiving Water Bacteriological Quality - Sasamat Lake, White Pine Beach South, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021

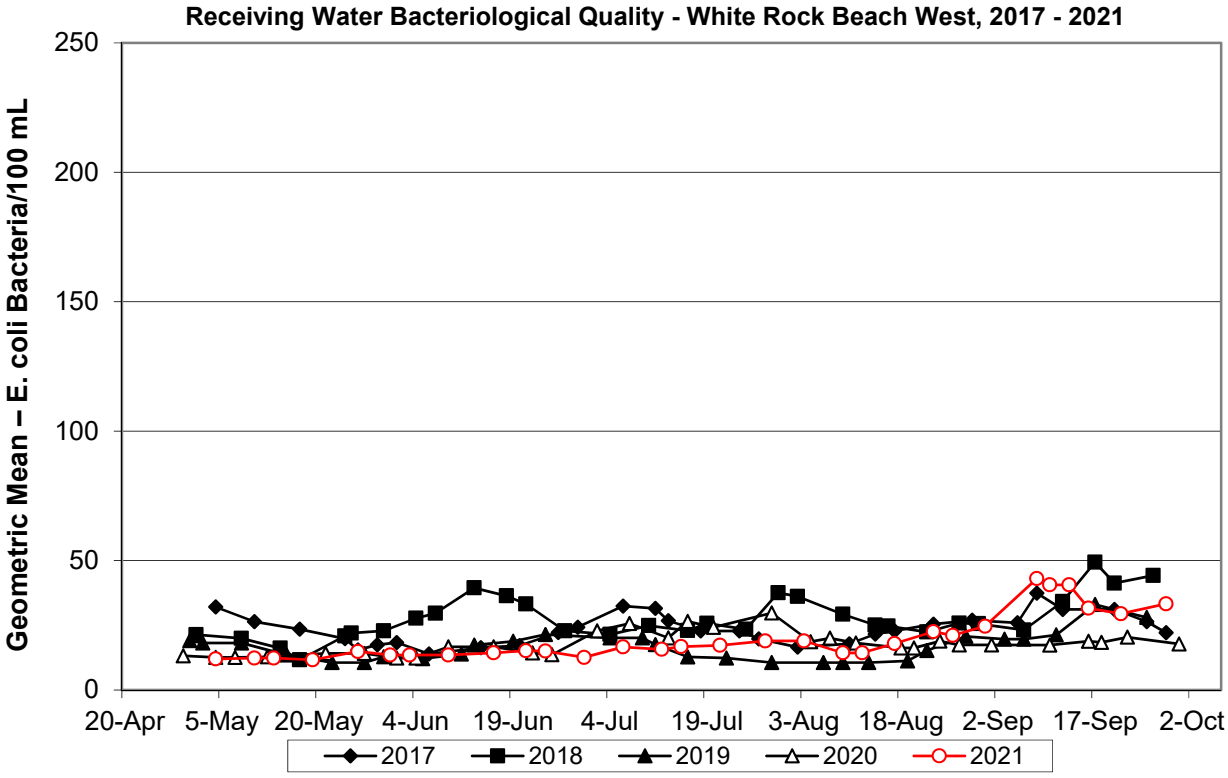

Receiving Water Bacteriological Quality - Second Beach, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021


Receiving Water Bacteriological Quality - Spanish Banks, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021


Receiving Water Bacteriological Quality - Sunset Beach, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
400
300
200
100
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021


Receiving Water Bacteriological Quality - Third Beach, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021


Receiving Water Bacteriological Quality - White Rock Beach East, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021


Receiving Water Bacteriological Quality - White Rock Beach West, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
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2-Sep
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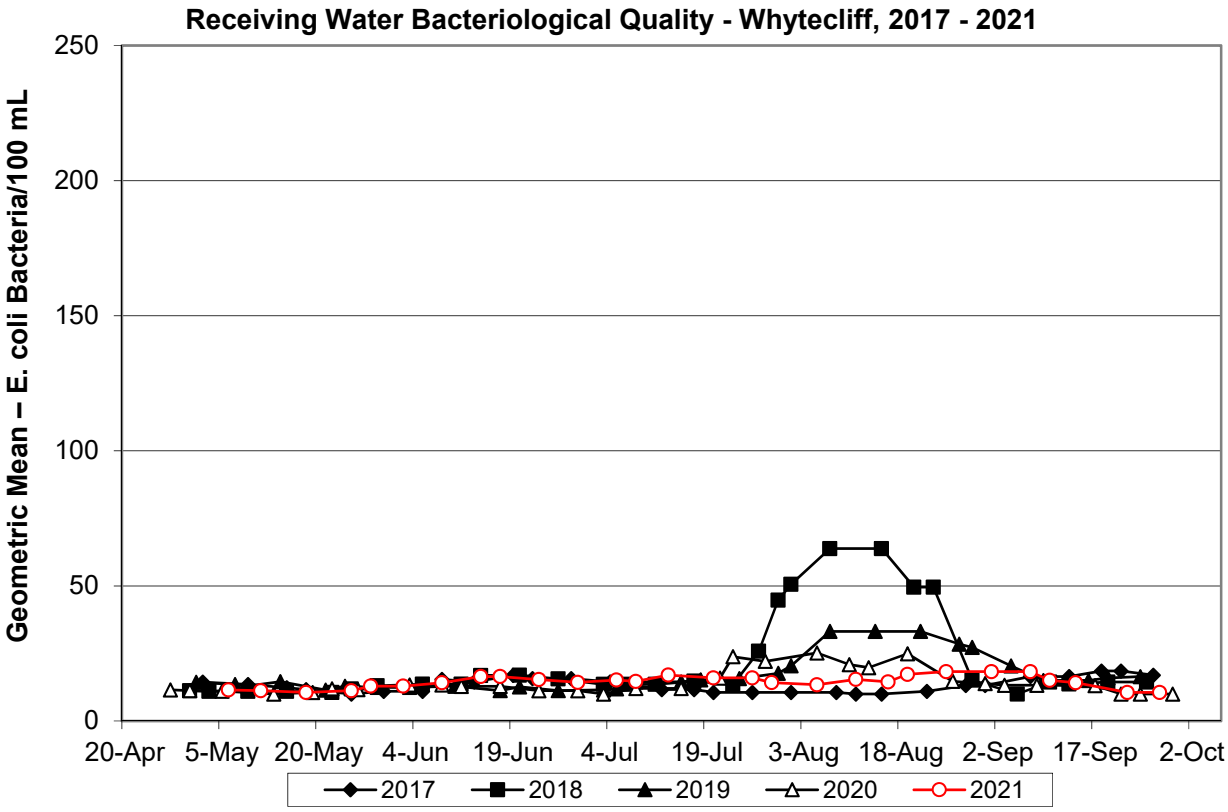
2-Oct
2017
2018
2019
2020
2021


Receiving Water Bacteriological Quality - Whytecliff, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
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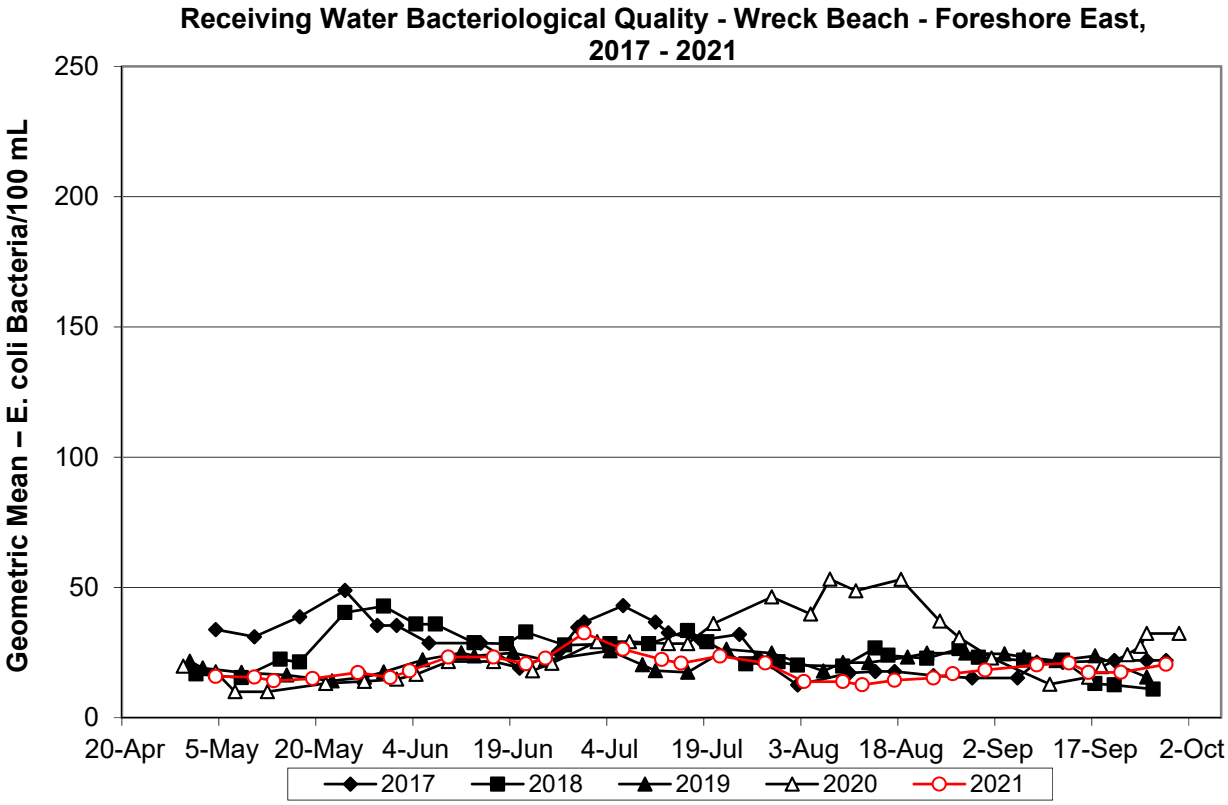
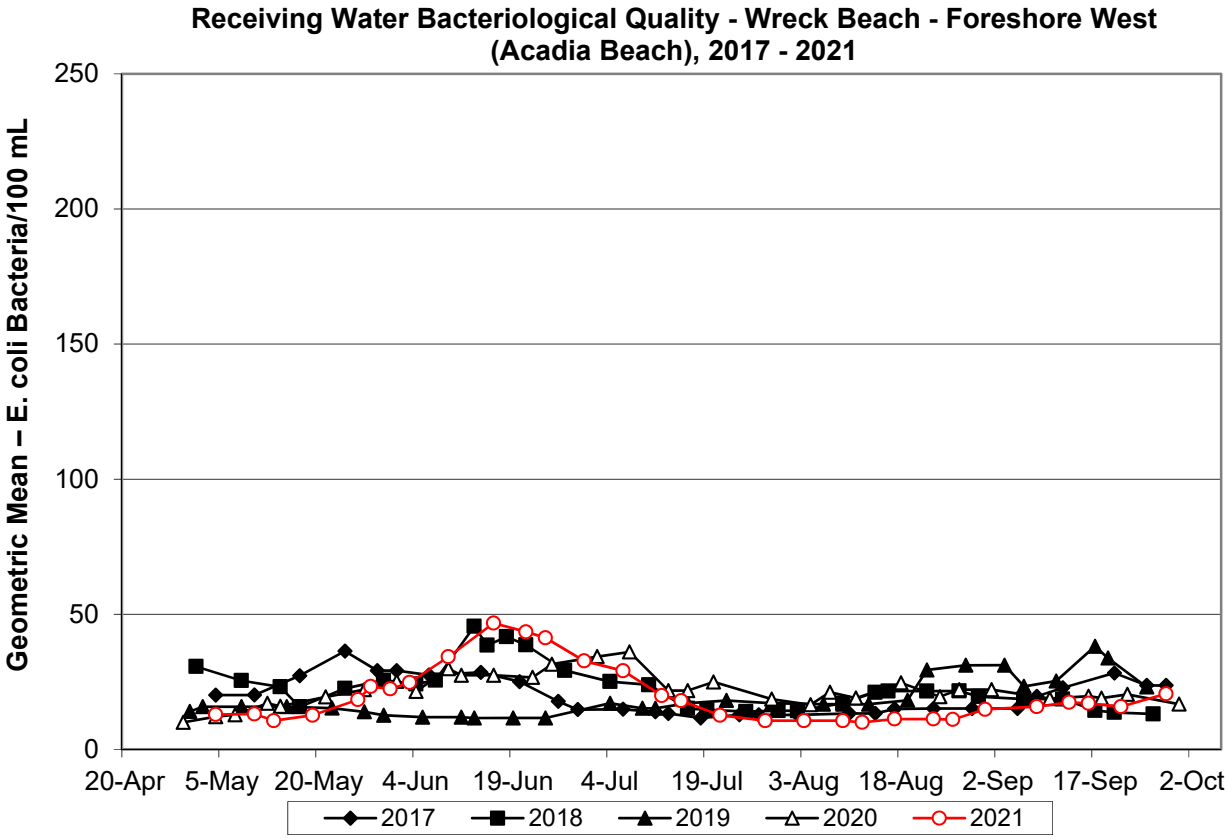
2-Oct
2017
2018
2019
2020
2021


Receiving Water Bacteriological Quality - Wreck Beach - Foreshore East, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
2019
2020
2021


Receiving Water Bacteriological Quality - Wreck Beach - Foreshore West (Acadia Beach), 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
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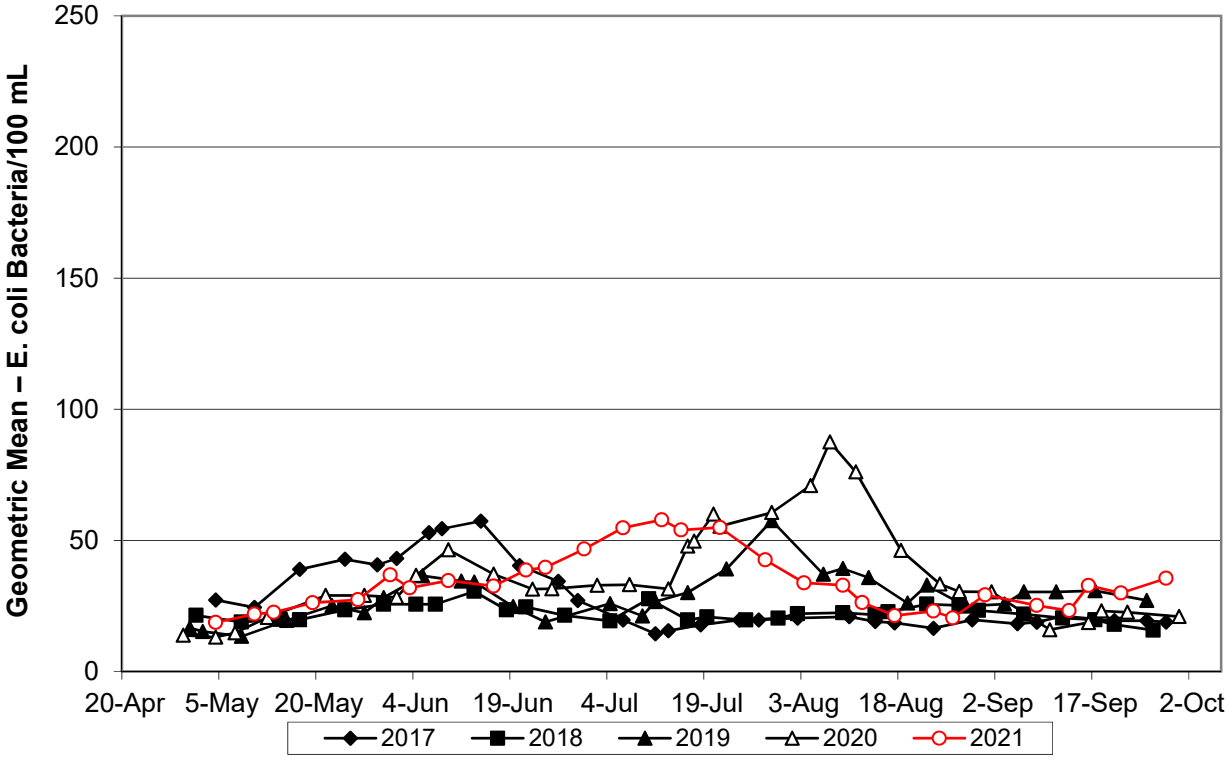
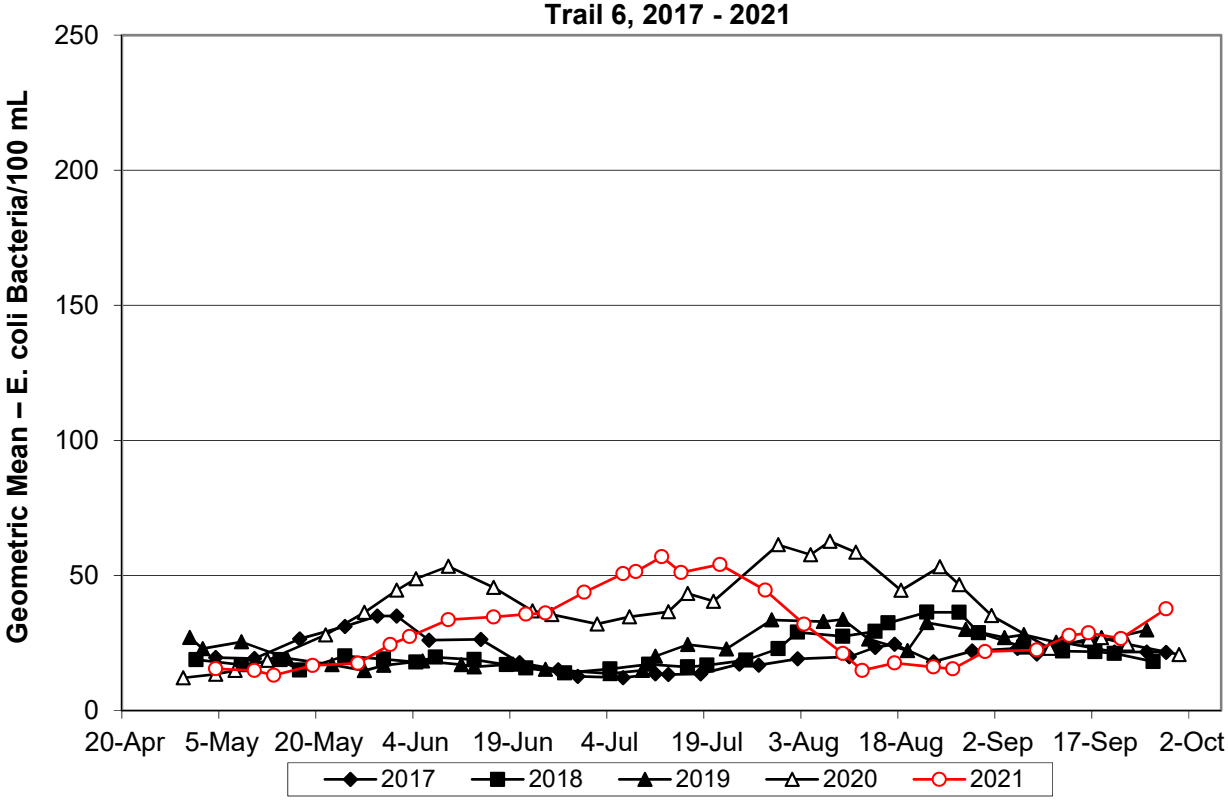
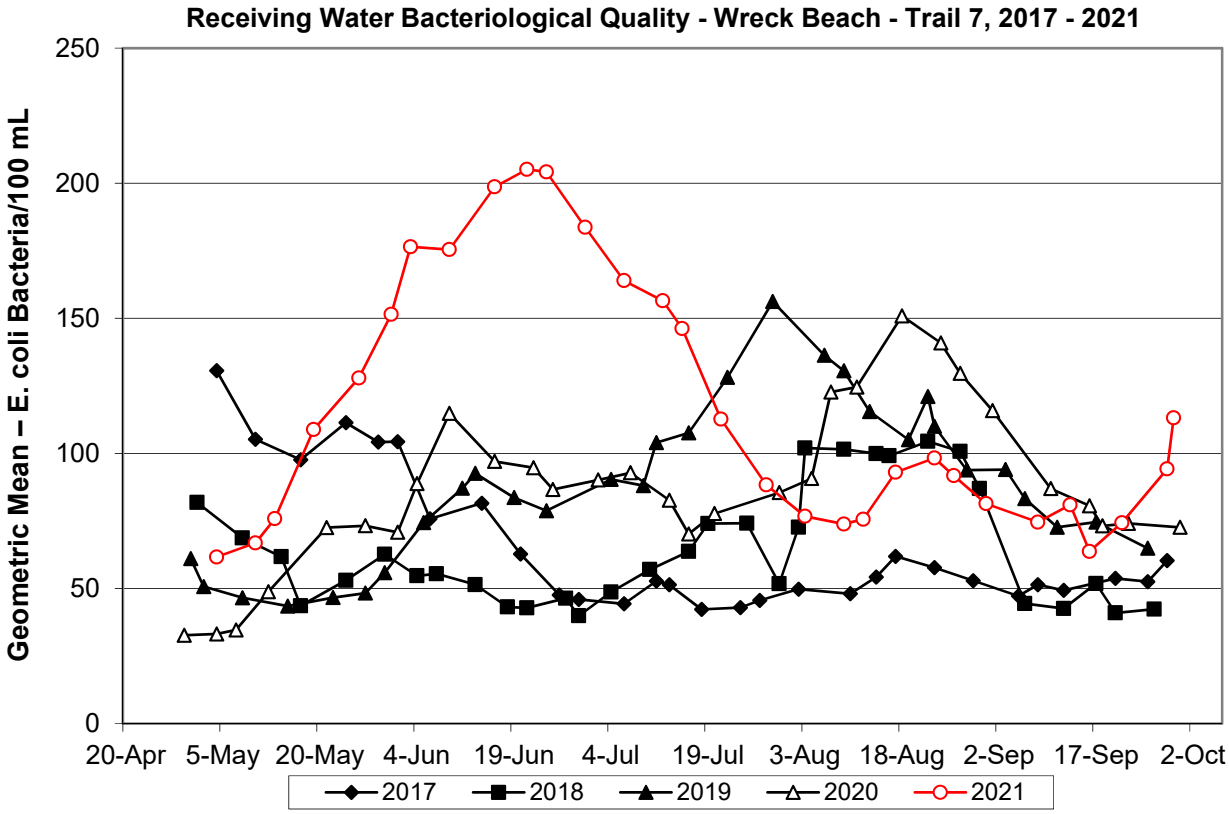
17-Sep
2-Oct
2017
2018
2019
2020
2021

Receiving Water Bacteriological Quality - Wreck Beach - Trail 4, 2017 - 2021



Receiving Water Bacteriological Quality - Wreck Beach - Breakwater - Trail 6, 2017 - 2021




Receiving Water Bacteriological Quality - Wreck Beach - Trail 7, 2017 - 2021
Geometric Mean – E. coli Bacteria/100 mL
250
200
150
100
50
0
20-Apr
5-May
20-May
4-Jun
19-Jun
4-Jul
19-Jul
3-Aug
18-Aug
2-Sep
17-Sep
2-Oct
2017
2018
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2021


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SERVICES AND SOLUTIONS FOR A LIVABLE REGION