

# 2022 Annual Wastewater Treatment Plant Report

Resort Municipality of Whistler Wastewater Treatment Plant

Operational Certificate ME-01452



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## 1.0 INTRODUCTION

Per section 3.6 Reporting of the Operation Certificate ME-01452 for the Resort Municipality of Whistler's (RMOW) Waste Water Treatment Plant (WWTP), the intent of this document is to report discharge and receiving environment data for the operating period. The report includes trend analysis data and interpretation from the receiving environment for the reported operating year and in comparison to previous years, in regards to the potential impact to the receiving environment. The report will also outline the past years achievement in regards to source control, water conservation programs, and environmental impact programs.

## 2.0 MONITORING AND REPORTING REQUIREMENTS

Per section 3.0 (Monitoring and Reporting Requirements) of the operational certificate, monitoring samples are taken by staff and collected for the WWTP to monitor discharge, receiving environment outfall and trucked waste.

Table 1 below highlights the samples taken and their frequency.

*Table 1: Discharge Monitoring Sampling Parameters*

Parameter	Unit of measure	Frequency	Sample Type
Chlorine residual *	mg/L	Daily	Grab
TSS	mg/L	5 times per week	Composite
Orthophosphate (as phosphorus)	mg/L	5 times per week	Composite
CBOD5**	mg/L	2 times per week	Composite
Fecal Coliform*	MPN/100mL	2 times per week	Grab
Total phosphorus	mg/L	Weekly	Composite
Iron	mg/L	Monthly	Composite
Fish Bioassay (rainbow trout) 96 hour LC50, %	% survival rate	2 times per year	Grab
Effluent volume discharge	m <sup>3</sup> /day	1 per day over a 24 period	Composite

\*if chlorine is used between May 15 and September 15 only

\*\*COD may be used in place of CBOD<sub>5</sub> if CBOD<sub>5</sub> is examined with every 5<sup>th</sup> sample

Table 2 highlights the sampling parameter requirements for the receiving environment.

*Table 2: Receiving Environment Monitoring Sampling Parameters*

Parameter	Unit of measure	Sample Type	Frequency
<b>pH</b>	-	3 times per year; winter low flow, spring freshet & fall flow	Grab
<b>Conductivity</b>	µmho/cm	3 times per year; winter low flow, spring freshet & fall flow	Grab
<b>Turbidity</b>	TU	3 times per year; winter low flow, spring freshet & fall flow	Grab
<b>Orthophosphate (as phosphorus)</b>	mg/L	3 times per year; winter low flow, spring freshet & fall flow	Grab
<b>Nitrate nitrogen</b>	mg/L	3 times per year; winter low flow, spring freshet & fall flow	Grab
<b>Nitrite nitrogen</b>	mg/L	3 times per year; winter low flow, spring freshet & fall flow	Grab
<b>Ammonia nitrogen</b>	mg/L	3 times per year; winter low flow, spring freshet & fall flow	Grab
<b>Nitrate+Nitrite as N</b>	mg/L	3 times per year; winter low flow, spring freshet & fall flow	Grab



## Permit Excursions

The WWTP tracks and monitors the number of permit excursions that occur during the reporting period (Figure 1). For the reporting period no permit excursions were recorded per section 1.1.3 Nutrient loading for the discharge from May 15 – September 15 inclusive of Orthophosphate (as phosphorus) 36.6 kg/month maximum.

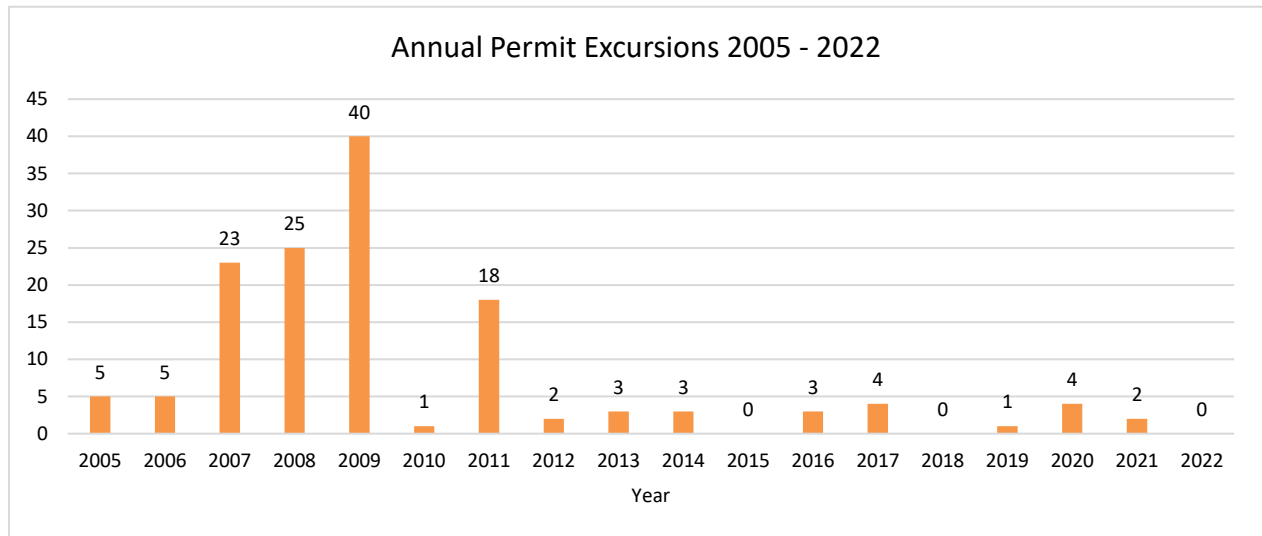


Figure 1: Quantity of Permit Excursions per year 2005-2022

## Outfall Inspections

Section 3.4 of the Operational Certificate requires the outfall to be inspected once every **five** years by independent qualified personnel to ensure that it is in good condition.

The last outfall inspection was conducted by Cascade Environmental Resource Group in 2018. Recommendations from that inspection to cut back shrub vegetation were completed, and this task now forms part of preventative maintenance program for the outfall.

The next outfall inspection will be in 2023.

## Website

Quarterly reports of WWTP monitoring data is posted on an ongoing basis to the Resort Municipality of Whistler's website, available at the following link:

<https://www.whistler.ca/services/water-and-wastewater/wastewater-treatment-plant>.

## Facility Staffing

The RMOW WWTP facility staff qualifications met EOCP requirements (Table 3) for the report period.

*Table 3: WWTP facility staffing list and certifications*

Name	Position	Certification
Chris Wike	Utilities Group Manager	
Wayne Dennien	Utilities Superintendent	
Jenny James	Chief Operator Wastewater	EOCP Level III Municipal Wastewater Collection EOCP Level I Municipal Wastewater Treatment
Elizabeth Toole	Operator IV	EOCP Level IV Municipal Wastewater Treatment
Hamish (Ty) MacFayden	Operator III	EOCP Level III Municipal Wastewater Treatment
Ahren Snikvalds	Operator II	EOCP Level II Municipal Wastewater Treatment
Kyle Quesnel	Operator II	EOCP Level I Municipal Wastewater Treatment EOCP Level I Municipal Wastewater Collection
Eric Verreault	Operator I	EOCP Level I Municipal Wastewater Treatment
Graham Cofell	Operator I	EOCP Level I Municipal Wastewater Collection
Sean Weiss	Operator I	
Neil Kearns	Lab Technician	EOCP Level II Municipal Wastewater Treatment
Bruce Eckersley	Millwright	Red Seal Certified Millwright

## Other Achievements

During the report period, no volume of effluent bypassed the WWTP as the raw sewage bypass line had been removed in 2010. Further to this, the operation had no emergency shut downs and zero (0) trucks were turned away due to hazardous waste.

The effluent treated by the WWTP is used to produce heat for the RMOW's District Energy System. This system provides radiant heat through its system to the residents and businesses of Cheakamus Crossing neighborhood of the RMOW.

# 3.0 DISCHARGE DISCUSSION AND ANALYSIS

## Discharge Volume

The year is split into two seasons for purposes of reporting discharge. The dry season runs from May 15 – September 15 (inclusive), while the wet season is defined as January 1 – May 14 and September 16 – December 31.

Maximum allowable discharge during the dry season is 16,000 m<sup>3</sup>/day while the maximum allowable discharge during the wet season is 25,000 m<sup>3</sup>/day.

The average discharge during the dry season was 8,999 m<sup>3</sup>/day and the average discharge during the wet season was 9,688 m<sup>3</sup>/day.

The effluent discharge limit was not reached at any point in the 2022 reporting period, as shown below in Figure 2.

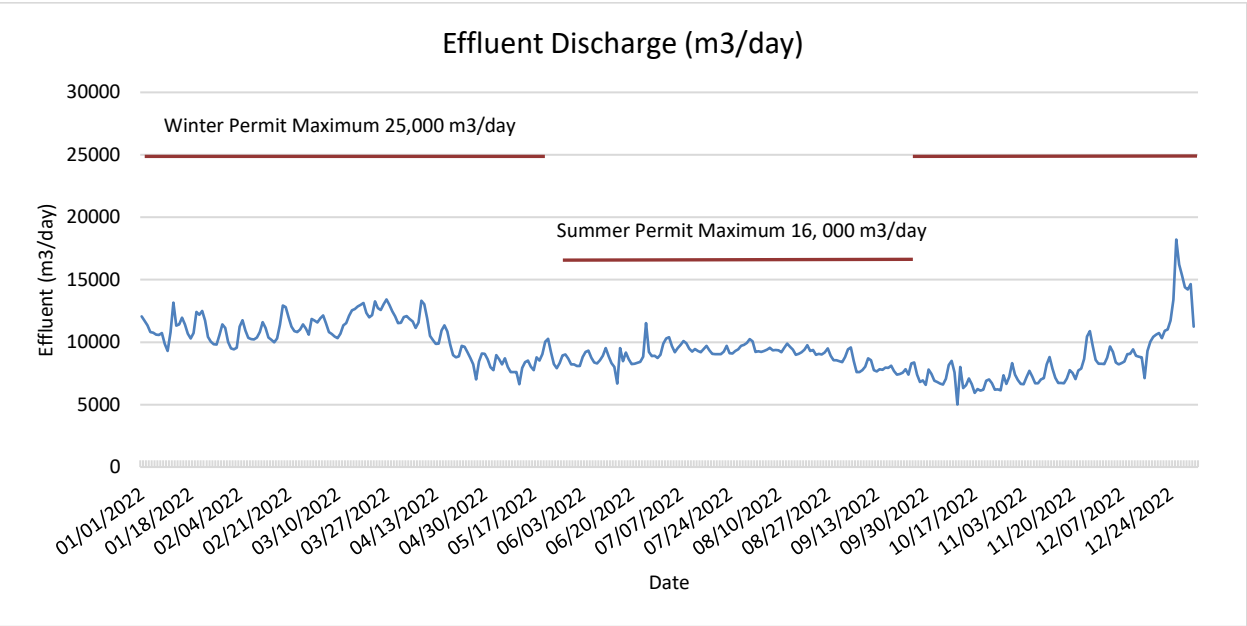


Figure 2: Whistler Wastewater Treatment Plant Daily Effluent Discharge Volume (m<sup>3</sup>/day)

Table 4: Average and maximum daily discharge (m3) wet and dry values by year since 2004

Year	Max Discharge Dry	Max Discharge Wet	Month Max Discharge Dry	Month Max Discharge Wet
2004	10,160	14,681	August	January
2005	12,238	13,720	August	December
2005	11,402	17,174	July	January
2006	13,742	19,731	July	December
2007	13,991	24,247	August	March
2008	12,891	17,568	August	December
2009	11,623	17,859	June	April
2010	12,891	22,855	August	January
2011	12,153	19,472	July	January
2012	13,397	20,575	June	January
2013	12,525	19,351	June	March
2014	11,646	25,070	August	December
2015	11,447	25,019	August	February
2016	12,119	21,284	August	February
2017	11,670	19,852	July	March
2018	11,395	16,927	August	December
2019	11,535	15,670	June	March
2020	10,780	26,793	August	February
2021	12,913	29,686	July	November
2022	11,520	18,215	June	December

## Orthophosphate as Phosphorous P04-P

Orthophosphate as Phosphorous P04-P concentration is permitted in discharge to a maximum of 1.75mg/L.

This limit was not exceeded at any point during 2022. This is shown below in Figure 3.

Figure 4 shows the final effluent total for the dry season on a monthly basis (the dry season defined as May 15 – September 15 inclusive).

The total nutrient loading maximum for the discharge is 36.6 kg/month. This was not exceeded in any period in 2022.

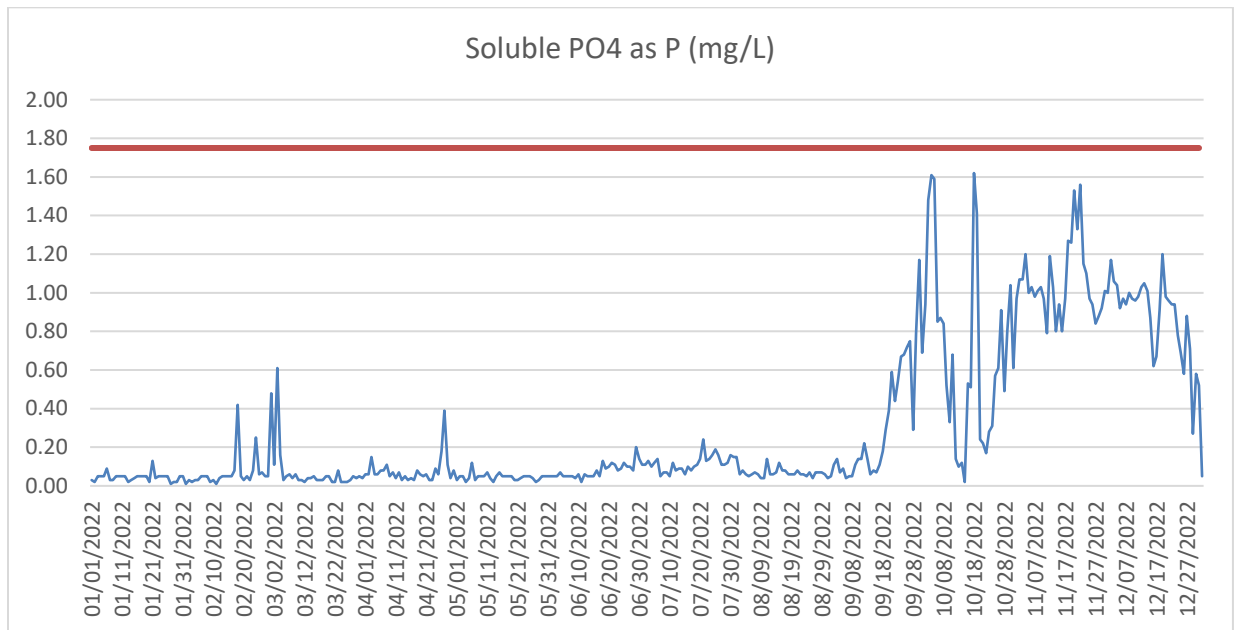


Figure 3: Final effluent daily Phosphorus (PO4-P) concentrations (mg/L)

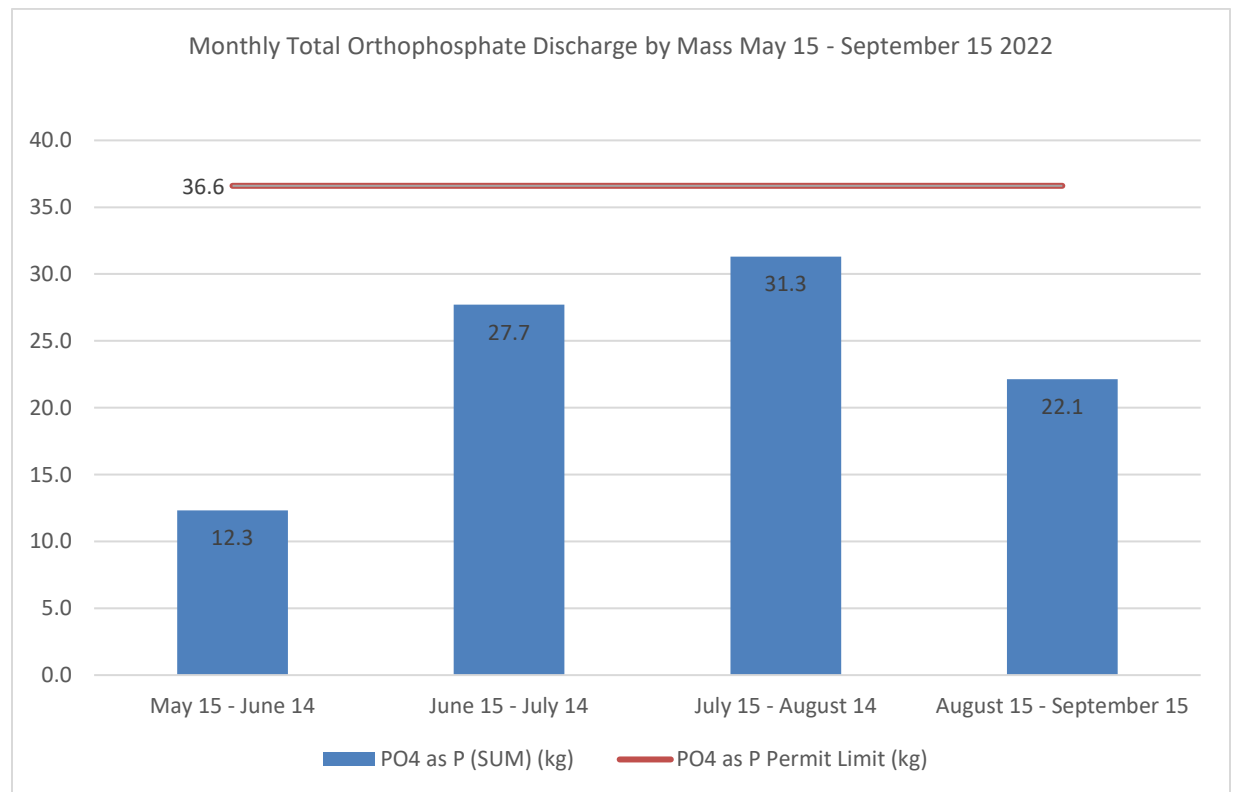


Figure 4: Final effluent total Phosphorus (PO4-P) discharge by month May 15 - September 15 2022

## Total Phosphorous – Laboratory Results

Weekly final effluent samples are submitted to a certified laboratory for total phosphorous concentration analysis.

Figure 5 shows the laboratory results of the total phosphorus in the final effluent.

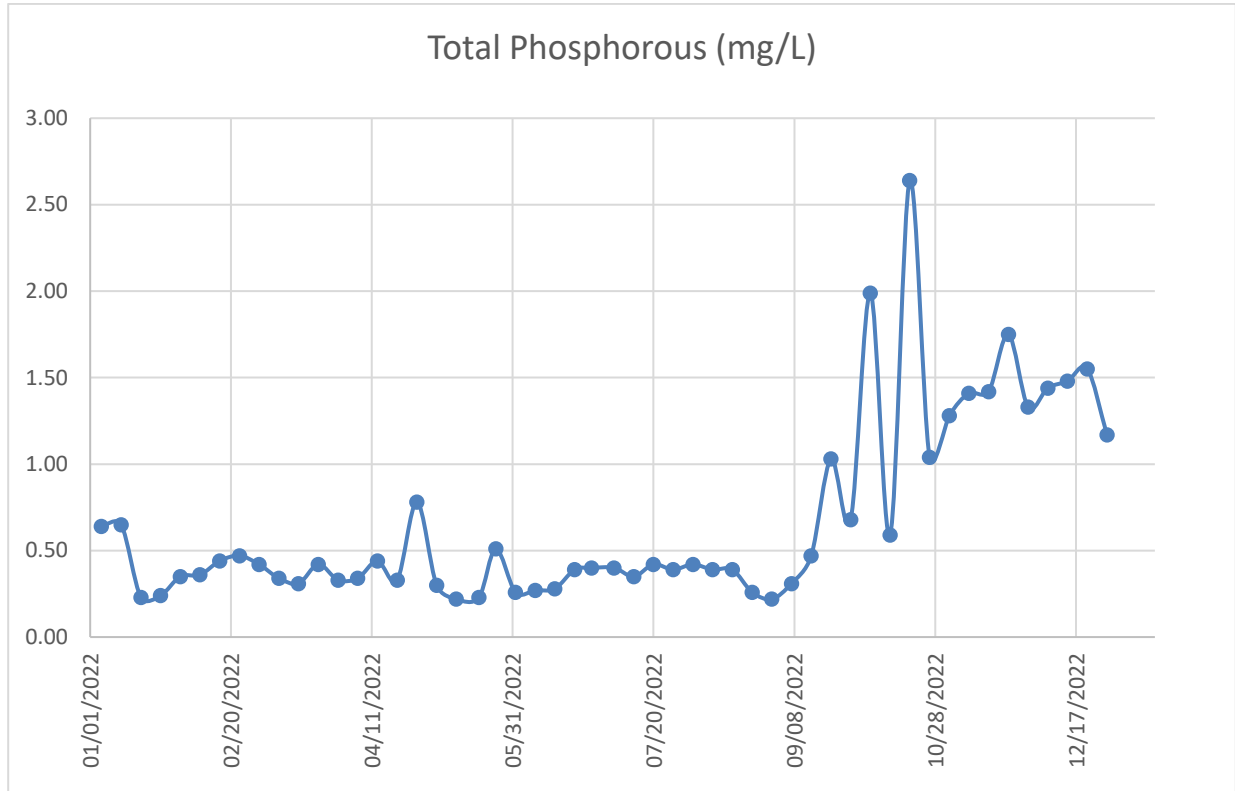


Figure 5: Final Effluent Total Phosphorous Concentration (mg/L) Weekly Laboratory Sampling Analysis

## Total Suspended Solids

Total suspended solids in monitored and reported daily. As per Section 1.1.2 of the Operational Certificate, the maximum limit is 40 mg/L.

In 2022 the Total Suspended Solids concentration did not exceed the permitted level, as highlighted in Figure 6. The TSS never exceeded 20 mg/L over the course of the year.

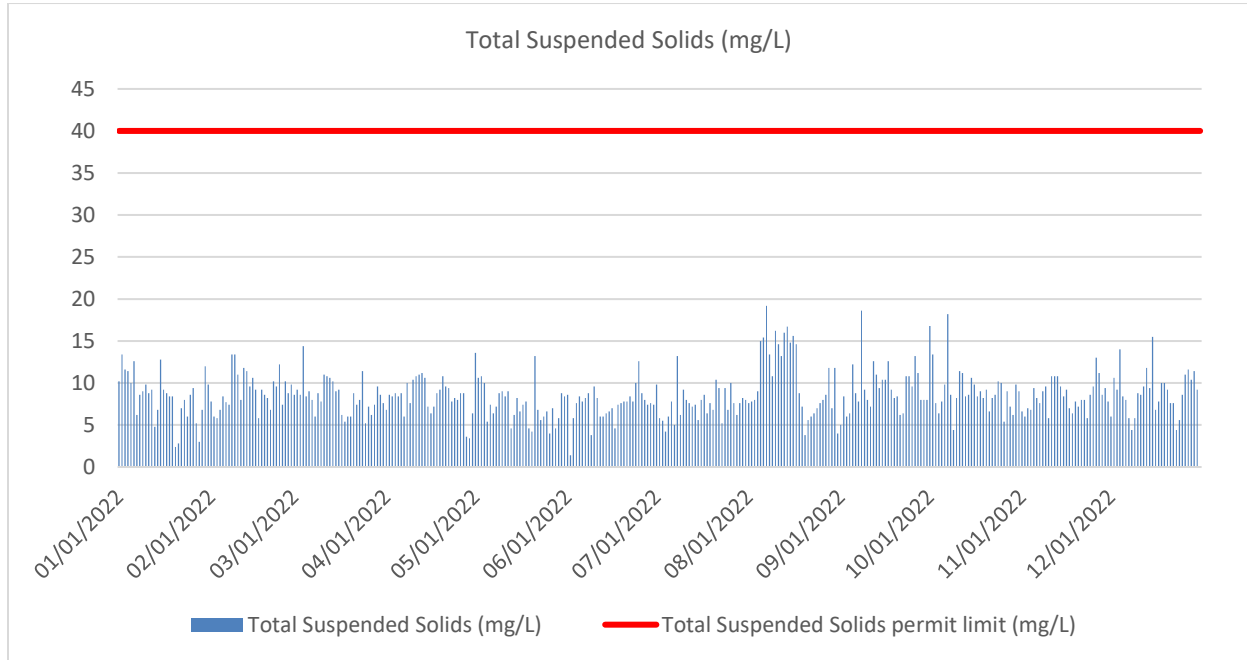


Figure 6: Daily Total Suspended Solids (mg/L)

Figure 7 highlights the average Total Suspended Solids year on year from 2005 to 2022. The average TSS for 2022 was 9 mg/L.

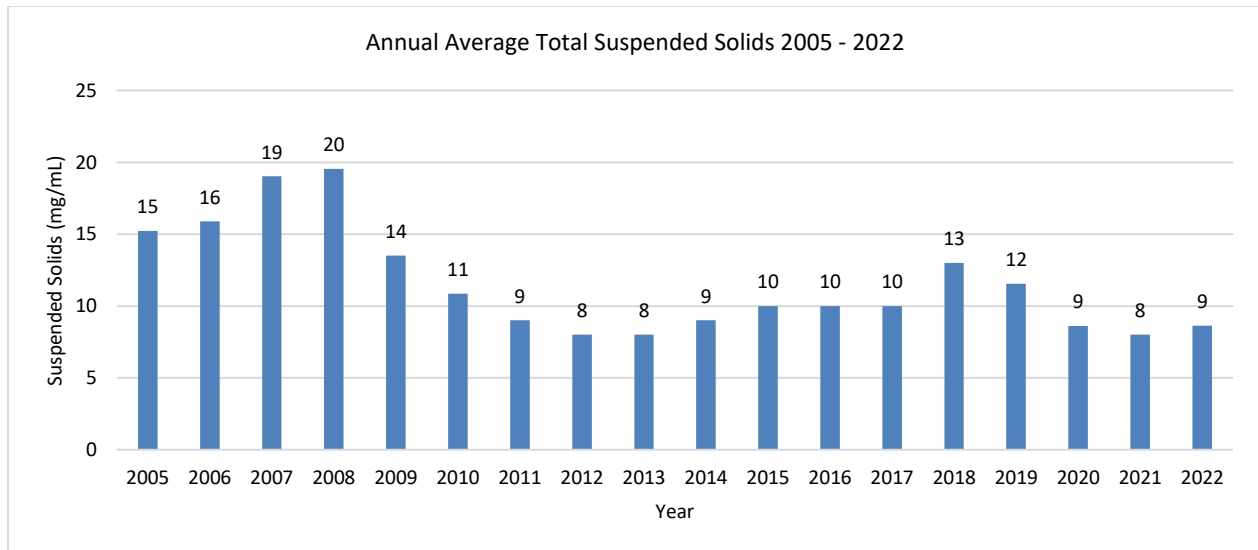


Figure 7: Annual Average Suspended Solids (mg/L) 2005 - 2022

## Carbonaceous Biochemical Oxygen Demand (BOD)

As per section 1.1.2, the maximum Carbonaceous BOD limit is 30mg/L per day for the reporting period.

In 2022 the Carbonaceous BOD concentration did not exceed the permitted level, as highlighted in Figure 8 by the weekly laboratory results.

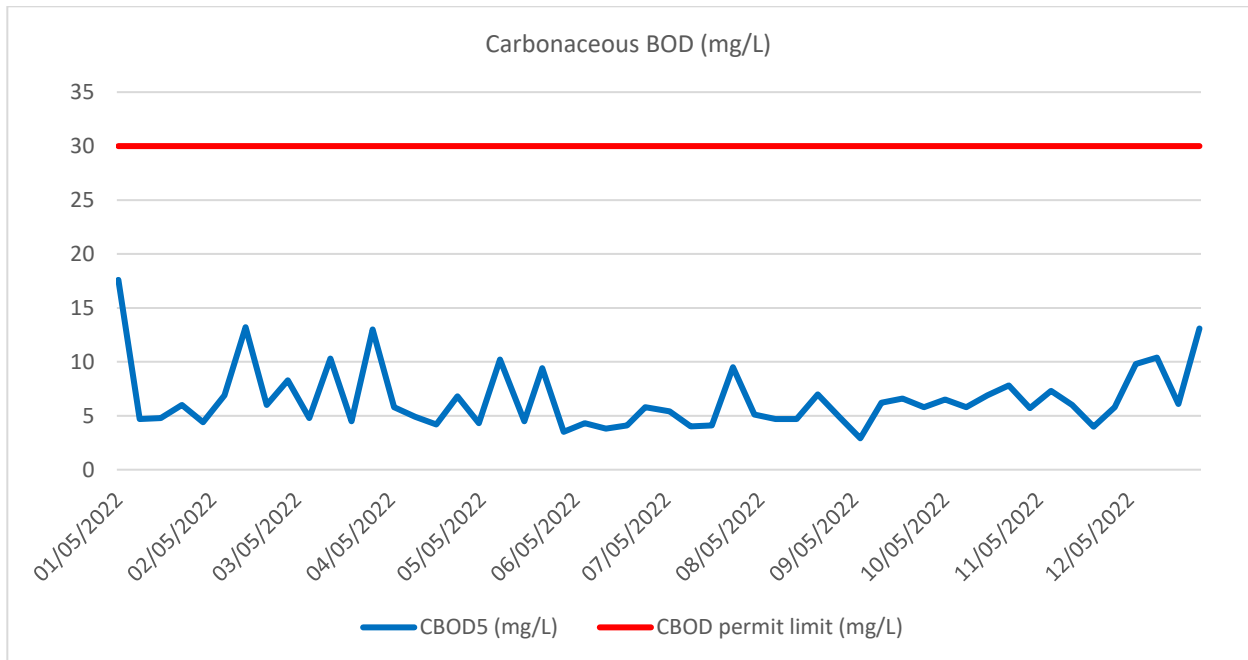


Figure 8: Weekly Carbonaceous BOD (mg/L)

## Effluent Disinfection

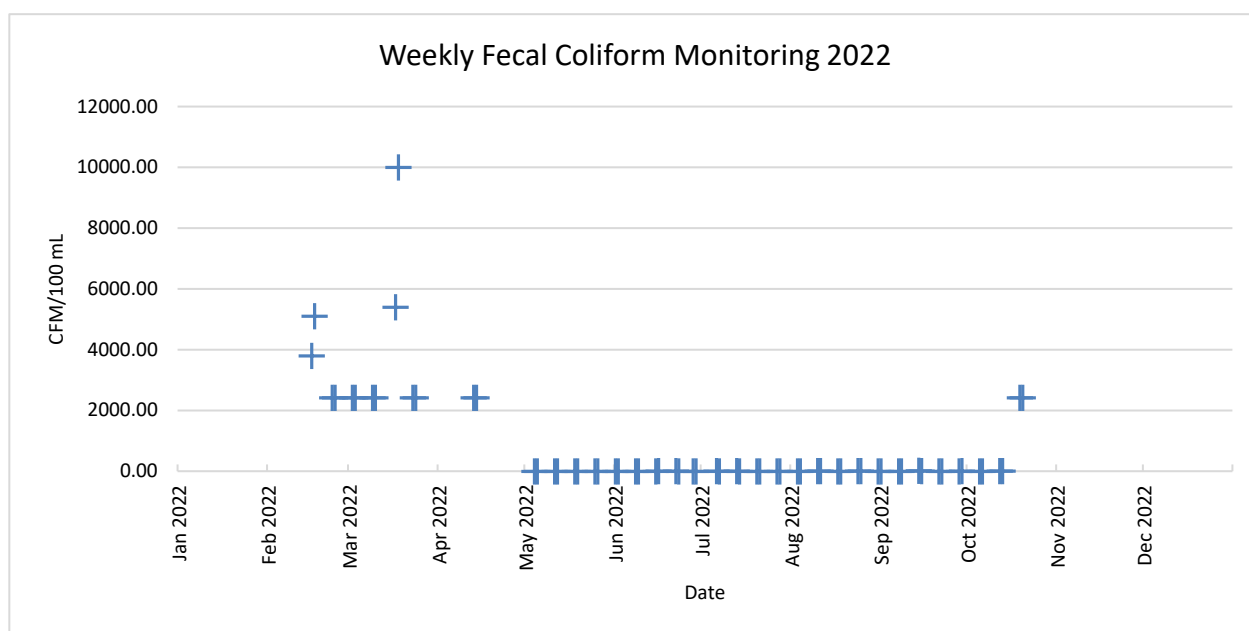
As a requirement of the Operational Certificate, the Whistler WWTP is required to disinfect the effluent from May 15 – October 15. To accomplish this, the WWTP operates a UV disinfection system during this period. Final effluent samples were taken twice weekly in this period and submitted to a certified laboratory for fecal coliform analysis throughout the disinfection period in order to confirm the effectiveness of the UV disinfection system.

Samples were taken sporadically outside of this period to validate that the UV system is working and highlight coliform results when the UV system is offline.

Figure 9 shows the results of the weekly laboratory tests for 2022. Samples during this period were low (average 1.0 CFM/100ml) when compared to samples taken prior to and after the May 15 – October 15 reporting period.

Note: results determined to be less than detection limit are shown on the graph as the laboratory detection limit of 2.0 cfu/100 ml.





## Total Iron

Total iron in the effluent is sampled on a monthly basis, and forms part of the monthly sampling for total metals as required by Section 3.0 of the Operating Permit.

Figure 10 displays the total iron detected graphically, while Table 5 summarizes the sample values.

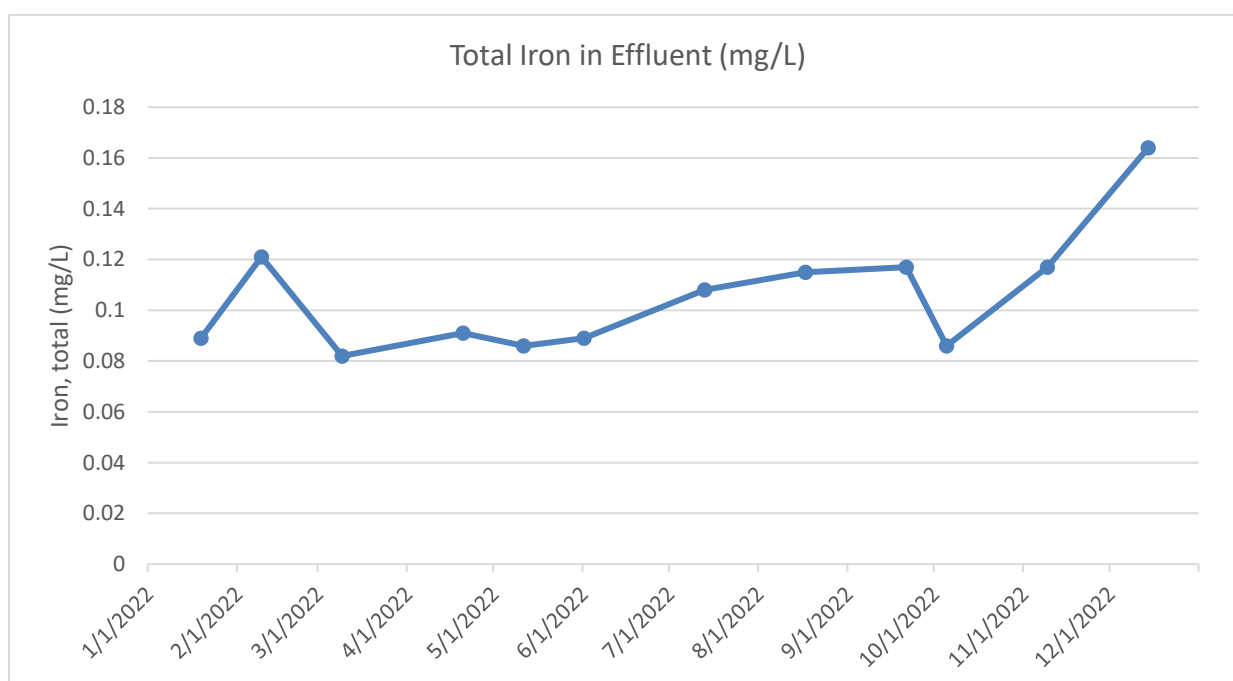


Table 5: Results of sampling for total iron in effluent

Month	Sample Date	Iron, total (mg/L)
January	1/19/2022	0.089
February	2/9/2022	0.121
March	3/9/2022	0.082
April	4/20/2022	0.091
May	5/11/2022	0.086
June	6/1/2022	0.089
July	7/13/2022	0.108
August	8/17/2022	0.115
September	9/21/2022	0.117
October	10/5/2022	0.086
November	11/9/2022	0.117
December	12/14/2022	0.164

Total iron in the effluent averaged 0.105 mg/L over 2022 according to the lab samples, with a minimum of 0.082 mg/L in March and a maximum of 0.164 mg/L in December

## Effluent Toxicity

Four (4) LC50 toxicity tests were performed during the report period.

Sample dates:

- 17 March 2022
- 7 July 2022
- 29 September 2022
- 22 December 2022

The results are 100% of rainbow trout fry surviving in raw (100% concentration) effluent for 96 hours. See Appendix B for results.

## Receiving Environment Monitoring

The receiving environment (the Cheakamus River) is sampled once per month by WWTP staff, and the samples are submitted to a certified laboratory. Cascade Environmental Resource Group completed an analysis of the Receiving Environment data for the reporting year and analysis can be found in Appendix E.

The operating certificate requires the RMOW to monitor two sampling stations, with samples taken three times per year. The RMOW exceeds this requirement by sampling at three locations (known as Camp, Bridge and Station B) every month of the year.

## 4.0 CONCLUSION

This report fulfills the requirements for the Operational Certificated ME-01452. Any further inquiries can be directed to Chris Wike, Utilities Group Manager at (604) 935-8321 or [cwike@whistler.ca](mailto:cwike@whistler.ca).

## APPENDIX A: ACUTE LETHALITY TEST RESULTS



# Acute Toxicity Test Results

Sample YVS108FE,  
collected March 17, 2022

Final Report

April 1, 2022

Submitted to: **Resort Municipality of Whistler**  
Whistler, BC

## SAMPLE INFORMATION

Sample ID	Dates		Rainbow trout test initiation	Receipt temperature
	Collected	Received		
YVS108FE	17-Mar-22 at 0900h	17-Mar-22 at 1245h	22-Mar-22 at 1445h	10.2-10.3°C

## TESTS

- Rainbow trout 96-h LC50 test

## RESULTS

### Toxicity test results

Sample ID	LC50 (% v/v)
YVS108FE	> 100

LC = Lethal Concentration

## QA/QC

QA/QC summary	Rainbow trout
Reference toxicant LC50 (95% CL)	1.1 (1.0-1.3) g/L KCl <sup>1</sup>
Reference toxicant historical mean (2 SD range)	1.6 (0.9 – 2.6) g/L KCl
Reference toxicant CV	26%
Organism health history	Acceptable
Protocol deviations	None
Water quality range deviations	None
Control performance	Acceptable
Test performance	Valid

<sup>1</sup>Test date: March 21, 2022, LC = Lethal Concentration, CL = Confidence Limits, SD = Standard Deviation, CV = Coefficient of Variation



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Report By:  
Ian Cronshaw, B.Sc.  
Laboratory Biologist



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Reviewed By:  
Andy Diewald, B.Sc.  
Senior Analyst

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

## **APPENDIX A – Summary of test conditions**

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**Table 1. Summary of test conditions: 96-h rainbow trout (*Oncorhynchus mykiss*) LC50 test.**

Test species	<i>Oncorhynchus mykiss</i>
Organism source	Hatchery
Organism age	Juvenile
Test type	Static
Test duration	96 hours
Test vessel	20-L glass aquarium
Test volume	10 to 20 L (depending on size of fish)
Test solution depth	≥ 15 cm
Test concentrations	Five concentrations, plus laboratory control
Test replicates	1 per treatment
Number of organisms	10 per replicate
Control/dilution water	Dechlorinated Metro Vancouver municipal tapwater
Test solution renewal	None
Test temperature	15 ± 1°C
Feeding	None
Light intensity	100 to 500 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	6.5 ± 1 mL/min/L
Test measurements	Temperature, dissolved oxygen and pH measured daily; salinity measured in the undiluted sample at test initiation; conductivity measured at test initiation and termination; survival checked daily
Test protocol	Environment Canada (2000), EPS 1/RM/13, with 2007 & 2016 amendments
Statistical software	CETIS Version 2.1.1
Test endpoints	Survival (96-hour LC50)
Test acceptability criterion for controls	Survival ≥ 90%
Reference toxicant	Potassium chloride (KCl)

## **APPENDIX B – Toxicity test data**

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## Rainbow Trout Summary Sheet

Client: RMOW

Start Date/Time: March 22/22 @ 1445h

Work Order No.: 220490

Test Species: Oncorhynchus mykiss

### Sample Information:

Sample ID: YVS108FE  
Sample Date: March 17, 2022  
Date Received: March 17, 2022  
Sample Volume: 2 X 20L  
Other: -

#### Test Validity Criteria:

≥ 90% Control Survival

#### WQ Ranges:

T (°C) = 15 ± 1; DO (mg/L) = 7.0 to 10.3; pH = 5.5 to 8.5

### Dilution Water:

Type: Dechlorinated Municipal Tap Water  
Hardness (mg/L CaCO<sub>3</sub>): 22  
Alkalinity (mg/L CaCO<sub>3</sub>): 22

### Test Organism Information:

Batch No.: 030422a  
Source: Lyndon Fish Hatchery  
No. Fish/Volume (L): 10/12L  
Loading Density (g/L): 0.33  
Mean Length ± SD (mm): 35 ± 2  
Mean Weight ± SD (g): 0.39 ± 0.07

Range: 34 - 39  
Range: 0.27 - 0.52

### KCI Reference Toxicant Results:

Reference Toxicant ID: RBTK18  
Stock Solution ID: N/A  
Date Initiated: Mar 21, 2022  
96-h LC50 (95% CL) [g/L KCl]: 1.1 (1.0 - 1.3) g/L KCl

Reference Toxicant Mean and Historical Range [g/L KCl]: 1.6 (0.9 - 2.6) g/L KCl  
Reference Toxicant CV (%): 26%

Test Results: 100% survival at 96h in the. The 96h LC50 is estimated to be >100% (v/v).

Reviewed by: As

Date reviewed: Mar April 1/22

## Client/Project#:

**Sample I.D.**

W.O. #

RBT Batch #:

Date Collected/Time:

**Date Setup/Time:**

CER #:

**Sample Setup By:**

**Thermometer:** CEA2

D.O. meter/probe: DO2-12

Cond./Salinity meter/probe: C-22 / 2

pH meter/probe: 0115 / 5

Row

YVS108EE

220499

0308122A

March 17<sup>11cc</sup> 2022 @ 09:00h

March 22 2022 14456

20

5

Number Fish/Volume:

**7-d % Mortality:**

**Total Pre-aeration Time (mins):**

Aeration rate adjusted to  $6.5 \pm 1$  mL/min/L? (Y/N): Y

Undiluted Sample WQ			
Parameters	Initial WQ	Adjustment	30 min WQ
Temp °C	14.0		14.6
D.O. (mg/L)	4.4		5.2
pH	6.5		6.5
Cond. (µS/cm)	442		446
Salinity (ppt)	0.2		0.2

09.9

Concentration	# Survivors							Temperature (°C)					Dissolved Oxygen (mg/L)					pH					Conductivity (µS/cm)		
	1	2	4	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	96	
(% v/v)																									
Ctrl				10	10	10	10	14.0	14.0	14.5	14.5	15.0	10.2	10.2	10.0	9.8	9.9	7.2	7.1	6.6	6.9	7.0	49	58	
6.2.5				10	10	10	10	14.0	14.0	14.5	14.5	15.0	10.0	10.0	10.1	9.9	9.8	7.3	7.0	6.7	6.9	7.0	95	87	
12.5				10	10	10	10	14.0	14.0	14.5	14.5	15.0	10.2	9.9	10.2	9.9	9.7	7.4	6.7	6.7	6.8	6.9	113	111	
25				10	10	10	10	14.0	14.0	14.5	14.5	15.0	10.1	10.0	10.0	9.9	10.0	7.4	6.8	6.7	7.0	7.1	144	149	
50				10	10	10	10	14.0	14.0	14.5	14.5	15.0	10.2	10.2	9.9	10.0	9.9	7.3	6.7	6.8	7.0	7.0	259	263	
100				10	10	10	10	14.0	14.0	14.5	14.5	15.0	6.9	9.9	9.9	9.8	9.9	6.5	6.9	6.8	7.1	7.2	447	446	
Initials				BAM	M	L	L	On	BAM	ph	On	ph	On	ph	BAM	ph	On	ph	On	ph	On	ph	On	ph	On

Sample Description/Comments:

Clear, pale yellow, odorless liquid w/ no particulates

Fish Description at 96 h

All fish appear normal

Number of Stressed Fish at 96 h

Other Observations:

Reviewed by: Dr. \_\_\_\_\_

Date Reviewed:

Version 2.5: Issued July 19, 2017

## **APPENDIX C – Chain-of-custody form**

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4340 Vandever Ave.  
San Diego, CA 92120  
Phone 858.587.7333  
Fax 858.587.3961

## Chain of Custody

March 17 2022 1 1

Sample Collection By:				Invoice To:				Neil Kearns				ANALYSES REQUIRED					
Report to:				Company				RMOW									
Company				Address				4325 Blackcomb Way									
City/State/Zip				Whistler, BC V8E 0A4													
Contact				Neil Kearns													
Phone				604-935-8384													
Email				nkearns@whistler.ca													
SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE	NO. OF CONTAINERS	COMMENTS											
YVS108FE	March 17/22	9:00 AM	Water	Jerry Can	2												
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
PROJECT INFORMATION				SAMPLE RECEIPT		RELINQUISHED BY (CLIENT)		RELINQUISHED BY (COURIER)									
Client:				Total No. of Containers		2		(Signature)		(Time) 9:00am		(Signature)		(Time)			
PO No.:				Received Good Condition?		y		(Printed Name) Neil Kearns		(Date) March 17 2022		(Printed Name)		(Date)			
Shipped Via:				Matches Test Schedule?		y		RMOW				(Company)					
SPECIAL INSTRUCTIONS/COMMENTS: PLEASE RETURN ALL CONTAINER FROM PREVIOUS TESTS ALSO THANK YOU :)										RECEIVED BY (LABORATORY)							
										(Signature)		(Time)		(Signature)		(Time)	
										(Printed Name)		(Date)		(Printed Name)		(Date)	
										(Company)				(Company)		(Date)	

**Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.**

DISTRIBUTION: WHITE - Nautilus Environmental, COLOR - Originator

**END OF REPORT**

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## Acute Toxicity Test Results

Sample YVS108FE,  
collected July 7, 2022

Final Report

July 26, 2022

Submitted to: **Resort Municipality of Whistler**  
Whistler, BC



## SAMPLE INFORMATION

Sample ID	Dates		Rainbow trout test initiation	Receipt temperature
	Collected	Received		
YVS108FE	07-Jul-22 at 0900h	07-Jul-22 at 1324h	12-Jul-22 at 1353h	17.6 – 17.9°C

## TESTS

- Rainbow trout 96-h LC50 test

## RESULTS

### Toxicity test results

Sample ID	LC50 (% v/v)
YVS108FE	> 100

LC = Lethal Concentration

## QA/QC

QA/QC summary	Rainbow trout
Reference toxicant LC50 (95% CL)	2.1 (1.7 – 2.7) g/L KCl <sup>1</sup>
Reference toxicant historical mean (2 SD range)	1.6 (0.9 – 2.8) g/L KCl
Reference toxicant CV	30%
Organism health history	Acceptable
Protocol deviations	None
Water quality range deviations	None
Control performance	Acceptable
Test performance	Valid

<sup>1</sup>Test date: July 08, 2022, LC = Lethal Concentration, CL = Confidence Limits, SD = Standard Deviation, CV = Coefficient of Variation



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Report By:  
Benji Mackay, B.Sc.  
Laboratory Biologist



---

Reviewed By:  
Stephanie Hans, M.Sc.  
Project Biologist

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## **APPENDIX A – Summary of test conditions**

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**Table 1. Summary of test conditions: 96-h rainbow trout (*Oncorhynchus mykiss*) LC50 test.**

Test species	<i>Oncorhynchus mykiss</i>
Organism source	Hatchery
Organism age	Juvenile
Test type	Static
Test duration	96 hours
Test vessel	20-L glass aquarium
Test volume	10 to 20 L (depending on size of fish)
Test solution depth	≥ 15 cm
Test concentrations	Five concentrations, plus laboratory control
Test replicates	1 per treatment
Number of organisms	10 per replicate
Control/dilution water	Dechlorinated Metro Vancouver municipal tapwater
Test solution renewal	None
Test temperature	15 ± 1°C
Feeding	None
Light intensity	100 to 500 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	6.5 ± 1 mL/min/L
Test measurements	Temperature, dissolved oxygen and pH measured daily; salinity measured in the undiluted sample at test initiation; conductivity measured at test initiation and termination; survival checked daily
Test protocol	Environment Canada (2000), EPS 1/RM/13, with 2007 & 2016 amendments
Statistical software	CETIS Version 2.1.1
Test endpoints	Survival (96-hour LC50)
Test acceptability criterion for controls	Survival ≥ 90%
Reference toxicant	Potassium chloride (KCl)

## **APPENDIX B – Toxicity test data**

---

## Rainbow Trout Summary Sheet

Client: RMOW

Start Date/Time: July 12, 2022/1353h

Work Order No.: 221389

Test Species: Oncorhynchus mykiss

### Sample Information:

Sample ID: YVS108FE  
Sample Date: July 7, 2022  
Date Received: July 7, 2022  
Sample Volume: 2x20L  
Other: —

#### Test Validity Criteria:

≥ 90% Control Survival

#### WQ Ranges:

T (°C) = 15 ± 1; DO (mg/L) = 7.0 to 10.3; pH = 5.5 to 8.5

### Dilution Water:

Type: Dechlorinated Municipal Tap Water  
Hardness (mg/L CaCO<sub>3</sub>): 23  
Alkalinity (mg/L CaCO<sub>3</sub>): 22

### Test Organism Information:

Batch No.: 062222  
Source: Aqua farms  
No. Fish/Volume (L): 10/12  
Loading Density (g/L): 0.24  
Mean Length ± SD (mm): 34 ± 1  
Mean Weight ± SD (g): 0.29 ± 0.07

Range: 31 - 36  
Range: 0.17 - 0.39

### KCI Reference Toxicant Results:

Reference Toxicant ID: RBTK35  
KCI Lot #: 22A2556387  
Date Initiated: July 8, 2022  
96-h LC50 (95% CL) [g/L KCI]: 2.1 (1.7 - 2.7) g/L KCI

Reference Toxicant Mean and Historical Range [g/L KCI]: 1.6 (0.9 - 2.8) g/L KCI  
Reference Toxicant CV (%): 30%

Test Results: The 96h LC50 is estimated to be >100% (v/v)

Reviewed by: SMH

Date reviewed: July 26, 2022

# 96-Hour Rainbow Trout Toxicity Test Data Sheet

Client/Project#:

RMON

Sample I.D.

YVS108FE

W.O. #

221393 W 221389

RBT Batch #:

062222

Date Collected/Time:

July 7, 2022 @ 9:00h

Date Setup/Time:

July 12, 2022 @ 13:53h

CER #:

2

Sample Setup By:

HEC

Thermometer: 6402

D.O. meter/probe: D05 / 5

Cond./Salinity meter/probe: C-5 / 5

pH meter/probe: pH 5 / 5

Number Fish/Volume:

10/12 L

7-d % Mortality:

0.61

Total Pre-aeration Time (mins):

30

Aeration rate adjusted to 6.5 ± 1 mL/min/L? (Y/N):

Y

Undiluted Sample WQ			
Parameters	Initial WQ	Adjustment	30 min WQ
Temp °C	14.0		14.5
D.O. (mg/L)	8.6		8.8
pH	7.0		7.1
Cond. (µS/cm)	475		475
Salinity (ppt)	0.2		0.2

Concentration	# Survivors										Temperature (°C)				Dissolved Oxygen (mg/L)				pH				Conductivity (µS/cm)	
	1	2	4	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	96
(% v/v)																								
Ctrl				10	10	10	10	15.0	15.0	15.0	15.0	15.0	15.5	15.0	15.0	15.0	15.0	9.8	9.8	9.8	9.8	7.3	7.4	58
G25				10	10	10	10	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	9.8	9.8	9.8	9.8	7.3	7.4	98
12.5				10	10	10	10	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	9.8	9.8	9.8	9.8	7.3	7.4	116
2.5				10	10	10	10	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	9.8	9.8	9.8	9.8	7.3	7.4	152
50				10	10	10	10	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	9.8	9.8	9.8	9.8	7.3	7.4	266
100				10	10	10	10	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	9.8	9.8	9.8	9.8	7.3	7.4	483
Initials				ML	ML	ML	ML	HEC	ML	ML	ML	ML	HEC	ML	ML	ML	ML	ML	ML	ML	ML	ML	HEC	HEC

Sample Description/Comments:

Clear green obscures liquid w/ white bottom-like particles

Fish Description at 96 h

All fish appear normal

Number of Stressed Fish at 96 h

0

Other Observations:

Reviewed by: SMH

Date Reviewed: July 26, 2022

## **APPENDIX C – Chain-of-custody form**

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4340 Vandever Ave.  
San Diego, CA 92120  
Phone 858.587.7333  
Fax 858.587.3961

## Chain of Custody

March 17 2022 1 1

[illegible]

**Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.**

**DISTRIBUTION: WHITE - Nautilus Environmental, COLOR - Originator**

**END OF REPORT**

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# Acute Toxicity Test Results

Sample YVS108FE,  
collected September 29, 2022

Final Report

October 13, 2022

Submitted to: **Resort Municipality of Whistler**  
Whistler, BC

## SAMPLE INFORMATION

Sample ID	Dates		Rainbow trout test initiation	Receipt temperature
	Collected	Received		
YVS108FE	29-Sept-22 at 0900h	29-Sept-22 at 1242h	29-Sept-22 at 1524h	18.3 – 18.6°C

## TESTS

- Rainbow trout 96-h LC50 test

## RESULTS

### Toxicity test results

Sample ID	LC50 (% v/v)
YVS108FE	> 100

LC = Lethal Concentration

## QA/QC

QA/QC summary	Rainbow trout
Reference toxicant LC50 (95% CL)	1.0 (0.9 – 1.1) g/L KCl <sup>1</sup>
Reference toxicant historical mean (2 SD range)	1.7 (1.2 – 2.5) g/L KCl
Reference toxicant CV	19%
Organism health history	Acceptable
Protocol deviations	Yes (See Below <sup>2</sup> )
Water quality range deviations	None
Control performance	Acceptable
Test performance	Valid

<sup>1</sup>Test date: September 23, 2022, LC = Lethal Concentration, CL = Confidence Limits, SD = Standard Deviation, CV = Coefficient of Variation

<sup>2</sup>The reference toxicant LC50 for the current batch of fish was slightly outside of 2SD, but within 3SD of the historical range. This could be due to random chance or susceptibility of the fish to the toxicant because of natural variability.



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Report By:  
Matteo Larosa, B.Sc.  
Laboratory Biologist



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Reviewed By:  
Stephanie Hans, M.Sc.  
Project Biologist

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

## **APPENDIX A – Summary of test conditions**

---

**Table 1. Summary of test conditions: 96-h rainbow trout (*Oncorhynchus mykiss*) LC50 test.**

Test species	<i>Oncorhynchus mykiss</i>
Organism source	Hatchery
Organism age	Juvenile
Test type	Static
Test duration	96 hours
Test vessel	20-L glass aquarium
Test volume	10 to 20 L (depending on size of fish)
Test solution depth	≥ 15 cm
Test concentrations	Five concentrations, plus laboratory control
Test replicates	1 per treatment
Number of organisms	10 per replicate
Control/dilution water	Dechlorinated Metro Vancouver municipal tapwater
Test solution renewal	None
Test temperature	15 ± 1°C
Feeding	None
Light intensity	100 to 500 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	6.5 ± 1 mL/min/L
Test measurements	Temperature, dissolved oxygen and pH measured daily; salinity measured in the undiluted sample at test initiation; conductivity measured at test initiation and termination; survival checked daily
Test protocol	Environment Canada (2000), EPS 1/RM/13, with 2007 & 2016 amendments
Statistical software	CETIS Version 2.1.1
Test endpoints	Survival (96-hour LC50)
Test acceptability criterion for controls	Survival ≥ 90%
Reference toxicant	Potassium chloride (KCl)

## **APPENDIX B – Toxicity test data**

---



## Rainbow Trout Summary Sheet

Client: SMH RMEW Resort Municipality of Whistler Start Date/Time: September 29, 2022/1524h  
Work Order No.: 221983 Test Species: Oncorhynchus mykiss

### Sample Information:

Sample ID: YVS108FE  
Sample Date: September 29, 2022  
Date Received: September 29, 2022  
Sample Volume: 2x20L  
Other:       

#### Test Validity Criteria:

≥ 90% Control Survival

#### WQ Ranges:

T (°C) = 15 ± 1; DO (mg/L) = 7.0 to 10.3; pH = 5.5 to 8.5

### Dilution Water:

Type: Dechlorinated Municipal Tap Water  
Hardness (mg/L CaCO<sub>3</sub>): 22  
Alkalinity (mg/L CaCO<sub>3</sub>): 24

### Test Organism Information:

Batch No.: 082322  
Source: Aqua Farms  
No. Fish/Volume (L): 10/12  
Loading Density (g/L): 0.34  
Mean Length ± SD (mm): 35 ± 2  
Mean Weight ± SD (g): 0.41 ± 0.11

Range: 32 - 38  
Range: 0.27 - 0.59

### KCI Reference Toxicant Results:

Reference Toxicant ID: RBTK46  
Stock Solution ID: 213248  
Date Initiated: Sep 23/22  
96-h LC50 (95% CL) [g/L KCl]: 1.0 (0.9 - 1.1)

Reference Toxicant Mean and Historical Range [g/L KCl]: 1.7 (1.2 - 2.5)  
Reference Toxicant CV (%): 19

Test Results: The 96h LC50 is estimated to be >100% (v/v).

Reviewed by: SMH Date reviewed: Oct 13, 2022

# 96-Hour Rainbow Trout Toxicity Test Data Sheet

Client/Project#: SRM R/VADAT Resort Municipality of Whistler  
 Sample I.D.: YV5103FC  
 W.O. #: 221983  
 RBT Batch #: 082322  
 Date Collected/Time: Sept. 29, 2022/0900h  
 Date Setup/Time: Sept. 29, 2022/1524h  
 CER #: 7  
 Sample Setup By: ML  
 Number Fish/Volume: 10/12 L  
 7-d % Mortality: 0.23  
 Total Pre-aeration Time (mins): 30  
 Aeration rate adjusted to 6.5 ± 1 mL/min/L? (Y/N): Y

Undiluted Sample WQ			
Parameters	Initial WQ	Adjustment	30 min WQ
Temp °C	16.0		16.0
D.O. (mg/L)	7.8		8.1
pH	6.6		6.7
Cond. (µS/cm)	369		369
Salinity (ppt)	0.2		0.2

Thermometer: CERT7

D.O. meter/probe: S / S

Cond./Salinity meter/probe: S / S

pH meter/probe: S / S

Concentration	# Survivors										Temperature (°C)				Dissolved Oxygen (mg/L)				pH				Conductivity (µS/cm)	
	1	2	4	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	96
(% v/v)																								
ctrl				10	10	10	10	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
6.25				10	10	10	10	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
12.5				10	10	10	10	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
25				10	10	10	10	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
50				10	10	10	10	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
100				10	10	10	10	16.0	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
Initials																								

Sample Description/Comments: Semi-turbid, green-tinted, odourless liquid w/ particulates  
 Fish Description at 96 h: All fish appear normal Number of Stressed Fish at 96 h: 0  
 Other Observations: Test solution depth in each vessel ≥ 15 cm? (Y/N) Y  
 Reviewed by: SMH Date Reviewed: Oct 13, 2022

## **APPENDIX C – Chain-of-custody form**

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4340 Vandever Ave.  
San Diego, CA 92120  
Phone 858.587.7333  
Fax 358.587.3961

## Chain of Custody

Sample Collection By:						Invoice To:						Neil Kearns						ANALYSES REQUIRED												Receipt Temperature (°C)							
<b>Report to:</b>						<b>Company:</b>						<b>RMOW</b>																									
<b>Address</b>						<b>1135 Cheakamus Lk Rd</b>						<b>Address</b>						<b>4325 Blackcomb Way</b>																			
<b>City/State/Zip</b>						<b>Whistler, BC V8E 0A4</b>						<b>City/State/Zip</b>						<b>Whistler, BC V8E 0X5</b>																			
<b>Contact</b>						<b>Neil Kearns</b>						<b>Contact</b>						<b>Jenny James/ Laura Bowack</b>																			
<b>Phone</b>						<b>604-935-8384</b>						<b>Phone</b>						<b>604-935-8385</b>																			
<b>Email</b>						<b>nkearns@whistler.ca</b>						<b>Email</b>						<b>ap@whistler.ca</b>																			
SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE	NO. OF CONTAINERS	COMMENTS													LC50 96 hr																		
YVS108FE	Sept 29/2022	9:00 AM	Water	Jerry Can	2														x																		
1																																					
2																																					
3																																					
4																																					
5																																					
6																																					
7																																					
8																																					
9																																					
10																																					
PROJECT INFORMATION			SAMPLE RECEIPT			RELINQUISHED BY (CLIENT)						RELINQUISHED BY (COURIER)																									
Client:		Total No. of Containers	2			(Signature)	(Time) 9:00am			(Signature)	(Time)																										
PO No.:		Received Good Condition?	y			(Printed Name)	Neil Kearns			(Printed Name)	September 29 2022																										
Shipped Via:		Matches Test Schedule?	x			(Company)	RMOW			(Company)																											
SPECIAL INSTRUCTIONS/COMMENTS: PLEASE RETURN ALL CONTAINER FROM PREVIOUS TESTS ALSO THANK YOU :)						RECEIVED BY (COURIER)						RECEIVED BY (LABORATORY)																									
						(Signature)	(Time)			(Signature)	(Time)																										
						(Printed Name)				(Printed Name)																											
						(Company)				(Company)																											

Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.

DISTRIBUTION: WHITE - Nautilus Environmental, COLOR - Originator

**END OF REPORT**

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# Acute Toxicity Test Results

Sample YVS108FE,  
collected December 22, 2022

Final Report

January 13, 2022

Submitted to: **Resort Municipality of Whistler**  
Whistler, BC



## SAMPLE INFORMATION

Sample ID	Dates		Rainbow trout test initiation	Receipt temperature
	Collected	Received		
YVS108FE	22-Dec-22 at 0900h	22-Dec-22 at 1329h	22-Dec-22 at 1505h	9.8°C

## TESTS

- Rainbow trout 96-h LC50 test

## RESULTS

### Toxicity test results

Sample ID	LC50 (% v/v)
YVS108FE	> 100

LC = Lethal Concentration

## QA/QC

QA/QC summary	Rainbow trout
Reference toxicant LC50 (95% CL)	2.1 (1.5 – 3.0) g/L KCl <sup>1</sup>
Reference toxicant historical mean (2 SD range)	1.3 (0.7 – 2.6) g/L KCl
Reference toxicant CV	35%
Organism health history	Acceptable
Protocol deviations	None
Water quality range deviations	None
Control performance	Acceptable
Test performance	Valid

<sup>1</sup>Test date: December 22, 2022, LC = Lethal Concentration, CL = Confidence Limits, SD = Standard Deviation, CV = Coefficient of Variation



---

Report By:  
Sierra Klueppel, B.Sc.  
Laboratory Biologist



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Reviewed By:  
Mikayla Oldach, M.Sc.  
Environmental Toxicologist

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.



## **APPENDIX A – Summary of test conditions**

---

**Table 1. Summary of test conditions: 96-h rainbow trout (*Oncorhynchus mykiss*) LC50 test.**

Test species	<i>Oncorhynchus mykiss</i>
Organism source	Hatchery
Organism age	Juvenile
Test type	Static
Test duration	96 hours
Test vessel	20-L glass aquarium
Test volume	10 to 20 L (depending on size of fish)
Test solution depth	≥ 15 cm
Test concentrations	Five concentrations, plus laboratory control
Test replicates	1 per treatment
Number of organisms	10 per replicate
Control/dilution water	Dechlorinated Metro Vancouver municipal tapwater
Test solution renewal	None
Test temperature	15 ± 1°C
Feeding	None
Light intensity	100 to 500 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	6.5 ± 1 mL/min/L
Test measurements	Temperature, dissolved oxygen and pH measured daily; salinity measured in the undiluted sample at test initiation; conductivity measured at test initiation and termination; survival checked daily
Test protocol	Environment Canada (2000), EPS 1/RM/13, with 2007 & 2016 amendments
Statistical software	CETIS Version 2.1.1
Test endpoints	Survival (96-hour LC50)
Test acceptability criterion for controls	Survival ≥ 90%
Reference toxicant	Potassium chloride (KCl)

## **APPENDIX B – Toxicity test data**

---

## Rainbow Trout Summary Sheet

Client: RMOW

Start Date/Time: Dec. 22, 2022 / 1505h

Work Order No.: 222572

Test Species: Oncorhynchus mykiss

### Sample Information:

Sample ID: YVS108FE  
Sample Date: Dec. 22, 2022  
Date Received: Dec. 22, 2022  
Sample Volume: 2x20L  
Other: -

#### Test Validity Criteria:

≥ 90% Control Survival

#### WQ Ranges:

T (°C) = 15 ± 1; DO (mg/L) = 7.0 to 10.3; pH = 5.5 to 8.5

### Dilution Water:

Type: Dechlorinated Municipal Tap Water  
Hardness (mg/L CaCO<sub>3</sub>): 20  
Alkalinity (mg/L CaCO<sub>3</sub>): 17

### Test Organism Information:

Batch No.: 120622A  
Source: DUNCAN  
No. Fish/Volume (L): 10/12  
Loading Density (g/L): 0.30  
Mean Length ± SD (mm): 37 ± 1  
Mean Weight ± SD (g): 0.36 ± 0.03

Range: 36 - 39

Range: 0.32 - 0.42

### KCI Reference Toxicant Results:

Reference Toxicant ID: RBTK56  
KCI Lot #: 213248  
Date Initiated: Dec. 22, 2022  
96-h LC50 (95% CL) [g/L KCI]: 2.1 (1.5 - 3.0)

Reference Toxicant Mean and Historical Range [g/L KCI]: 1.3 (0.7 - 2.6)

Reference Toxicant CV (%): 35%

Test Results: The 96h LC50 is estimated to be >100% (v/v).

Reviewed by: MDO

Date reviewed: Jan 11, 2023

# 96-Hour Rainbow Trout Toxicity Test Data Sheet

Client/Project#:

2403

**Sample I.D.**

338015N

#.O.W.

222572

**RBT Batch #:**

120622A

Date Collected/Time:

Dec 22 2022 / 0900h

Date Set

Dec 27 20

CER#:

2,

**Sample Setup By:**

Σ

Thermometer: CCR#2

D.O. meter/probe: 5 / 5

Cond./Salinity meter/probe: 5 / 5

How many probes/5

Undiluted Sample WQ			
Parameters	Initial WQ	Adjustment	30 min WQ
Temp °C	15.0		15.0
D.O. (mg/L)	7.1		8.8
pH	6.3		6.6
Cond. (µS/cm)	420		420
Salinity (ppt)	0.2		0.2

Concentration	# Survivors							Temperature (°C)					Dissolved Oxygen (mg/L)					pH					Conductivity (μS/cm)			
																		①								
	1	2	4	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	96		
(% v/v)																										
Ctrl				10	10	10	10	15.0	15.0	15.0	15.0	16.0	9.7	9.7	9.8	9.8	8.4	7.1	7.1	7.1	7.1	7.0	7.1	7.1	53	55
6.25				10	10	10	10	15.0	15.0	15.0	15.0	16.0	9.6	9.7	9.7	9.8	8.5	7.0	7.1	7.1	7.1	7.1	7.1	85	84	
12.5				10	10	10	10	15.0	15.0	15.0	15.0	16.0	9.6	9.7	9.7	9.8	8.7	6.8	7.1	7.2	7.1	7.1	7.1	93	93	
25				10	10	10	10	15.0	15.0	15.0	15.0	16.0	9.6	9.7	9.6	9.7	8.6	6.7	7.2	7.2	7.2	7.2	7.2	146	144	
50				10	10	10	10	15.0	15.0	15.0	15.0	16.0	9.4	9.6	9.7	9.7	8.7	6.7	7.2	7.1	7.2	7.2	7.2	235	231	
100				10	10	10	10	15.0	15.0	15.0	15.0	16.0	8.8	9.3	9.5	9.7	8.4	6.6	7.4	7.5	7.4	7.3	7.3	420	412	
Initials				T.C.	Shah	Shah	Shah	ML	T.C.	Shah	Shah	Shah	ML	T.C.	Shah	Shah	Shah	ML	T.C.	Shah	Shah	Shah	ML	ML	ML	ML

Sample Description/Comments:

Semi-turbid, green-yellow coloured, odourless liquid w/ large particulates

Fish Description at 96 h All fish appear normal

Number of Stressed Fish at 96 h

Other Observations:

Test solution depth in each vessel  $\geq 15$  cm? (Y/N)

Reviewed by:

① 1990-1991

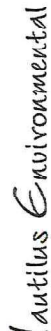
Date Reviewed:

Jan 11, 2023

## **APPENDIX C – Chain-of-custody form**

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## Chain of Custody



1

[illegible]

Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.

**END OF REPORT**

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## APPENDIX B: WASTEWATER TREATMENT PLANT DATA

Date	Effluent (m3/day)	Total Suspended Solids (mg/L)	CBOD5 (mg/L)	Soluble PO4 as P (mg/L)	PO4 as P (kg/day)	Total Phosphorous (mg/L)	Fecal Coliform (cfu/100mL)
01/01/2022	12068	10		0.03	0.36		
01/02/2022	11703	13		0.02	0.23		
01/03/2022	11343	12		0.05	0.57		
01/04/2022	10809	11		0.05	0.54		
01/05/2022	10764	10	18	0.05	0.54	0.64	
01/06/2022	10607	13		0.09	0.95		
01/07/2022	10567	6		0.03	0.32		
01/08/2022	10729	9		0.03	0.32		
01/09/2022	9849	9		0.05	0.49		
01/10/2022	9293	10		0.05	0.46		
01/11/2022	10771	9		0.05	0.54		
01/12/2022	13156	9	5	0.05	0.66	0.65	
01/13/2022	11312	5		0.02	0.23		
01/14/2022	11418	7		0.03	0.34		
01/15/2022	11960	13		0.04	0.48		
01/16/2022	11430	9		0.05	0.57		
01/17/2022	10669	9		0.05	0.53		
01/18/2022	10282	8		0.05	0.51		
01/19/2022	10724	8	5	0.05	0.54	0.23	
01/20/2022	12416	2		0.02	0.25		
01/21/2022	12182	3		0.13	1.58		
01/22/2022	12487	7		0.04	0.50		
01/23/2022	11733	8		0.05	0.59		
01/24/2022	10418	6		0.05	0.52		
01/25/2022	10029	9		0.05	0.50		
01/26/2022	9821	9	6	0.05	0.49	0.24	
01/27/2022	9813	5		0.01	0.10		
01/28/2022	10570	3		0.02	0.21		
01/29/2022	11433	7		0.02	0.23		
01/30/2022	11151	12		0.05	0.56		
01/31/2022	10012	10		0.05	0.50		
02/01/2022	9510	8		0.01	0.10		
02/02/2022	9420	6	4	0.03	0.28	0.35	
02/03/2022	9558	6		0.02	0.19		
02/04/2022	11254	7		0.03	0.34		
02/05/2022	11760	8		0.03	0.35		

02/06/2022	10931	8		0.05	0.55		
02/07/2022	10355	7		0.05	0.52		
02/08/2022	10245	13		0.05	0.51		
02/09/2022	10206	13	7	0.02	0.20	0.36	
02/10/2022	10376	11		0.03	0.31		
02/11/2022	10817	8		0.01	0.11		
02/12/2022	11611	12		0.04	0.46		
02/13/2022	11137	11		0.05	0.56		
02/14/2022	10372	10		0.05	0.52		
02/15/2022	10192	11		0.05	0.51		
02/16/2022	9999	9	13	0.05	0.50	0.44	3800.00
02/17/2022	10301	6		0.08	0.82		5100.00
02/18/2022	11409	9		0.42	4.79		
02/19/2022	12925	9		0.05	0.65		
02/20/2022	12815	8		0.03	0.38		
02/21/2022	11993	7		0.05	0.60		
02/22/2022	11238	10		0.03	0.34		
02/23/2022	10896	10	6	0.08	0.87	0.47	2420.00
02/24/2022	10811	12		0.25	2.70		2420.00
02/25/2022	11016	7		0.06	0.66		
02/26/2022	11419	10		0.07	0.80		
02/27/2022	11078	9		0.05	0.55		
02/28/2022	10614	10		0.05	0.53		
03/01/2022	11858	9		0.48	5.69		
03/02/2022	11723	9	8	0.11	1.29	0.42	2420.00
03/03/2022	11580	9		0.61	7.06		2420.00
03/04/2022	11900	14		0.16	1.90		
03/05/2022	12132	8		0.03	0.36		
03/06/2022	11500	9		0.05	0.58		
03/07/2022	10806	8		0.06	0.65		
03/08/2022	10656	6		0.04	0.43		
03/09/2022	10441	9	5	0.06	0.63	0.34	2420.00
03/10/2022	10326	8		0.03	0.31		2420.00
03/11/2022	10689	11		0.03	0.32		
03/12/2022	11345	11		0.02	0.23		
03/13/2022	11532	11		0.04	0.46		
03/14/2022	12117	10		0.04	0.48		
03/15/2022	12551	9		0.05	0.63		
03/16/2022	12644	9	10	0.03	0.38	0.31	
03/17/2022	12869	6		0.03	0.39		5400.00
03/18/2022	12980	5		0.03	0.39		10000.00
03/19/2022	13139	6		0.05	0.66		
03/20/2022	12353	6		0.05	0.62		
03/21/2022	11995	9		0.02	0.24		

03/22/2022	12161	7		0.02	0.24		
03/23/2022	13274	8	5	0.08	1.06	0.42	2420.00
03/24/2022	12717	11		0.02	0.25		2420.00
03/25/2022	12573	5		0.02	0.25		
03/26/2022	13025	7		0.02	0.26		
03/27/2022	13428	6		0.03	0.40		
03/28/2022	12978	7		0.05	0.65		
03/29/2022	12475	10		0.04	0.50		
03/30/2022	12074	9	13	0.05	0.60	0.33	
03/31/2022	11529	8		0.04	0.46		
04/01/2022	11557	7		0.06	0.69		
04/02/2022	12022	9		0.06	0.72		
04/03/2022	12092	8		0.15	1.81		
04/04/2022	11847	9		0.06	0.71		
04/05/2022	11649	8		0.06	0.70		
04/06/2022	11144	9	6	0.08	0.89	0.34	
04/07/2022	11581	6		0.08	0.93		
04/08/2022	13323	10		0.11	1.47		
04/09/2022	13041	8		0.05	0.65		
04/10/2022	11899	10		0.07	0.83		
04/11/2022	10505	11		0.04	0.42		
04/12/2022	10160	11		0.07	0.71		
04/13/2022	9854	11	5	0.03	0.30	0.44	2420.00
04/14/2022	9880	11		0.05	0.49		2420.00
04/15/2022	10946	7		0.03	0.33		
04/16/2022	11353	6		0.04	0.45		
04/17/2022	10865	7		0.03	0.33		
04/18/2022	9819	9		0.08	0.79		
04/19/2022	8965	9		0.06	0.54		
04/20/2022	8784	11	4	0.05	0.44	0.33	
04/21/2022	8851	10		0.06	0.53		
04/22/2022	9696	9		0.03	0.29		
04/23/2022	9630	8		0.03	0.29		
04/24/2022	9204	8		0.09	0.83		
04/25/2022	8730	8		0.06	0.52		
04/26/2022	8216	9		0.18	1.48		
04/27/2022	7007	9	7	0.39	2.73	0.78	
04/28/2022	8451	4		0.11	0.93		
04/29/2022	9088	3		0.04	0.36		
04/30/2022	9065	6		0.08	0.73		
05/01/2022	8620	14		0.03	0.26		
05/02/2022	7999	11		0.05	0.40		
05/03/2022	7769	11		0.05	0.39		
05/04/2022	8955	10	4	0.02	0.18	0.30	1.00

05/05/2022	8622	5		0.04	0.34		1.00
05/06/2022	8218	7		0.12	0.99		
05/07/2022	8699	6		0.03	0.26		
05/08/2022	8002	7		0.05	0.40		
05/09/2022	7599	9		0.05	0.38		
05/10/2022	7604	9		0.05	0.38		
05/11/2022	7607	8	10	0.07	0.53	0.22	1.00
05/12/2022	6634	9		0.04	0.27		1.00
05/13/2022	7933	5		0.02	0.16		
05/14/2022	8390	6		0.05	0.42		
05/15/2022	8520	8		0.07	0.60		
05/16/2022	8039	7		0.05	0.40		
05/17/2022	7762	7		0.05	0.39		
05/18/2022	8795	8		0.05	0.44		1.00
05/19/2022	8526	5	5	0.05	0.43	0.23	1.00
05/20/2022	9044	4		0.03	0.27		
05/21/2022	10026	13		0.03	0.30		
05/22/2022	10267	7		0.04	0.41		
05/23/2022	9184	6		0.05	0.46		
05/24/2022	8252	6		0.05	0.41		
05/25/2022	7916	7	9	0.05	0.40	0.51	1.00
05/26/2022	8316	4		0.04	0.33		1.00
05/27/2022	8946	7		0.02	0.18		
05/28/2022	9001	5		0.03	0.27		
05/29/2022	8675	6		0.05	0.43		
05/30/2022	8211	9		0.05	0.41		
05/31/2022	8209	8		0.05	0.41		
06/01/2022	8100	9	4	0.05	0.41	0.26	1.00
06/02/2022	8080	1		0.05	0.40		1.00
06/03/2022	8804	6		0.05	0.44		
06/04/2022	9225	8		0.07	0.65		
06/05/2022	9319	8		0.05	0.47		
06/06/2022	8768	8		0.05	0.44		
06/07/2022	8365	8		0.05	0.42		
06/08/2022	8287	9	4	0.05	0.41	0.27	1.00
06/09/2022	8548	4		0.04	0.34		1.00
06/10/2022	8903	10		0.06	0.53		
06/11/2022	9519	8		0.02	0.19		
06/12/2022	8874	6		0.06	0.53		
06/13/2022	8313	6		0.05	0.42		
06/14/2022	8021	6		0.05	0.40		
06/15/2022	6673	7	4	0.05	0.33	0.28	1.00
06/16/2022	9530	7		0.08	0.76		7.00
06/17/2022	8475	5		0.05	0.42		

06/18/2022	9159	7		0.13	1.19		
06/19/2022	8633	8		0.09	0.78		
06/20/2022	8257	8		0.10	0.83		
06/21/2022	8264	8		0.12	0.99		
06/22/2022	8359	8	4	0.11	0.92	0.39	2.00
06/23/2022	8432	8		0.08	0.67		1.00
06/24/2022	8835	10		0.09	0.80		
06/25/2022	11520	13		0.12	1.38		
06/26/2022	9217	9		0.10	0.92		
06/27/2022	8882	8		0.10	0.89		
06/28/2022	8911	7	6	0.08	0.71	0.40	1.00
06/29/2022	8729	8		0.20	1.75		1.00
06/30/2022	9000	7		0.14	1.26		
07/01/2022	9893	10		0.11	1.09		
07/02/2022	10290	6		0.11	1.13		
07/03/2022	10400	6		0.13	1.35		
07/04/2022	9678	4		0.10	0.97		
07/05/2022	9188	6		0.12	1.10		
07/06/2022	9517	8	5	0.14	1.33	0.40	2.00
07/07/2022	9788	5		0.05	0.49		1.00
07/08/2022	10087	13		0.07	0.71		
07/09/2022	9912	6		0.07	0.69		
07/10/2022	9468	9		0.05	0.47		
07/11/2022	9253	8		0.12	1.11		
07/12/2022	9451	8		0.08	0.76		
07/13/2022	9299	7	4	0.09	0.84	0.35	2.00
07/14/2022	9193	7		0.09	0.83		1.00
07/15/2022	9462	6		0.06	0.57		
07/16/2022	9709	8		0.10	0.97		
07/17/2022	9355	9		0.08	0.75		
07/18/2022	9059	6		0.10	0.91		
07/19/2022	9029	8		0.11	0.99		
07/20/2022	9049	7	4	0.14	1.27	0.42	1.00
07/21/2022	9036	10		0.24	2.17		1.00
07/22/2022	9232	9		0.13	1.20		
07/23/2022	9697	5		0.14	1.36		
07/24/2022	9110	9		0.16	1.46		
07/25/2022	9088	7		0.19	1.73		
07/26/2022	9286	10		0.16	1.49		
07/27/2022	9415	8	10	0.11	1.04	0.39	1.00
07/28/2022	9709	6		0.11	1.07		1.00
07/29/2022	9787	8		0.12	1.17		
07/30/2022	9948	8		0.16	1.59		
07/31/2022	10235	8		0.15	1.54		

08/01/2022	10064	8		0.15	1.51		
08/02/2022	9222	8		0.06	0.55		
08/03/2022	9271	8	5	0.08	0.74	0.42	1.00
08/04/2022	9213	9		0.06	0.55		1.00
08/05/2022	9288	15		0.05	0.46		
08/06/2022	9394	15		0.06	0.56		
08/07/2022	9563	19		0.07	0.67		
08/08/2022	9357	13		0.06	0.56		
08/09/2022	9378	11		0.04	0.38		
08/10/2022	9346	16	5	0.04	0.37	0.39	4.00
08/11/2022	9205	15		0.14	1.29		5.00
08/12/2022	9550	13		0.06	0.57		
08/13/2022	9880	16		0.06	0.59		
08/14/2022	9636	17		0.07	0.67		
08/15/2022	9409	15		0.12	1.13		
08/16/2022	8997	16		0.08	0.72		
08/17/2022	9055	15	5	0.08	0.72	0.39	1.00
08/18/2022	9193	9		0.06	0.55		1.00
08/19/2022	9387	7		0.06	0.56		
08/20/2022	9753	4		0.06	0.59		
08/21/2022	9308	6		0.08	0.74		
08/22/2022	9361	6		0.06	0.56		
08/23/2022	8997	6		0.06	0.54		
08/24/2022	9060	7	7	0.05	0.45	0.26	2.00
08/25/2022	9025	8		0.07	0.63		8.00
08/26/2022	9157	8		0.04	0.37		
08/27/2022	9494	9		0.07	0.66		
08/28/2022	8900	12		0.07	0.62		
08/29/2022	8557	7		0.07	0.60		
08/30/2022	8560	12		0.06	0.51		
08/31/2022	8475	4	5	0.04	0.34	0.22	1.00
09/01/2022	8401	5		0.05	0.42		1.00
09/02/2022	8820	8		0.11	0.97		
09/03/2022	9422	6		0.14	1.32		
09/04/2022	9565	6		0.07	0.67		
09/05/2022	8511	12		0.09	0.77		
09/06/2022	7600	9		0.04	0.30		
09/07/2022	7611	8	3	0.05	0.38	0.31	1.00
09/08/2022	7762	19		0.05	0.39		1.00
09/09/2022	8052	9		0.11	0.89		
09/10/2022	8705	8		0.14	1.22		
09/11/2022	8562	7		0.14	1.20		
09/12/2022	7764	13		0.22	1.71		
09/13/2022	7664	11		0.14	1.07		

09/14/2022	7833	9	6	0.06	0.47	0.47	15.00
09/15/2022	7789	10		0.08	0.62		4.00
09/16/2022	7973	10		0.07	0.56		
09/17/2022	7937	13		0.11	0.87		
09/18/2022	8107	9		0.18	1.46		
09/19/2022	7669	8		0.29	2.22		
09/20/2022	7389	8		0.39	2.88		
09/21/2022	7451	6	7	0.59	4.40	1.03	1.00
09/22/2022	7562	6		0.44	3.33		1.00
09/23/2022	7839	11		0.54	4.23		
09/24/2022	7388	11		0.67	4.95		
09/25/2022	8307	10		0.68	5.65		
09/26/2022	8384	13		0.72	6.04		
09/27/2022	7395	11		0.75	5.55		
09/28/2022	6801	8	6	0.29	1.97	0.68	1.00
09/29/2022	6942	8		0.79	5.48		2.00
09/30/2022	6589	8		1.17	7.71		
10/01/2022	7806	17		0.69	5.39		
10/02/2022	7458	13		0.94	7.01		
10/03/2022	6904	8		1.48	10.22		
10/04/2022	6806	6		1.61	10.96		
10/05/2022	6683	8	7	1.59	10.63	1.99	1.00
10/06/2022	6604	10		0.85	5.61		1.00
10/07/2022	7069	18		0.87	6.15		
10/08/2022	8178	9		0.84	6.87		
10/09/2022	8501	4		0.52	4.42		
10/10/2022	7582	8		0.33	2.50		
10/11/2022	5008	11		0.68	3.41		
10/12/2022	8027	11	6	0.14	1.12	0.59	2.00
10/13/2022	6322	8		0.10	0.63		6.00
10/14/2022	6560	9		0.12	0.79		
10/15/2022	7089	11		0.02	0.14		
10/16/2022	6642	10		0.53	3.52		
10/17/2022	5945	8		0.51	3.03		
10/18/2022	6237	9		1.62	10.10		
10/19/2022	6123	8	7	1.41	8.63	2.64	2419.00
10/20/2022	6183	9		0.24	1.48		2419.00
10/21/2022	6921	7		0.22	1.52		
10/22/2022	7026	8		0.17	1.19		
10/23/2022	6719	9		0.28	1.88		
10/24/2022	6207	10		0.31	1.92		
10/25/2022	6224	10		0.57	3.55		
10/26/2022	6140	5	8	0.61	3.75	1.04	
10/27/2022	7338	9		0.91	6.68		

10/28/2022	6663	7		0.49	3.26		
10/29/2022	7215	6		0.80	5.77		
10/30/2022	8313	10		1.04	8.65		
10/31/2022	7405	9		0.61	4.52		
11/01/2022	6953	7		0.97	6.74		
11/02/2022	6645	6	6	1.07	7.11	1.28	
11/03/2022	6629	7		1.07	7.09		
11/04/2022	7192	7		1.20	8.63		
11/05/2022	7710	9		1.00	7.71		
11/06/2022	7250	8		1.03	7.47		
11/07/2022	6708	8		0.98	6.57		
11/08/2022	6705	9		1.01	6.77		
11/09/2022	7013	10	7	1.03	7.22	1.41	
11/10/2022	7125	6		0.97	6.91		
11/11/2022	8221	11		0.79	6.49		
11/12/2022	8806	11		1.19	10.48		
11/13/2022	7885	11		1.03	8.12		
11/14/2022	7149	10		0.80	5.72		
11/15/2022	6740	8		0.94	6.34		
11/16/2022	6725	9	6	0.80	5.38	1.42	
11/17/2022	6703	7		0.97	6.50		
11/18/2022	7096	6		1.27	9.01		
11/19/2022	7764	8		1.26	9.78		
11/20/2022	7536	7		1.53	11.53		
11/21/2022	7036	8		1.33	9.36		
11/22/2022	7724	8		1.56	12.05		
11/23/2022	7884	6	4	1.15	9.07	1.75	
11/24/2022	8651	9		1.10	9.52		
11/25/2022	10451	10		0.97	10.14		
11/26/2022	10877	13		0.94	10.22		
11/27/2022	9692	11		0.84	8.14		
11/28/2022	8570	9		0.88	7.54		
11/29/2022	8260	9		0.92	7.60		
11/30/2022	8279	8	6	1.01	8.36	1.33	
12/01/2022	8253	6		1.00	8.25		
12/02/2022	8767	11		1.17	10.26		
12/03/2022	9651	9		1.06	10.23		
12/04/2022	9228	14		1.04	9.60		
12/05/2022	8369	8		0.92	7.70		
12/06/2022	8227	8		0.97	7.98		
12/07/2022	8331	6	10	0.94	7.83	1.44	
12/08/2022	8449	4		1.00	8.45		
12/09/2022	9044	6		0.97	8.77		
12/10/2022	9053	9		0.96	8.69		



12/11/2022	9417	9		0.98	9.23		
12/12/2022	8912	10		1.03	9.18		
12/13/2022	8845	12		1.05	9.29		
12/14/2022	8788	9	10	1.01	8.88	1.48	
12/15/2022	7118	16		0.87	6.19		
12/16/2022	9293	7		0.62	5.76		
12/17/2022	10038	8		0.67	6.73		
12/18/2022	10431	10		0.91	9.49		
12/19/2022	10594	10		1.20	12.71		
12/20/2022	10738	9		0.98	10.52		
12/21/2022	10324	8	6	0.96	9.91	1.55	
12/22/2022	10919	8		0.94	10.26		
12/23/2022	11023	4		0.94	10.36		
12/24/2022	11719	6		0.78	9.14		
12/25/2022	13403	9		0.69	9.25		
12/26/2022	18215	11		0.58	10.56		
12/27/2022	16223	12		0.88	14.28		
12/28/2022	15348	10	13	0.71	10.90	1.17	
12/29/2022	14391	11		0.27	3.89		
12/30/2022	14226	9		0.58	8.25		
12/31/2022	14661	11		0.52	7.62		

## APPENDIX C: RECEIVING ENVIRONMENT MONITORING



**DATE:** February 6, 2023  
**TO:** Brett Jenaway, Resort Municipality of Whistler  
**FROM:** Macaila Wagner, Cascade Environmental Resource Group Ltd.  
Candace Rose-Taylor, Cascade Environmental Resource Group Ltd.  
**RE:** 2022 Whistler Wastewater Treatment Plant Report: Receiving Environment Data Analysis  
**FILE #:** 013-34-11

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## **1 Introduction**

The Resort Municipality of Whistler (RMOW) retained Cascade Environmental Resource Group Ltd. (Cascade) to conduct the data analysis of the Receiving Environment Monitoring section of the 2022 Annual Wastewater Treatment Plant Report. The Whistler Wastewater Treatment Plant (WWTP) is operated by the RMOW under the operational certificate ME-01452 under the provisions of the *Environmental Management Act*, which requires the RMOW to sample the WWTP discharge effluent and the receiving environment in the Cheakamus River and summarize the sample data in an annual report.

## **2 Receiving Environment Monitoring**

The receiving environment (the Cheakamus River) is sampled once per month by WWTP staff, and the samples are submitted to a certified laboratory. The operational certificate requires the RMOW to monitor two sampling stations, with a grab sample taken three times per year. The RMOW exceeds this requirement by sampling at three locations, every month of the year.

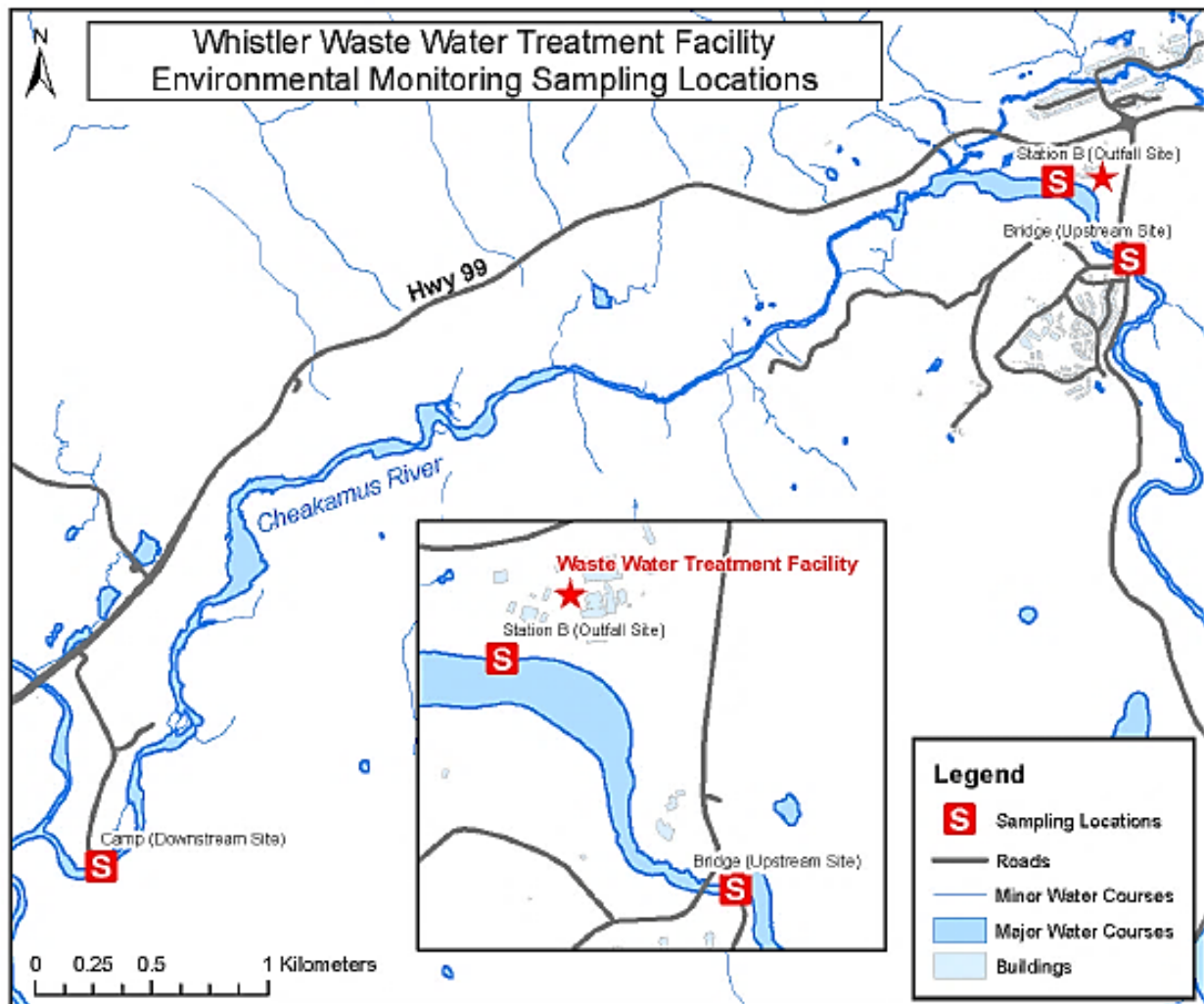
The monitored parameters are compared at three sampling locations: Upstream, Outfall and Downstream (see Map 1). The sample locations are as follows: the upstream sampling location is at the 'Bridge', approximately 100 metres upstream of the outfall; the outfall location is also referred to as 'Station B'; and the downstream sampling location is also known as 'Camp', which is approximately 4 kilometres downstream of the outfall.

Parameters required for sample analysis in the receiving environment by the operational certificate are pH, conductivity, turbidity, orthophosphate (as phosphorous), nitrate nitrogen, nitrite nitrogen, and ammonia nitrogen. Results that fall below the laboratory detection limit are represented graphically in this report as equal to the laboratory detection limit.

This report is intended to meet the operational certificate reporting requirements to be provided by a qualified professional that includes a compendium of both discharge and receiving environment data, a trend analysis review and interpretation of analytical data for results of the 2022 sample year and comparisons with past years in terms of potential impact to the receiving environment.



Map 1: Whistler Wastewater Treatment Plant Environmental Monitoring Sampling Locations



### 3 Water Quality Guidelines

Receiving environment sample results were compared to several water quality guidelines to determine compliance. Guidelines exist for many of the sample parameters: the operational certificate (ME-01452), current British Columbia approved water quality guidelines for aquatic life (BC WQG), and the Province of BC *Environmental Management Act* Contaminated Sites Regulation (CSR) - Schedule 3.2 – Generic Numerical Water Standards. The BC WQGs provide policy direction and are used as the basis for determining the allowable limits in waste discharge authorizations, however they do not have direct legal standing. The CSR standards are legally upheld in BC. The operational certificate requirements must be met to maintain legal authorization to operate the WWTP. All water quality standards used in this report are for the protection of freshwater aquatic life. Legally binding guidelines will be used (operational certificate and CSR) where possible and the most conservative guideline will be prioritized.

**Table 1: Guidelines for Water Samples in the Receiving Environment**

Parameter	Unit	Operational Certificate	CSR	BC WQG
Ammonia-N	mg/L	-	1.3 (pH $\geq$ 8.5) 3.7 (pH 8.0 – 8.5) 11.3 (pH 7.5 – 8.0) 18.5 (pH 7.0 – 7.5) 18.4 (pH $<$ 7.0)	Varies with temperature and pH
Conductivity	$\mu$ S/cm	No guideline or standard for conductivity - typical range in Western Canadian surface waters is 4.8 to 84,600 $\mu$ S/cm (NAQUADAT, 1985)		
Nitrate-N	mg/L	-	400	3.0
Nitrite-N	mg/L	-	0.2 (Cl $<$ 2 mg/L) 0.4 (Cl 2 – 4 mg/L) 0.6 (Cl 4 – 6 mg/L) 0.8 (Cl 6 – 8 mg/L) 1.0 (Cl 8 – 10 mg/L) 2.0 (Cl $>$ 10 mg/L)	0.02 (when Cl <sup>-</sup> $\leq$ 2 mg/L) 30 day average 0.06 (Cl <sup>-</sup> $\leq$ 2 mg/L) short-term
Nitrate + Nitrite	mg/L	-	400	3.0
Orthophosphate (as phosphorus)	mg/L	1.75	-	0.01* (for recreational use)
pH	-	-	-	6.5-9.0
Turbidity	NTU	-	-	$\pm$ 8 (clear water/ 24 hours) $\pm$ 2 (clear water/ 30 days) $\pm$ 5 (background is 8-50) $\pm$ 10% (background is $>$ 50)



#### 4 pH in the Receiving Environment

The provincial water quality guidelines state that pH should measure between 6.5 and 9.0. Sample results from 2022 are displayed in Figure 1, which show that all samples comply with the guideline range (displayed in red) and exhibit minimal variation throughout the year. The average pH measurements for 2022 are 7.17 upstream, 7.14 at the outfall, and 7.17 at the downstream.

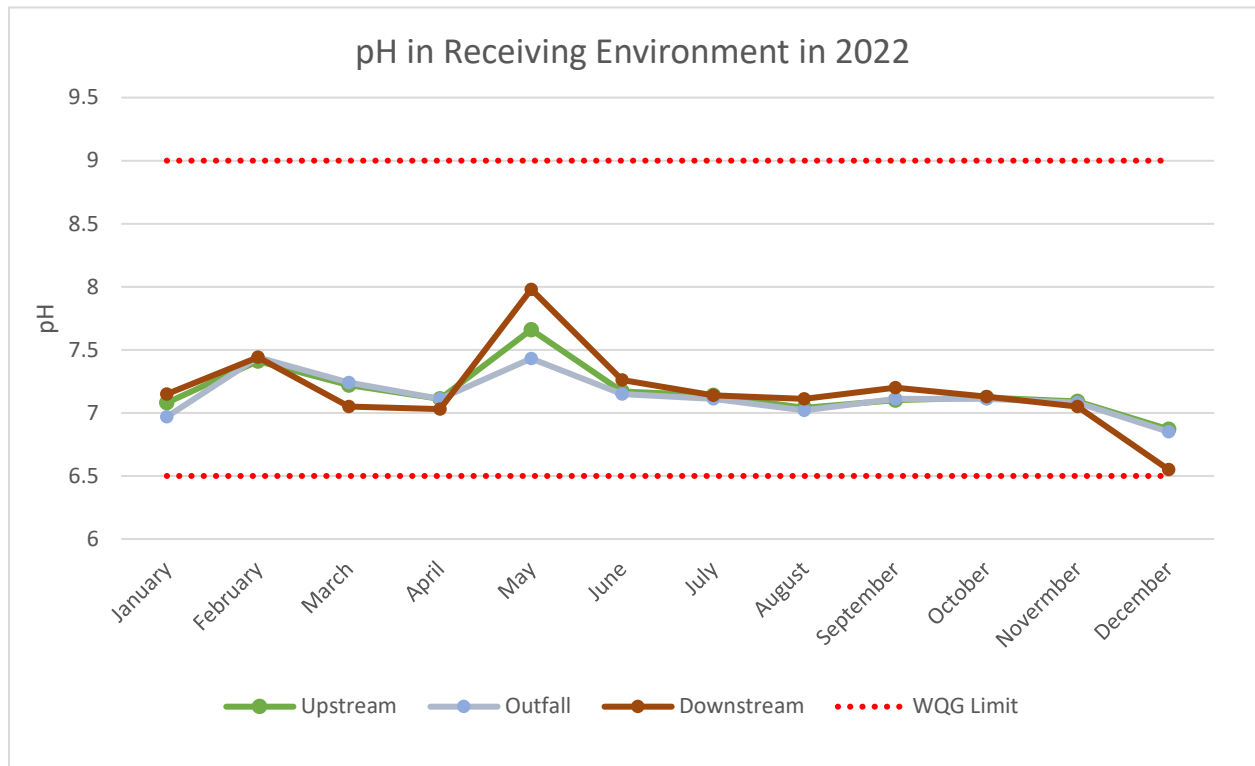


Figure 1: Whistler Wastewater Treatment Plant pH Monitoring in the Receiving Environment for 2022.

Figure 2 compares the pH sample results from 2016 to 2022 at the outfall location, to the provincial water quality guidelines graphed in red. The pH has remained within the WQG for all years sampled, except for one measurement of 6.1, not identified on the graph, taken at the downstream sample location in October 2017. However, the recorded pH at the outfall during this same sample event was 6.68 which complies with the guidelines.

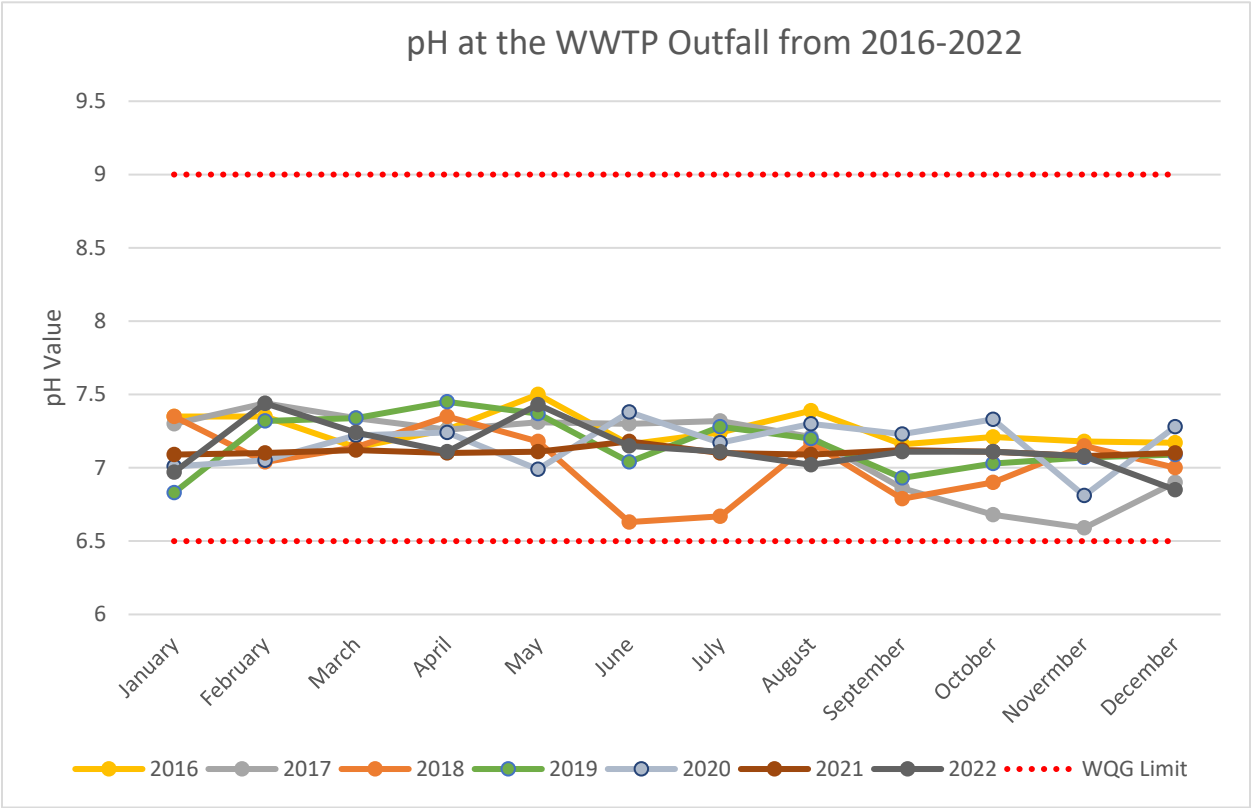


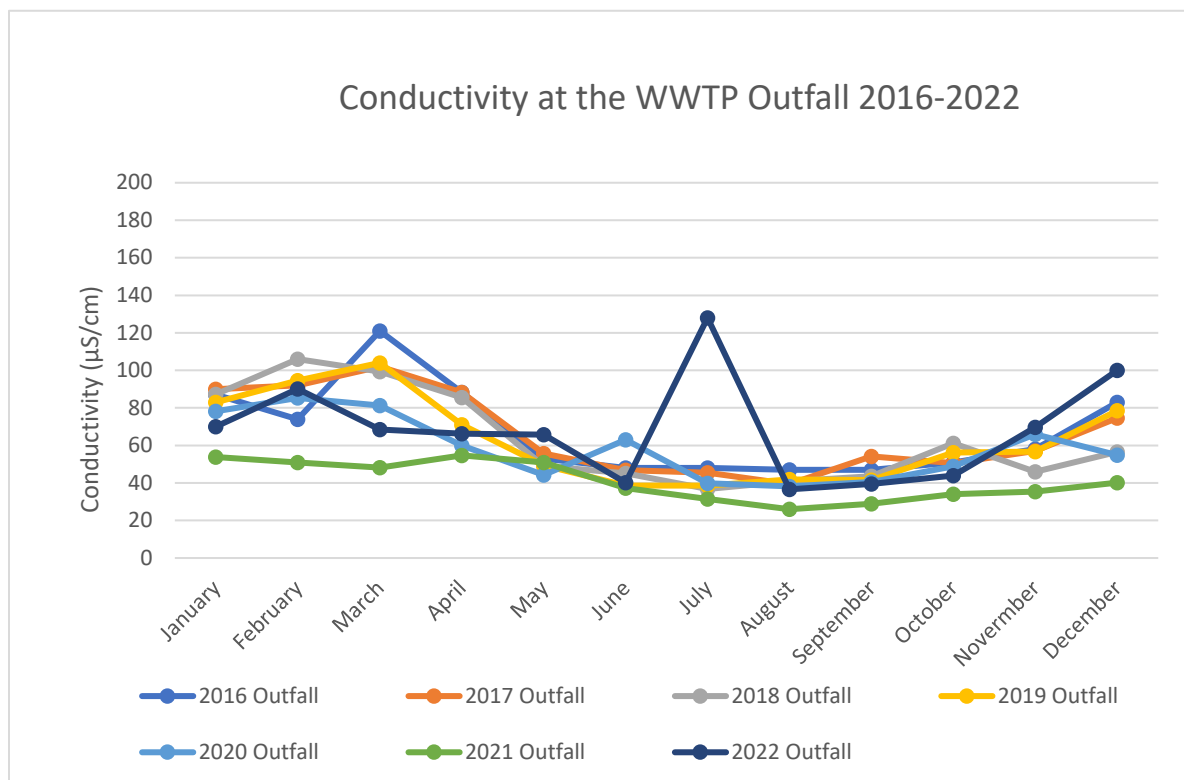
Figure 2: pH at the Whistler WWTP Outfall on the Cheakamus River from 2016-2022.



## 5 Conductivity in the Receiving Environment

The water quality samples from the Cheakamus River receiving environment in 2022 demonstrated an electrical conductivity range of 28 to 100  $\mu\text{S}/\text{cm}$  at all sample locations. This is in alignment with the data from 2016 to 2021 that had an overall range of 26 to 121  $\mu\text{S}/\text{cm}$  (Figure 3). Conductivity typically ranges from 4.8 to 84,600  $\mu\text{S}/\text{cm}$  in Western Canada surface waters (NAQUADAT, 1985); therefore, all conductivity results are within range.

Figure 3 displays conductivity results from the outfall location with a general trend of higher readings in the winter months (December to April) and lower in summer months (May to November). Increased conductivity may be due to increased salts and minerals present during months with higher precipitation. The average conductivity at the outfall during the winter of 2022 is 77.27  $\mu\text{S}/\text{cm}$  and 60.51  $\mu\text{S}/\text{cm}$  in the summer. This trend is consistent with the previous years, apart from an increase in conductivity in July. Increased conductivity was measured at all of the sample locations, which indicates that the source is upstream of the WWTP.



**Figure 3: Conductivity Sample Results from the Whistler WWTP Outfall on the Cheakamus River from 2016-2022.**





## 6 Turbidity in the Receiving Environment

There are no operational certificates or CSR guidelines for the turbidity of water. The BC WQG states that in clear waters (less than 8 NTU) the allowable turbidity is a short-term change of 8 NTU from background. When background is between 8 to 50 NTU, the allowable change is 5 NTU, and when background is over 50 NTU the allowable change is 10% from background. The upstream sample location will provide the background turbidity measurement.

Figure 4 displays the results for turbidity samples in the receiving environment for the year 2022 with the BC WQG displayed in red. There is no sample event for the year 2022 that exceeds the BC WQG for turbidity. All sample locations display the same natural variations throughout the year.

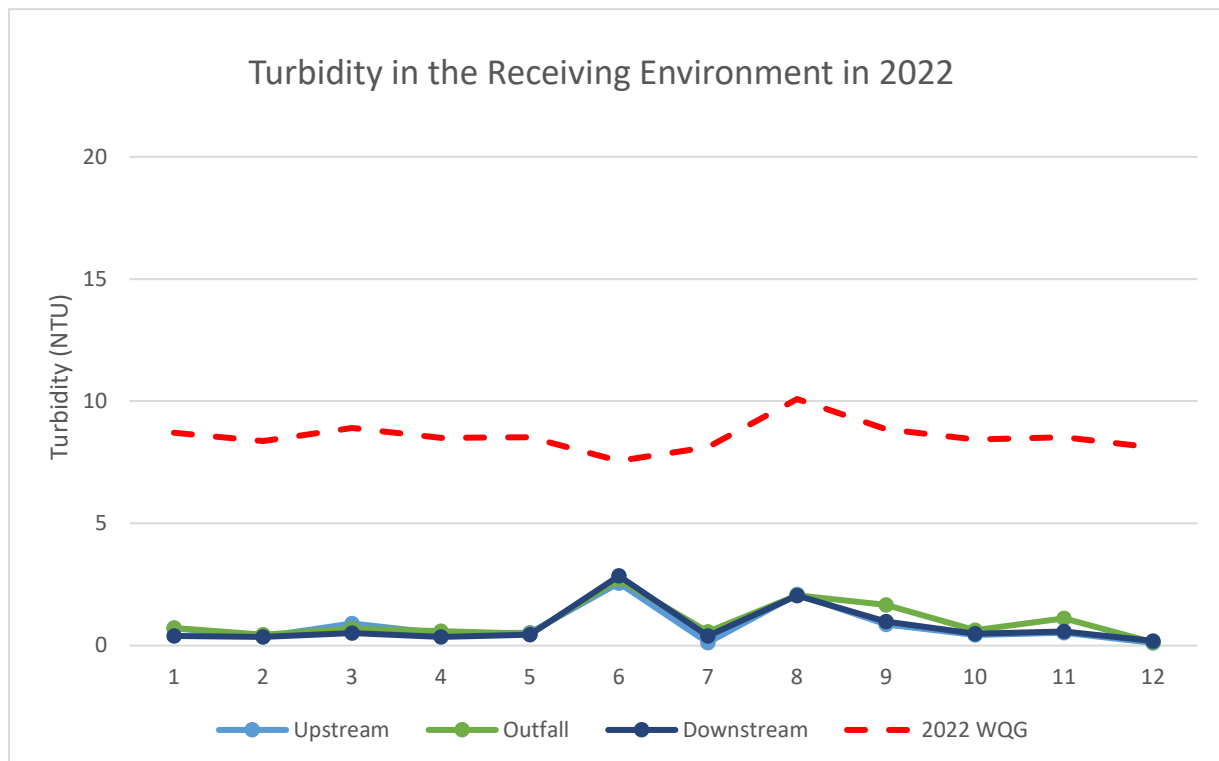


Figure 4: 2022 Turbidity Sample Results of the Whistler WWTP Receiving Environment.

Figure 5 depicts the results of turbidity samples from the years 2016 to 2022 at the Whistler WWTP Outfall sample location. Turbidity records for this period have not exceeded the BC WQG. However, increased turbidity was recorded during some sample events.

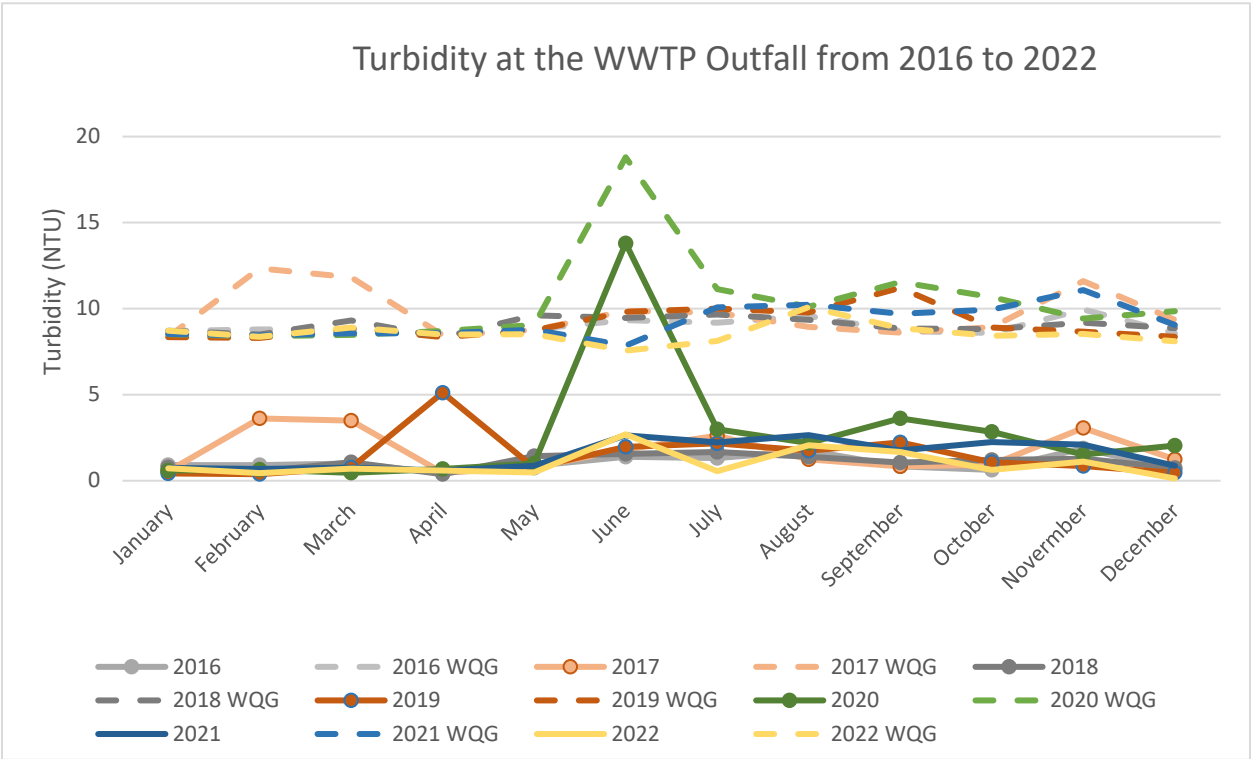


Figure 5: Turbidity Results at the Whistler WWTP Outfall from 2016 to 2022 and Guidelines.



## 7 Phosphorous in the Receiving Environment

There are no water quality guidelines for phosphate, orthophosphate or total phosphorous by the BC WQG or CSR for the protection of freshwater aquatic life, as this is non-toxic to aquatic organisms at levels and forms present in the environment. Most phosphorous in freshwater occurs as organic phosphates (95%), whereas orthophosphate is inorganic. The operational certificate specifies a maximum limit of 1.75 mg/L of ortho-phosphate (as phosphorous) for WWTP discharge. The total phosphorous does not exceed the limit of 1.75 mg/L, therefore orthophosphate also does not exceed the limit for any sample event within the receiving environment.

The Canadian Council of Ministers of the Environment (CCME) provide water quality guidelines for all of Canada. The CCME guideline displayed in Figure 6 provides a recommended framework for total phosphorous in the freshwater aquatic environment (CCME, 2004). Based on phosphorous annual average and median concentrations, the environment is typically Oligotrophic (0.004 to 0.01 mg/L) but is often in the range of Mesotrophic (0.01 to 0.02 mg/L) with the range limits outlined in red for Figure 6.

Figure 6 displays the total phosphorous results of 2022. The CCME guideline was exceeded in June, July, September and November at the downstream sample location. Samples taken from the upstream and outfall locations did not exceed the CCME guideline. The source of the exceedance is likely downstream of the WWTP.

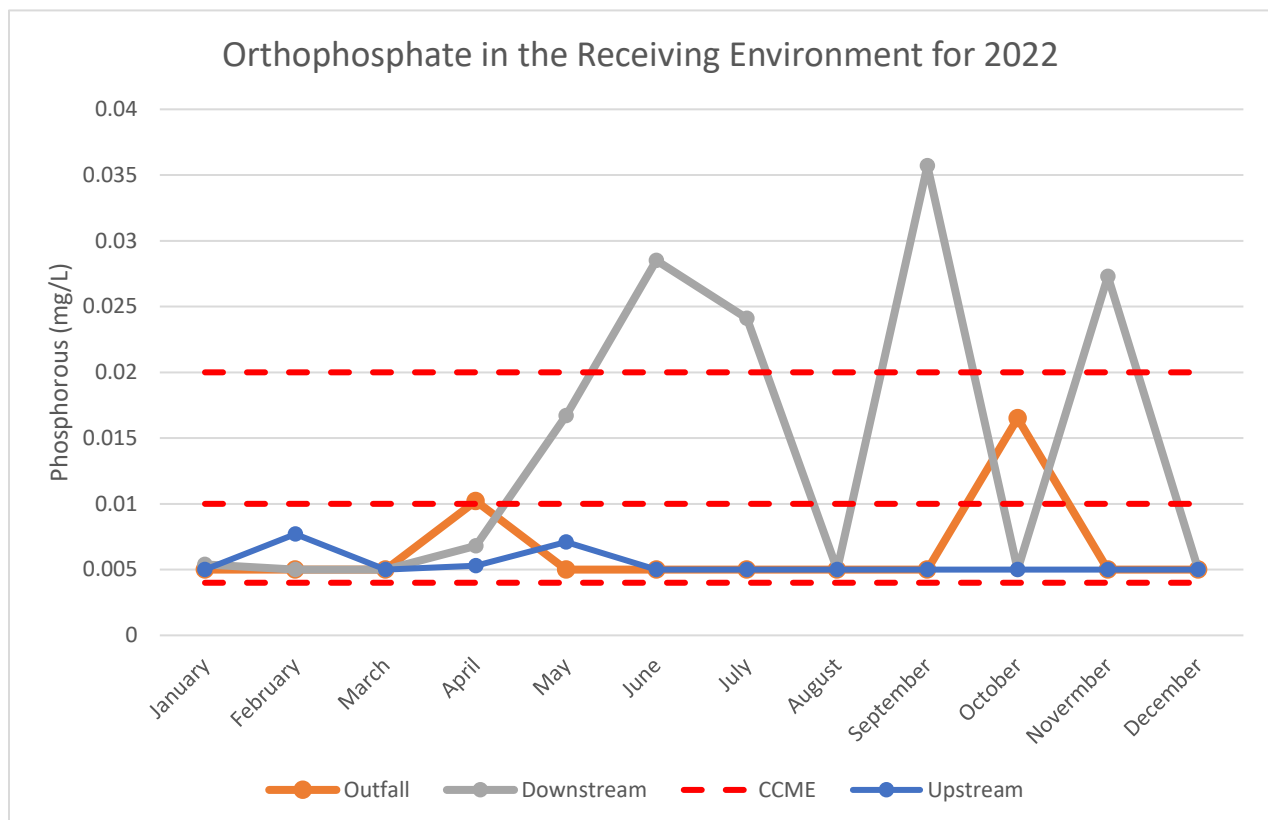


Figure 6: Orthophosphate Sample Results for the year 2022 in the Receiving Environment. All values that were recorded as <0.005 mg/L are displayed as 0.005 mg/L for graphing purposes.

Figure 7 displays the orthophosphate sample results from the outfall location in the receiving environment for the years 2016 to 2022. The operational certificate has a limit of 1.75 mg/L of orthophosphate which is not exceeded at any sample event.

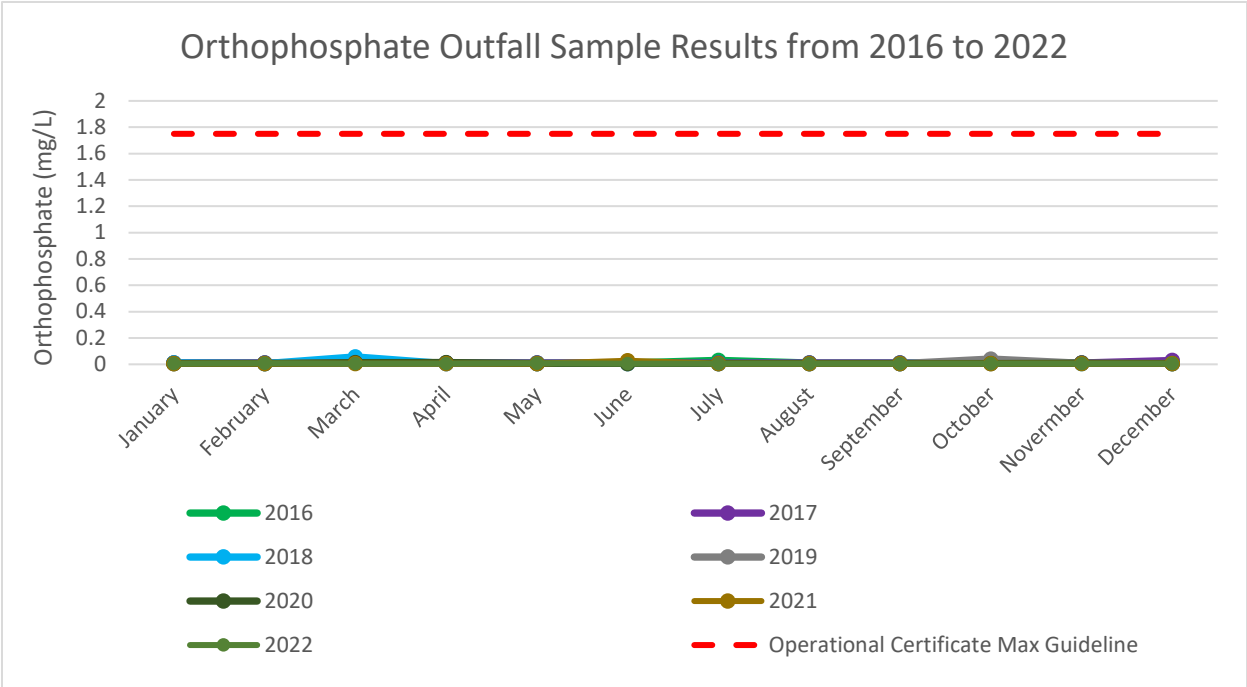


Figure 7: Orthophosphate Sample Results from the Outfall Location between 2016 to 2022. All values that were recorded as <0.005 mg/L are displayed as 0.005 mg/L for graphing purposes.



## 8 Nitrogen in the Receiving Environment

### 8.1 Nitrate Nitrogen

The CSR guideline for nitrate nitrogen is 400 mg/L and this is not exceeded for any sample event between 2016 to 2022. Figure 8 and Figure 9 display the BC WQG of 3.0 mg/L which is also not exceeded for any sample event between 2016 to 2022 in the receiving environment.

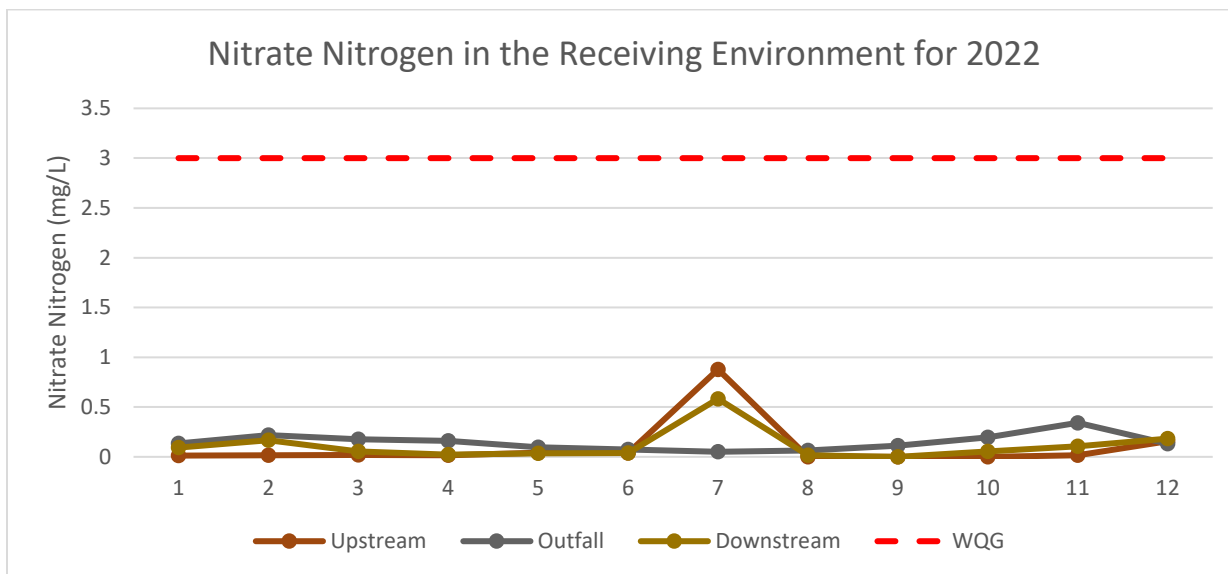


Figure 8: Nitrate Nitrogen Sample Results in the Receiving Environment for 2022.

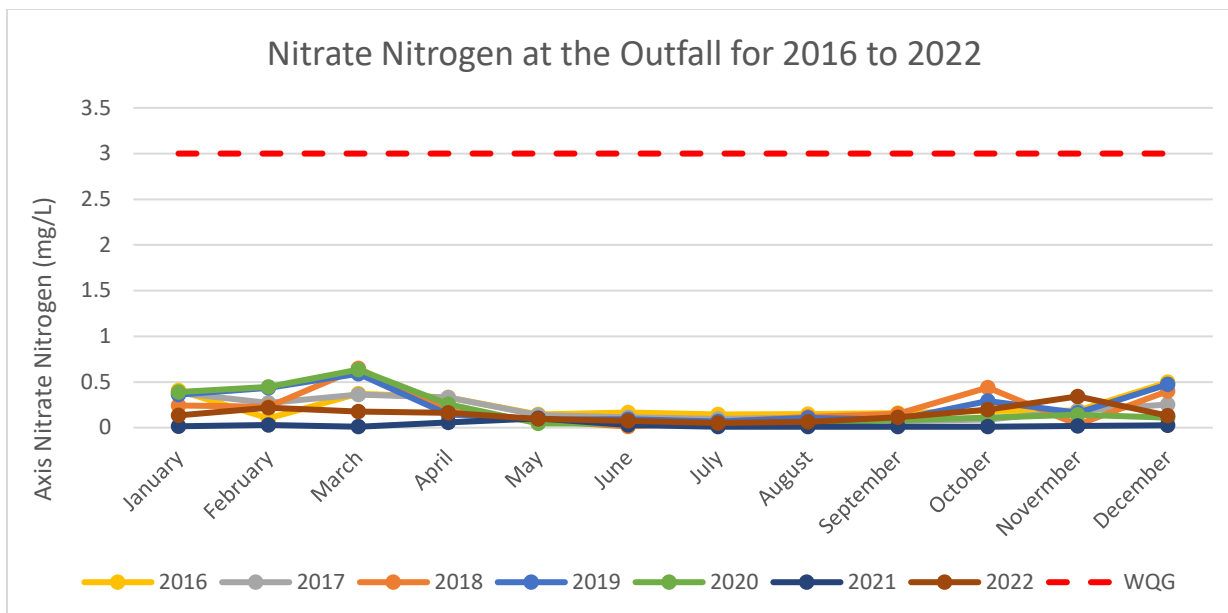


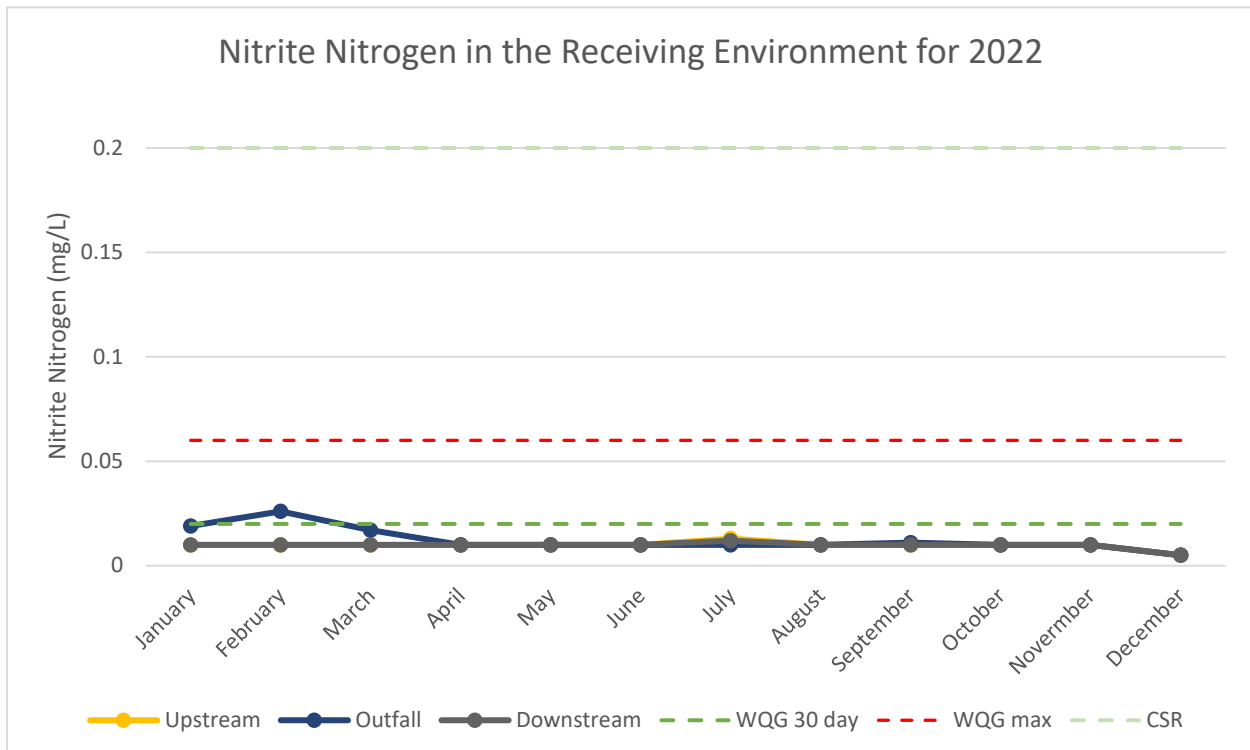
Figure 9: Nitrate Nitrogen Sample Results at the Outfall Sample Location between 2016 and 2022.

## 8.2 Nitrite Nitrogen

The CSR guideline is 0.2 mg/L for nitrite nitrogen, determined from chlorine concentrations. No sample event from 2016 to 2022 in the receiving environment exceeds the CSR guideline.

The BC WQG when chlorine is less than 2 mg/L is 0.02 mg/L of nitrite nitrogen for a 30-day period (long-term) and 0.06 mg/L for a short-term maximum concentration of nitrite nitrogen. Chlorine sampling was initiated in June of 2020 following the recommendations from the 2019 Wastewater Treatment Plant Report. The chlorine results for 2022 show a concentration of <0.02 mg/L at all locations, so the guidelines provided in Figure 10 assume that the chlorine concentrations are below 2 mg/L for the entire year. Chlorine sampling should continue to be conducted for all sample events when nitrite nitrogen is sampled.

Figure 10 displays the nitrite nitrogen sample results for the year 2022. No sample events exceeded the short-term maximum BC WQG of 0.06 mg/L. One sample event in February of 2022 exceeded the 30-day BC WQG of 0.02 mg/L at the outfall. There are no exceedances in BC WQG at the downstream sample location.



**Figure 10: Nitrite Nitrogen Sample Results of the Receiving Environment for 2022.** All values that were recorded as <0.010 and <0.005 mg/L, are displayed as 0.01 mg/L and 0.005 mg/L for graphing purposes.

Figure 11 displays the nitrite nitrogen sample results at the outfall location from the years 2016 to 2022. The CSR guidelines of 0.2 mg/L nitrite nitrogen was not exceeded at any sample event.

The BC 30-day WQG of 0.02 mg/L is exceeded in 2016 to 2022 typically in winter months at the outfall location (December to March). The BC WQG maximum limit of 0.06 mg/L is exceeded in February of 2017 and February of 2018. Winter increases in nitrite nitrogen are not reflected in background (upstream) sample results, which suggests nitrite concentration increases may be linked to the WWTP. There are no exceedances in BC WQG at the downstream sample location.

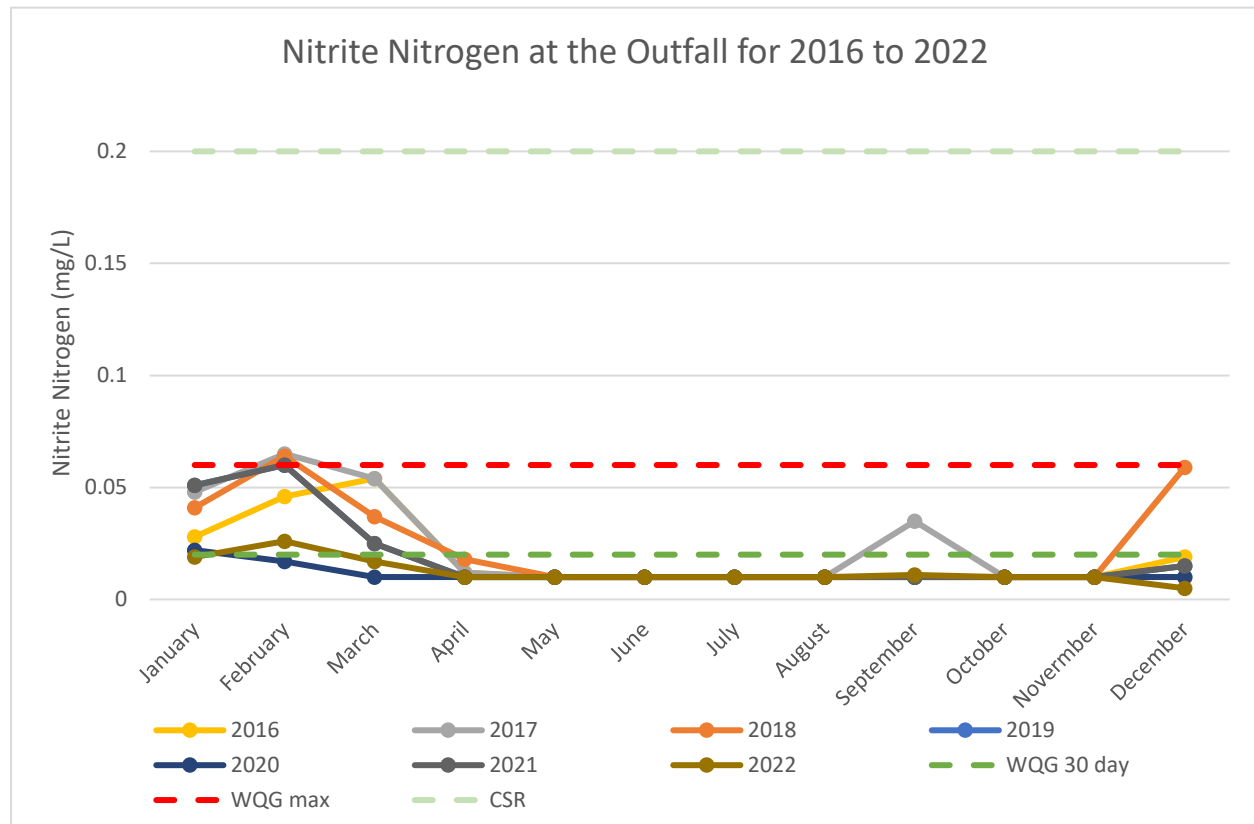


Figure 11: Nitrite Nitrogen Sample Results at the Outfall between 2016 to 2022. All values that were recorded as <0.010 and <0.005 mg/L, are displayed as 0.01 mg/L and 0.005 mg/L for graphing purposes.

### 8.3 Ammonia Nitrogen

The CSR guideline for ammonia nitrogen varies based on pH. The most conservative CSR guideline value for the 2022 sampling year was 11.3 mg/L which was not exceeded for any sample event.

Figure 12 displays the BC WQG in red for ammonia nitrogen, that varies based on temperature and pH. The BC WQG was not exceeded at any sample event in 2022. Temperature and pH should be recorded whenever ammonia is sampled.

Figure 13 displays the results for ammonia nitrogen in the receiving environment for the sample years 2019 to 2022. The WQG differs for each sample event based on the pH and temperature. No sample event exceeds the BC WQG.

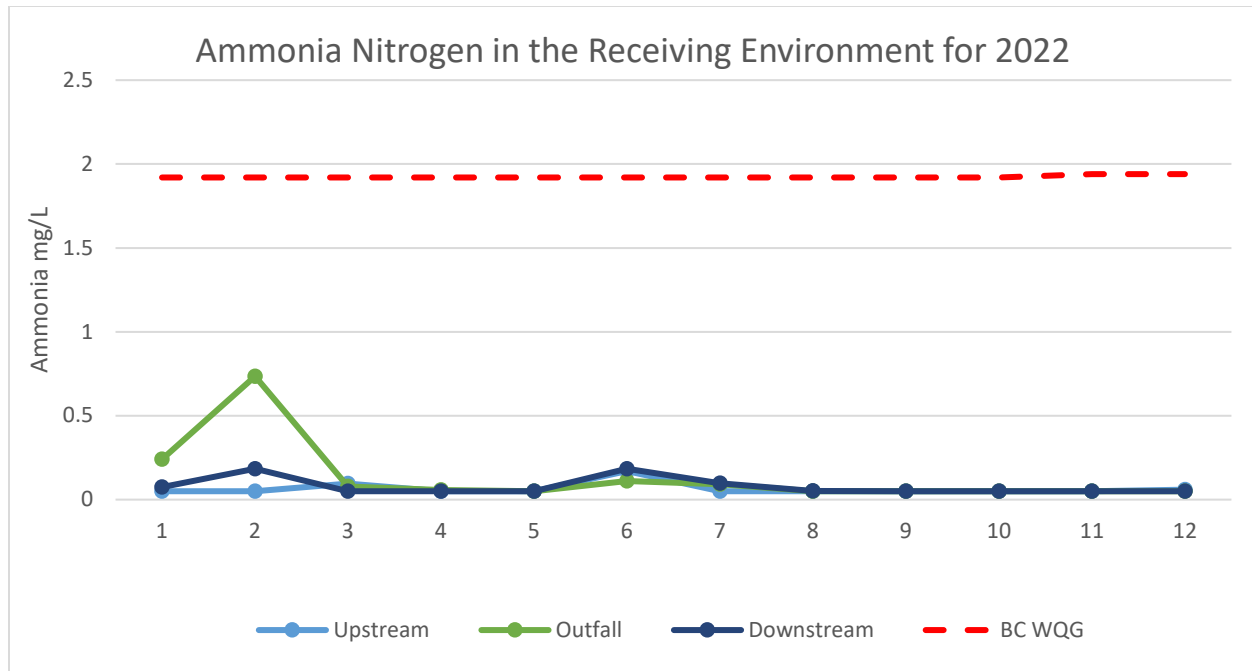


Figure 12: Ammonia Nitrogen in the Receiving Environment for 2022. All values that were recorded as <0.05 mg/L are displayed as 0.05 mg/L for graphing purposes.

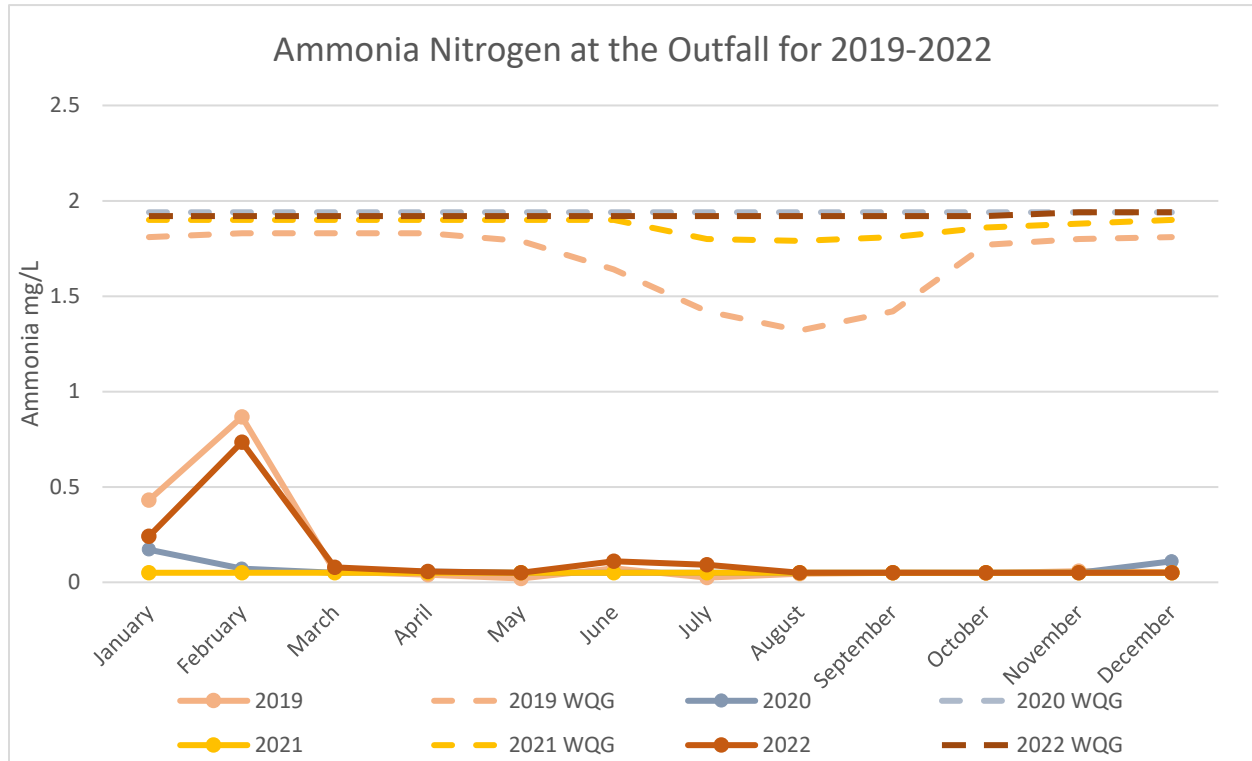


Figure 13: Ammonia Nitrogen Sample Results at the Outfall for 2019 to 2022. All values that were recorded as <0.05 mg/L are displayed as 0.05 mg/L for graphing purposes.





## 9 Conclusions and Recommendations

The monthly samples taken by the RMOW from the Cheakamus River receiving environment in the year 2022 all comply with the CSR Standards and the operational certificate sampling standards for the following sample parameters: orthophosphate (as phosphorous), nitrate nitrogen, nitrite nitrogen and ammonia nitrogen. All sample events for the year 2022 comply with the BC water quality guidelines (WQG) for turbidity and pH. No guidelines or standards are available for conductivity. However, conductivity measurements throughout 2022, with the exception of July are all within the natural range of western Canadian surface waters (NAQUADAT, 1985).

The BC WQG was exceeded for the maximum allowable nitrite nitrogen in February 2017 and February 2018, and the 30-day average was exceeded for winter months in 2016 to 2022 at the Outfall. Nitrite nitrogen measurement from the background (upstream) sample location was within the BC WQG. Potential sources of nitrite nitrogen include wastewater treatment plants and chemical fertilizer. Low flows of the Cheakamus River in winter months or increased WWTP discharge may result in higher effluent concentrations. There are no downstream nitrite concentrations that exceed WQG for the years 2016 to 2022. The exceedances of nitrite nitrogen above BC WQG are localized at the outfall location during winter months and dissipate before reaching the downstream sample location. The CSR standard is not exceeded at any time.

Orthophosphate results comply with the operational certificate for all sample events from 2016 to 2022. The CCME guideline provides a framework to observe the total phosphorous concentrations that may be outside of the natural range of the Cheakamus River. Increased phosphorous concentrations were seen throughout the year 2022 in May June, July, September, and November at the downstream sample location. However, phosphorus concentrations of samples from the upstream and outfall sample locations were within the CCME guidelines. The increased phosphorous concentrations could be due to another source between the WWTP and the Camp. It is recommended that the RMOW continue to monitor these trends closely.

It is recommended that the RMOW continue to include chlorine measurements and field temperature measurements whenever samples are taken in the receiving environment for nitrite nitrogen and ammonia nitrogen due to the guideline requirements.

It is also recommended that the RMOW monitor discharge for high nitrite nitrogen particularly in winter months when samples at the Outfall have exceeded the BC WQG limits.

Should you have any questions regarding this report or would like further information, please do not hesitate to contact the Cascade Whistler office.

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Principal  
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