

Highway 91/17 and Deltaport Way Upgrade Project – Groundwater and Surface Water Monitoring Report



Photo Credit: Hemmera, 2020

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Definition
AWf	Freshwater Aquatic Life
BC ENV	British Columbia Ministry of Environment and Climate Change Strategy
BTEX	Benzene, toluene, ethylbenzene, and xylene
DNR	Delta Nature Reserve
DO	Dissolved oxygen
DOC	Dissolved organic carbon
DQO	Data Quality Objective
EC	Electrical conductivity
GW	Groundwater
HEPH	Heavy Extractable Petroleum Hydrocarbon
LEPH	Light Extractable Petroleum Hydrocarbon
MTBE	Methyl tert-butyl ether
m asl	Meters above sea level
ORP	Oxidation reduction potential
PAH	Polycyclic Aromatic Hydrocarbon
QA/QC	Quality Assurance/ Quality Control
RPD	Relative Percent Difference
SW	Surface Water
TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen
TOC	Total Organic Carbon
VPH	Volatile Petroleum Hydrocarbons

LIST OF SYMBOLS AND UNITS OF MEASURE

Symbol / Unit of Measure	Definition
°C	Degrees Celsius
mm	Millimeter
mg/L	Milligram per Litre
m bgs	Meters below ground surface
µg/L	Micrograms per litre

1.0 INTRODUCTION

The Highway 91/17 and Deltaport Way Upgrade Project (the “Project”) includes several improvements to Highway 91, Highway 91 Connector, Highway 17 and Deltaport Way to improve travel safety, reliability and efficiency to allow for growth in goods and commercial movement. The project area is shown in **Figure 1**. Hemmera Envirochem Inc. (Hemmera) was retained to continue an ongoing surface water (SW) and groundwater (GW) monitoring program to monitor potential effects of the Project on surrounding groundwater conditions. Potential changes to ambient water quality and flow characteristics, as a result of the Highway 91/17, are important to monitor to ensure protection of the unique ecosystems associated with Burns Bog.

Burns Bog covers roughly 3,000 hectares of the Fraser River delta between the south arm of the Fraser River and Boundary Bay of which the Burns Bog Ecological Conservancy Area (BBECA) constitutes approximately 2,000 hectares. It is the largest undeveloped urban landmass in North America and the largest raised bog on the west coast of the Americas. Burns Bog is unique because of its size, diversity of flora and fauna.

The groundwater monitoring program has been carried out since September 2018 and is the continuation of a program that has been conducted since 2006 in support of construction of the South Fraser Perimeter Road (SFPR). The areas of focus for the monitoring program are: areas within and adjacent to the BBECA and Delta Nature Reserve (DNR) and several drainages leading from the Project to the Fraser River.

1.1 Monitoring Objectives

The objective of this monitoring program is to measure water quality and quantity around the Project as potential indicators of effects to ecological values associated with the BBECA, the DNR and several drainages by assessing the following:

- Groundwater levels and characteristics (including water quality)
- Surface water flow characteristics, drainage patterns, and surface water quality
- Bog water chemistry and classification

2.0 BACKGROUND

The project area is in North Delta, British Columbia (BC) (**Figure 1**) and includes several jurisdictions and features around the northeastern portion of Burns Bog that may potentially be impacted by the Highway 91/17 Project:

- Burns Bog Ecological Conservancy Area – currently under joint Metro Vancouver and City of Delta governance
- Delta Nature Reserve – City of Delta jurisdiction
- Gravel Ridge ditch also known as 96th St Ditch – City of Delta jurisdiction
- Pump station and flood box at the Gravel Ridge ditch outlet to Fraser River – operated by City of Delta
- Silda Ditch – City of Delta jurisdiction
- Flood Box at Silda ditch outlet to the Fraser River – City of Delta jurisdiction
- Burns Bog East-West Perimeter Ditch
- Rights of way for BC Hydro and Fortis BC
- MK Delta Lands Group property
- Sunbury Delta Investments property.

2.1 Burns Bog History

Burns Bog has been used by Indigenous people, including the Tsawwassen, Semiahmoo, Sto:lo, Katzie, and Musqueam First Nations for thousands of years. The bog produces various important food sources and medicinal plants for the people in the region (City of Delta, 2021).

Peat extraction and other industrial activities impacted the bog's drainage and ecosystem throughout the 20th century. A summary of the historical industrial activities and changes to the bog can be found in the 2019 report by Hatfield entitled *Highway 91/17 & Deltaport Upgrade Project: Groundwater and Surface Water Baseline* (Hatfield 2019).

2.2 Previous Studies

A baseline study was completed by Hatfield from September 2018 to July 2019 (Hatfield 2019) to assess the surface water and groundwater flow, water levels, drainage patterns, water quality and bog water chemistry in Burns Bog surrounding the Project. The 2019 baseline report also reviewed the following previous studies completed in the Project area:

- Hebda et al. 200. Burns Bog Ecosystem Review, Synthesis Report for Burns Bog, South Fraser River Delta, South-western British Columbia, Canada. Environmental Assessment Office, Victoria. March 2000.
- Golder Associates Inc. 2006. South Fraser Perimeter Road Hydrogeology Impact Assessment. Prepared for Ministry of Transportation and Infrastructure. October 2019.
- Golder Associates Inc. 2009. Results of Groundwater Monitoring Program from May 2006 through June 2009 in the Vicinity of Burns Bog, South Fraser Perimeter Road. Prepared for the Ministry of Transportation and Infrastructure. July 2009.

- Golder Associates Inc. 2017. Results of Groundwater Monitoring Program from April 2016 through March 2017 in the Vicinity of Burns Bog, South Fraser Perimeter Road. Prepared for the Ministry of Transportation and Infrastructure. June 2017.
- EBA, A Tetra Tech Company. 2013. South Fraser Perimeter Road, Burns Bog Hydrology Mitigation Monitoring: 2012-2013 Annual Monitoring. Prepared for Ministry of Transportation and Infrastructure. September 2013.
- Tetra-Tech. 2017. South Fraser Perimeter Road, Burns Bog Hydrology Mitigation Monitoring: 2016 Annual Monitoring. Prepared for Ministry of Transportation and Infrastructure.
- Enterprise Geoscience Services Ltd. 2013. Hydrology Baseline Report 10770, 72 Ave Delta, BC. Prepared for MK Delta Land Group. January 2013.
- Howie, SA. 2012. Lagg Characteristics of Burns Bog: Final Report to Metro Vancouver Regional Parks. Prepared for Metro Vancouver Regional Parks. May 2012.
- Owen. 2018. Hydrology of the Delta Nature Reserve. Prepared for the Burns Bog Conservation Society. September 2018.
- Sims, R. 2018. Summary Report (April 2018): Water Monitoring Wells Adjacent to the Highway 91/72 Avenue Interchange. Prepared for Ministry of Transportation and Infrastructure. April 2018.

This report relied on the baseline report (Hatfield 2019) for information about previous studies, previous sampling results and locations and builds on studies of similar scope that have been conducted since 2006 to monitor effects of SFPR construction on hydrology, hydrogeology, and water quality in and around the bog.

A bridging report was prepared by Hatfield, *Highway 91/17 & Deltaport Way Upgrade Project: Bridging Period Groundwater and Surface Water Baseline Monitoring*, dated August 2020, which outlines the data collected by Hatfield from July 2019 to July 2020. This data has been incorporated into this report.

2.3 Climate

Burns Bog is located in the Lower Mainland of British Columbia and is considered to have a moderate climate. The average annual temperature (from 1981 to 2010) is 10.4 °C (at the Vancouver International Airport; Environment Canada climate station ID 1108447, located approximately 20 km west-northwest of the study area). The lowest temperatures are recorded in December and maximum temperatures on average occur in July and August. The Vancouver International Airport receives on average 1,189 mm of precipitation per year, with an average of 168.9 days per year recording 0.2 mm or more precipitation. The average precipitation per month ranges from 35.6 mm in July, to 188.9 in November.

2.4 Burns Bog Water Chemistry

As indicated in Hatfield, 2019, the water chemistry within Burns Bog itself is generally nutrient poor, as precipitation is its primary water source. The water chemistry can be identified by low pH and low calcium concentrations, which is caused by the exchange processes occurring through contact with the bog peat, where calcium is replaced in porewater by hydrogen ions, causing the pH to decrease.

Three designated water types were identified by Hatfield 2019 based on descriptions from *Burns Bog Ecosystem Review: Water Chemistry* (Balfour and Banack 2000). The three water types were used to describe the water chemistry in and around Burns Bog, based on observed calcium concentrations and pH values as follows:

- Type I (bog water): with pH values from 3.5 – 5.5 and calcium concentrations ranging from 0-3 mg/L
- Type II (transitional water): with pH values from 4.5 – 6.0 and calcium concentrations ranging between 3 – 10 mg/L
- Type II (non-bog water): with pH values from 5.0 – 8.0 and calcium concentrations > 10 mg/L.

Based on studies reviewed by Hatfield (2019), electrical conductivity (EC), a surrogate for Total Dissolved Solids (TDS), can be an additional indicator of water type. Bog water is low in dissolved solids and therefore has a very low EC. Ion concentrations are expected to increase toward the margins of the bog due to mixing with mineralized “non-bog” type water and therefore increasing the EC.

3.0 FIELD METHODS

3.1 Study Scope

The field program was completed using the baseline program by Hatfield (2019), which was based on recommendations by Sims (2018b). This included:

- Seasonal monitoring: groundwater and surface water monitoring conducted quarterly to assess seasonality in water quality and flow characteristics.
- Continuous monitoring using level-loggers at key locations for water level and in-situ indicator parameters (pH, specific conductivity, and water temperature) to assess changes over time and response to storm events. Potential water quality impacts on Burns Bog related to flooding events, especially because of urban stormwater runoff, are a key consideration of the Highway 91/17 Project stormwater runoff plan (Binnie 2018).

The data collected by Hatfield from July 2019 to July 2020 has been incorporated in this report along with the data collected during field programs carried out by Hemmera.

3.2 Field Program

The field program was completed from September 2019 to December 2020 and consisted of the following tasks:

- Field reconnaissance to confirm the status of monitoring equipment installed by Hatfield for the purposes of the baseline and bridging monitoring programs (completed in September and October 2020 by Hemmera).
- Continuous and quarterly monitoring of water levels and water quality.

The September 2019, April 2020 and June 2020 field events were completed by Hatfield and have been reported on in the Bridging Period report (Hatfield 2020) as well as in this report. The October and December 2020 field events were completed by Hemmera staff and are reported on in this document. Field photos are included in **Appendix A**.

3.2.1 Continuous Water Level Monitoring

3.2.1.1 Groundwater Monitoring Wells

Table A outlines the groundwater monitoring wells installed throughout the project and includes planned sampling frequency and expected presence of Solinst M5 Leveloggers (Levellogger) based on the baseline monitoring report (Hatfield, 2019). The installation details for each well can be found in Hatfield, 2019. **Figure 1** shows the locations of the groundwater monitoring wells.

Table A Groundwater Monitoring Wells

Well ID	Location ¹		Sampling Planned ²	Levellogger Expected (Y/N)
	Easting	Northing		
MW06-Q2	502975	5443744	Y	Y
MW06-Q3S	502976	5443447	Y	Y
MW08-Q4(1)	502988	5443884	Y	Y
MW08-Q4(2)	502988	5443884	Y	Y
MW08-Q4(3)	502987	5443882	Y	Y
MW01	505458	5442528	Y	Y
MW03	505295	5442451	Y	Y
MW05	505026	5442378	Y	Y
GW04	503481	5443533	Y	Y
GW18-01	503750	5443756	Y	Y
GW18-02	503624	5443641	Y	Y
GW18-03	504369	5443395	Y	Y
GW18-04	504182	5443272	Y	Y
GW18-05	503941	5443133	Y	Y
GW18-06	504864	5443303	Y	Y
GW18-07 ³	504913	5443838	Y	Y ³

Notes:

1. All coordinates are shown in NAD 83 UTM Zone 10.
2. Sampled Quarterly for pH, Conductivity and Total Calcium and annually as outlined in **Section 3.2.2.1**.
3. In addition to a Levellogger, GW18-07 also had a Barologger installed to measure atmospheric pressure changes.

Water level measurements were collected continuously using Levelloggers, which were installed in each monitoring well across the Highway 91/17 Project area. The monitoring network is grouped as outlined below and shown on **Figure 1**:

- Group 1 (north of the BBECA, bog-like ecosystem): MW06-Q3S, MW06-Q2, MW08-Q4(1), MW08-Q4(3): a 435 m long north to south transect located south of Highway 17 near the western end of the Highway 91/17 Project footprint.
- Group 2 (north of the BBECA, on private property, bog-like ecosystem): GW04, GW18-02 and GW18-01: a 355 m long transect, extending northeast to southwest to the south of Highway 91C.
- Group 3 (north of the BBECA, on private property, bog-like ecosystem): GW18-05, GW18-04 and GW18-03: a 495 m long transect, orientated northeast to southwest to the south of the Nordel Way Truck Parking.
- Group 4 (in the BBECA): MW05, MW03 and MW01: a 450 m long east to west transect located across Highway 91 at the 72nd Avenue exit, south of the Highway 91/17 Project footprint.
- Group 5 (in the DNR): GW18-06 and GW18-07: located within the DNR, east of the Highway 91/17 Project footprint.

Levelloggers were suspended from J-plug caps in each well using stainless steel aircraft cable and clamps. Each Levellogger was deployed at the bottom of the well to ensure that the removal of the J-plug would not interfere with water level measurements. Levelloggers were programmed to collect water level measurements every 60 minutes and data was downloaded during each quarterly sampling event. A Solinst Barologger (Barologger) was installed in monitoring well GW18-07 to measure variations in barometric pressure. In the event of gaps in the Barologger data, hourly atmospheric pressure from a nearby Environment Canada climate station within Burns Bog was used. The data from the Barologger and the Environment Canada climate station was used for barometric compensation of the groundwater level.

During each quarterly monitoring and sampling event, water level measurements were collected manually at each monitoring well from the top of the well casing and were recorded to the nearest centimeter.

3.2.1.2 Surface Water Stations

Table B shows the surface water station locations, planned sampling locations and the presence of Levelloggers and water quality sondes (based on the baseline water quality report by Hatfield (2019). **Figure 1** shows the locations of the surface water stations.

Table B Surface Water Stations

Station ID	Location ¹		Sampling Planned ²	Levellogger (Y/N)	Water Quality Sonde (Y/N)
	Easting	Northing			
WQ01	503123	5443856	Y	Y	Y
WQ02	503123	5443768	Y	Y	Y
WQ03	503858	5443787	Y	Y	Y
WQ04	504723	5443105	Y	Y	Y
WS01	503128	5444446	Y	Y	N
WS02	503718	5444431	Y	Y	N
WS03	503856	5443556	Y	Y	N
WS04	504842	5443013	Y	Y	N
WS05-E	505207	5442448	Y	Y	N
WS05-W	505136	5442409	Y	Y	N
DNR01	504885	5443902	Y	-	-
DNR02	504775	5443185	Y	-	-

Notes:

1. All coordinates are shown in NAD 83 UTM Zone 10.
2. Sampled Quarterly for pH, conductivity and calcium and sampled annually as outlined in **Section 3.2.2.2**.
3. There are no stilling wells at DNR01 and DNR02 and therefore Levelloggers cannot be installed at these locations.

Surface water levels were measured continuously with a Levellogger. The surface water station network was divided into two groups:

- Group 1 includes stations that are along drainage ditches which ultimately discharge at Gravel Ridge (WQ01, WQ02, WQ03, WS01, WS03). These locations are primarily located on private land north of the BBECA.
- Group 2 includes the stations that are along drainage ditches which ultimately discharge at Silda (WS05-E, WS05-W, WQ04, WS02). WS05-E and WS05-W are within the BBECA and WS04 is adjacent to the DNR.

Levelloggers were suspended in each surface water station stilling well on a piece of rebar. Each Levellogger was deployed at the bottom of the stilling well to ensure surface water level fluctuation would not result in the Levellogger being out of water during drier seasons. Levelloggers were programmed to collect water level measurements every 15 minutes and data was downloaded during each quarterly sampling event. The Barologger in monitoring well GW18-07 was used for barometric compensation of the surface water levels along with supplemental data from the Environment Canada climate station within Burns Bog.

3.2.2 Quarterly Monitoring and Sampling

Groundwater and surface water samples were to be collected from each respective monitoring stations during quarterly monitoring and sampling events. The September 2019 and April 2020 sampling events were completed by Hatfield and have been reported on in the Bridging Period report (Hatfield, 2020) as well as included in this report. The October and December 2020 field events were completed by Hemmera staff and presented in this document.

The quarterly events also included the collection of manual water level measurements, in-situ field parameters and the download of the continuous Levellogger data. The water quality Sondes were not found in the October or December 2020 events. These were not removed by Hatfield or MOTI, and it is unknown why or how they were missing (see **Section 3.2.3**).

3.2.2.1 Groundwater Sampling

Groundwater quality samples were planned to be collected from the monitoring wells identified in **Table A**, based on the analytical sampling plan outlined in **Table C**.

Table C Groundwater Analytical Plan

Quarterly Sampling Events	Detailed Sampling Event (January)	
Total Calcium	Alkalinity	Total Dissolved Solids (TDS)
Conductivity	Anions	Total Kjeldahl Nitrogen (TKN)
pH	Total Organic Carbon (TOC)	Volatile Petroleum Hydrocarbons (VPH) – includes BTEX (Benzene, toluene, ethylbenzene, and xylene)
	Total Cyanide	Methyl tert-butyl ether (MTBE)
	Colour	Light Extractable Petroleum Hydrocarbons and Heavy Extractable Petroleum Hydrocarbons (LEPH/HEPH)
	Total Metals	Tannins and Lignins
	Dissolved Metals	Polycyclic Aromatic Hydrocarbons (PAHs)
	Total Phosphate	
	Total Dissolved Phosphate	
	Dissolved Orthophosphate	

The analysis was selected to be consistent with the baseline water quality monitoring program, however due to the transitional period between work completed by Hatfield and Hemmera, the full-scale analytical suite, to be completed annually during the detailed sampling event, was not completed for groundwater in 2020. A summary of the sampling completed by location and date is provided in **Appendix B**.

Groundwater samples were collected by Hemmera according to established procedures outlined in the BC ENV's *British Columbia Field Sampling Manual* and included the following tasks:

- Monitoring wells were purged and measurements for temperature, DO, pH, specific conductivity and oxidation reduction potential were collected.
- Where measurements of the above-listed parameters stabilized (indicating purging of representative formation groundwater) sampling of groundwater was completed using a bailer. Field duplicates were collected concurrently by alternating filling sample bottles during collection.
- Visual and olfactory observations of the groundwater were noted during sampling (i.e. sheen, color, transparency, silt content, and odor if present).

Sampling procedures for the Bridging period completed by Hatfield can be found in the Bridging Period Groundwater and Surface Water Monitoring report (Hatfield, 2020), the data from the Bridging period has been included in this report.

3.2.2.2 Surface Water Sampling

Surface water samples were planned to be collected from the surface water stations identified in **Table B**, based on the analytical sampling plan outlined in **Table D**.

Table D Surface Water Analytical Plan

Quarterly Sampling Events	Detailed Sampling Event (January)	
Total Calcium Conductivity pH	Alkalinity Anions Biological Oxygen Demand (BOD) Dissolved Organic Carbon (DOC) TOC Chemical Oxygen Demand (COD) Colour Total Metals Dissolved Metals Salinity	TDS Total Suspended Solids (TSS) Turbidity Mineral Oil & Grease Oil & Grease PAHs Tannins and Lignins Total Coliform Fecal Coliform

The analysis was selected to be consistent with the baseline water quality monitoring, however due to the transitional period between work completed by Hatfield and Hemmera, the full annual monitoring plan was not completed. **Table F** outlines the locations where samples were collected by sampling date. A full analytical suite, to be completed annually, was completed at WS01 and WS02 in September 2019 and February 2020, but no other surface water locations were sampled by Hatfield. A summary of the sampling completed by location and date is provided in **Appendix B**.

Surface water samples were collected according to established procedures outlined in the BC ENV's *British Columbia Field Sampling Manual*. The following tasks were completed during the surface water sampling program:

- Sample locations were located by use of GPS coordinates recorded from the previous sampling events.
- Surface water samples were collected upstream of the sampler by immersing clean new sample bottles into the body of water, taking care to limit the amount of sediment entering the bottle.
- Where a preserving agent was required to retain sample integrity, the preserving agent was added once the sample collection bottle was adequately filled.
- Surface water physical characteristics at each sampling location were measured for temperature, pH, DO, specific conductance, oxidation reduction potential, and turbidity.

3.2.3 Surface Water Quality Sondes

While continuous water quality monitoring was conducted in the baseline study using YSI Sondes (Sondes) at four surface water stations to measure pH, temperature, and conductivity continuously, no Sondes monitors were deployed in the field, nor were Sondes monitors located in 2020, during the period that this monitoring report covers. Sondes will be replaced and included in future monitoring events.

3.3 Data Analysis

3.3.1 Levellogger Data Processing

Data was downloaded from Levelloggers deployed at groundwater wells and surface water stations and processed following each quarterly monitoring event. The barometric data from the Barologger was used to correct the total pressure readings for each Levellogger to determine groundwater head at each location. This was completed by subtracting the barometric pressure from the total (barometric and water) pressure measured by the Levellogger.

Data were analyzed using Solinst Levellogger Software (Solinst 2020). Anomalous data and data points from when the Levelloggers were removed for data download were removed from the data set. Manual measurements from quarterly field visits assisted in the interpolation of linear drift corrections and offsets. Manual well measurements are presented in **Table F** and **Table G**.

The water level data was then compared to precipitation using precipitation data from the Vancouver International Airport climate station.

The length of the cable hanging the Levelloggers is required such that pressure heads recorded by the Levellogger can be converted to groundwater elevations. This allows for the Levellogger measurements to be verified using the following relationship:

$$\text{Top of Casing} - \text{Cable Length} = \text{Levellogger Elevation 1}$$

$$\text{Top of Casing} - \text{Depth To Water} - \text{Pressure Head} = \text{Levellogger Elevation 2}$$

3.4 Quality Assurance and Quality Control (QA/QC)

This section describes the set of processes used to measure and assure the quality and integrity of the samples both in the field and in the laboratory.

3.4.1 Field

Hemmera's field quality assurance/quality control program (QA/QC) included practicing standard groundwater and surface water sampling protocols to minimise the potential for cross contamination between samples. The field QA/QC procedure also included the collection and analysis of field duplicates. Where field duplicates were collected, relative percent difference (RPD) calculations were completed between characterization samples and their duplicates. RPDs are calculated as the difference between a sample and its field duplicate, over the average of the two values. RPDs were not calculated where concentrations were less than five times the detection limit, which is too low to accurately calculate RPD values. RPD calculations were completed for surface water and groundwater samples and are presented with analytical results in **Tables 1 to 3** (following report text). The RPD data quality objectives (DQOs) used in this investigation for groundwater and soil are listed below in **Table E**.

Table E BC ENV Recommended DQOs for Surface Water and Groundwater

Parameter Category	DQOs
Metals in Water	20%
General Inorganics in Water	20%
Organics in Water	30%

Groundwater and surface water sample analyses were completed by Bureau Veritas Laboratories (BV) and ALS Laboratories (ALS). The samples were subjected to QA/QC procedures specific to the laboratory. Laboratory QA/QC included internal/surrogate standards, replicates and duplicates, method blanks and method spikes. Laboratory QA/QC results from BV and ALS are included with each certified laboratory report (**Appendix C**).

3.4.1.1 Levelloggers

During the collection of the data from the Levelloggers, steps were taken in the field to improve the quality of the data collected over the course of the monitoring program. As stated in **Section 3.3.1**, depth to water (DTW) was used to determine if the Levelloggers have significant drift or error occurring. When Levellogger Elevation 1 and Levellogger Elevation 2 are within 0.01 m of each other, this indicates the Levellogger is deployed at a known elevation and is not significantly drifting. Pressure readings recorded by each Levellogger can then be added to Levellogger elevation to calculate groundwater elevation. Using this approach, pressure measured by the Levellogger can be accurately converted to groundwater elevation verified by depth to water measurements.

To facilitate this quality check, at each field program DTW was measured prior to retrieval and then the Levellogger data was downloaded and the Levellogger was reprogrammed. During re-deployment, the cable length was measured again and a second DTW measurement was recorded. This allowed for comparison with the original deployment, as well as comparison for subsequent retrieval, download, and redeployment.

3.4.2 Laboratory

Water analyses were completed by BV and ALS. Test methods used by the labs followed approved test reference methods with some modifications where they would improve performance. The samples submitted to the laboratory were subjected to QA/QC procedures specific to the laboratory. Laboratory QA/QC included internal/surrogate standards, replicates and duplicates, method blanks and method spikes. Laboratory QA/QC procedures are included in each certified laboratory report, and all met the required QA/QC measures set forth by the BC ENV's *British Columbia Field Sampling Manual*. Certified lab reports are included in **Appendix C**.

4.0 RESULTS

4.1 Field Observations

It was observed that some of the metal aircraft cables used to suspend the Leveloggers in the monitoring wells are rusting and may be at risk of breaking resulting in the Levelogger falling to the bottom of the well. Leveloggers were missing from locations GW18-07 and MW08-Q4(2) and had likely already fallen to the bottom of the wells. Field photos are included in **Appendix A**.

4.2 Water Level and Flow

4.2.1 Groundwater Levels

Continuous groundwater level measurements were collected from groundwater monitoring wells from August 2019 until December 2020. **Table F** shows the groundwater levels at each location for each monitoring event, including the water levels collected using Levelogger data, manual water level measurements and groundwater elevation. According to the baseline report (Hatfield 2019), the vertical survey of some monitoring wells (GW18-04 and GW18-07) may not be accurate due to the challenging field conditions that may have impacted the survey results. This inaccuracy of the survey results is further discussed in the baseline report (Hatfield 2019), however due to these inaccuracies the water levels relative to geodetic datum are not used for these two locations.

Table F Groundwater Monitoring Results

Group	Station	Maximum Groundwater Level		Minimum Groundwater Level		Water Level Range from Minimum to Maximum (m)	Manual Water Level Measurement Date	Manual Water Level (m asl)
		Date	Level (m bgs)	Date	Level (m bgs)			
Group 1	MW06-Q2	February 1, 2020		October 2, 2020			October 2 2020	1.79
	MW06-Q3S	February 1, 2020	-0.301	October 2, 2020	1.620	0.634	October 2 2020	1.85
	MW08-Q4(1)	February 1, 2020	-0.140	September 21, 2020	0.623	0.763	September 21, 2020	1.40
	MW08-Q4(3)	February 1, 2020	0.423	September 23, 2020	0.623	0.200	September 21, 2020	1.07
Group 2	GW04	November 19, 2019	0.121	October 8, 2020	1.412	1.291	-	
	GW18-01	February 1, 2020	-0.186	October 1, 2020	1.047	1.233	October 1 2020	1.07
	GW18-02	February 1, 2020	-0.342	October 1, 2020	0.848	1.189	October 1 2020	1.66
Group 3	GW18-03	February 1, 2020	-0.456	September 12, 2019	0.203	0.659	October 1 2020	2.50
	GW18-04	June 16, 2020	0.149	September 22, 2020	0.608	0.460	-	
	GW18-05	June 16, 2020	-0.039	September 23, 2020	0.308	0.347	-	
Group 4	MW01	January 31, 2020	-0.191	August 19, 2020	0.763	0.954	October 14 2020	3.77
	MW03	January 31, 2020	-0.367	September 12, 2019	1.045	1.411	October 2 2020	3.35
	MW05	February 1, 2020	0.179	September 12, 2019	0.816	0.638	-	
Group 5	GW18-06	June 16, 2020	0.513	August 23, 2020	0.815	0.302	-	
	GW18-07	February 1, 2020	-0.539	August 20, 2019	0.247	0.786	-	

The water level data for Levelloggers in each of the five designated groups were graphed relative to time and precipitation data, as outlined in the following Sections. The data is presented on graphs showing metres below ground surface (m bgs) and metres above sea level (m asl), based on survey data collected by Hatfield. As discussed, the survey data for several locations may not be fully representative of field conditions, and it is also possible that the elevation of the monitoring wells may have changed over time due to the nature of the ground conditions.

The data collected from the Levelloggers represents pressure head that is converted to groundwater elevation through the length of cable on which the Levellogger is hung. The length of cable used to convert the data from August 2019 to June 2020 was slightly different than was used to convert the data from June 2020 to December 2020. A consistent cable length will be used for future events.

In addition, there is low confidence in the barometric data collected following the October 14, 2020 monitoring event. After downloading the barometric data and resetting the Barologger, there was an anomalous increase of approximately 10 kPa, that resulted in abnormal compensation for the Levelloggers. It is recommended that the unit be checked and recalibrated. As such, data from October 14, 2020 to December 1, 2020 has not been considered in the analysis. To account for some error in the compensation using the Barologger data, additional manual correction of the data from June to December 2020 was carried out.

Groundwater levels for all wells exhibit variability in response to seasonal precipitation and individual precipitation events. Generally, there is a steady increase in groundwater level beginning in September 2019 and reaching a maximum in February 2020. Groundwater levels remain high in most wells until late spring in April 2020 and decrease gradually through the summer and fall. High individual precipitation events, such as those in October 2019 and February 2020 are reflected in increases in groundwater levels across most wells on-site. Seasonal fluctuations and precipitation responses are discussed in more detail for each grouping below.

4.2.1.1 Group 1 (SFPR monitoring wells)

Group 1 is located north of the BBECA and south of the SFPR, in a bog-like ecosystem. Groundwater elevations and levels in MW06-Q2, MW06-Q3S, MW08-Q4(1), and MW08-Q4(3) are shown in the **Figure A** and **Figure B**. Groundwater levels for August 2019 to October 2020 were consistent with those measured during the October 2018 to August 2019 events. The groundwater levels for the wells screened in peat (MW06-Q2, MW06-Q3S and MW06-Q4(1)) are within the same range, while the level for MW08-Q4(3) is approximately 1 m lower owing to a deeper screen depth in the sand unit underlying the peat.

In the Hatfield 2019 Groundwater and Surface Water Baseline report, diurnal water level fluctuations in the Fraser River were found to cause dampened tidal response in the ditches in the downgradient portion of the Highway 91/17 Project area and were inferred to affect groundwater levels. The tidal influence in Group 1 wells was noted to be relatively small, with MW08-Q4(3) exhibiting the strongest response. The data collected from August 2019 to October 2020 is consistent with previous findings, and as such the groundwater wells are inferred to be tidally influenced.

Negative water level readings (m bgs) occurred in MW06-Q2, MW06-Q3S and MW08-Q4(1) between November 2019 and April 2020. This is interpreted to reflect water levels rising above ground surface, and was confirmed by Hatfield field staff in January 2019, the surface water was observed to also be high at the time.

Data was not collected from the following:

- MOW06-Q3S: June 2020 to October 2020
- MW06-Q2 and MW08-Q4(1): August 2020 to September/October 2020

4.2.1.2 Group 2 (Highway 91C/Nordel Way Interchange)

Group 2 is located on private property, to the north of the BBECA and south of the SFPR, in a bog-like ecosystem. Groundwater elevation and levels in GW04, GW18-01 and GW18-02 are shown on **Figure C** and **Figure D**, and are generally consistent with those recorded during the October 2018 to August 2019 events. However, water levels at GW04 were approximately 1 m higher in 2020 than 2019, this increase in water level was not observed in any other location in this area and may be attributed to measurement error. Data will continue to be collected from this location to monitor the water levels. Hatfield 2019, noted that a minor tidal influence was observed in the monitoring wells, which is less significant in comparison to the influence of precipitation events on water levels. As noted in Group 1, negative readings at GW18-01 and GW18-02 are indicative of flooding events, where water levels were above ground surface.

Data was not collected from the following:

- GW04: June 2020 to October 2020
- GW18-02: August 2020 to October 2020

4.2.1.3 Group 3 (Highway 91/Nordel Way)

Group 3 is located on private property, to the north of the BBECA and west of Highway 91, in a bog-like ecosystem. Groundwater levels in GW18-03, GW18-04 and GW18-05 are shown on **Figure E** and **Figure F**. The data for GW18-04 and GW18-05 is incomplete, as barometric data from August 2019 to June 2020 was not available for compensation. GW18-03 exhibits similar groundwater level seasonal patterns and responses to precipitation events. Maximum groundwater levels were observed in GW18-04 and GW18-05 in June 2020, however, groundwater levels were not measured in February 2020 at these locations when the maximum groundwater levels would be expected to be.

GW18-05 was not accessed by Hatfield during the 2019 or early 2020 events, and data was not collected from the Levellogger in GW18-05.

4.2.1.4 Group 4 (Highway 91/72nd Avenue Interchange)

Group 4 is located on within the BBECA. Groundwater levels in MW01, MW03 and MW05 are shown on **Figure G** and **Figure H**. Within this group of wells, MW01 and MW03 on the east side of Highway 91 show slightly larger seasonal fluctuations and responses to precipitation events than MW05. Groundwater levels at each of the wells are generally consistent with those recorded from October 2018 to August 2019.

Partial data was collected from MW01 and MW03 from late August to October 2020.

4.2.1.5 Group 5 (DNR monitoring wells)

Group 5 is located on within the DNR. Water levels in GW18-06 and GW18-07 in the DNR are shown on **Figure I** and **Figure J**. There is a significant amount of missing data from GW18-06, though declining water levels from June to August 2020 are consistent with those of other wells across the site. Water level data from GW18-07 is consistent with seasonal patterns in other wells and exhibits responses to precipitation events, however these responses are amplified as a result of periodic flooding relative to those observed in other groups of monitoring wells; from September 2019 to March 2020 the water level in GW18-07 is near ground level or above. Maximum groundwater levels were observed in GW18-06 in June 2020, however, groundwater levels were not measured in February 2020 at these locations, when the maximum groundwater levels would be expected to be.

As the Levellogger was missing from GW18-07, data was not collected for June to December 2020.

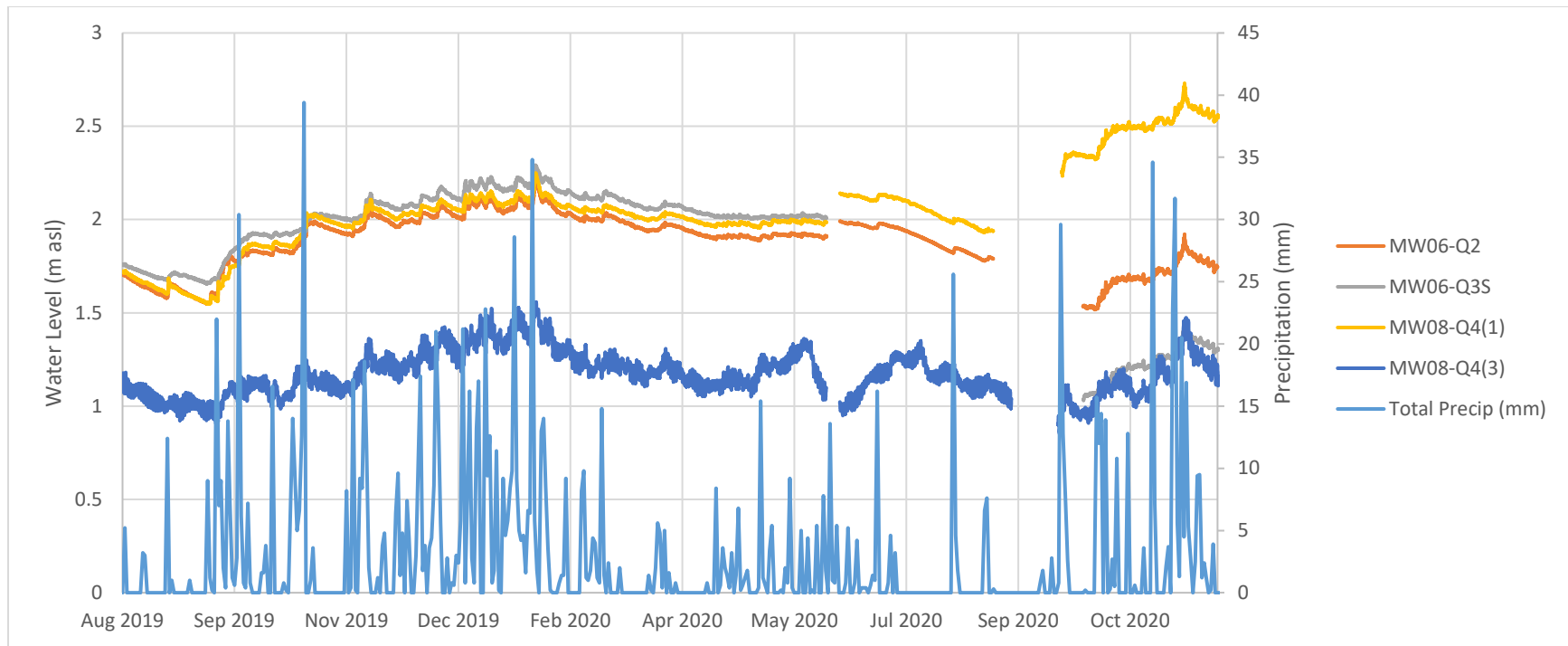


Figure A Groundwater Elevations (m asl) and Precipitation for Group 1

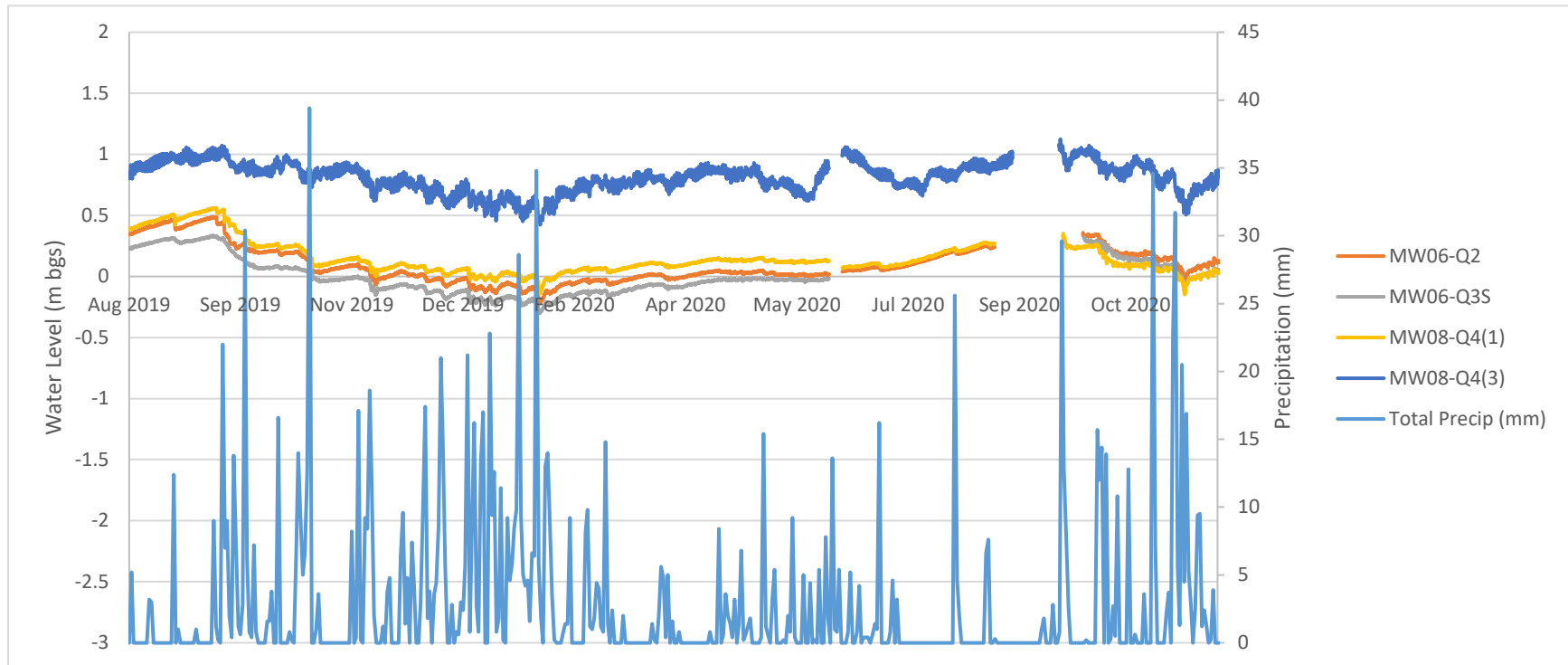


Figure B Groundwater Levels (m bgs) and Precipitation for Group 1

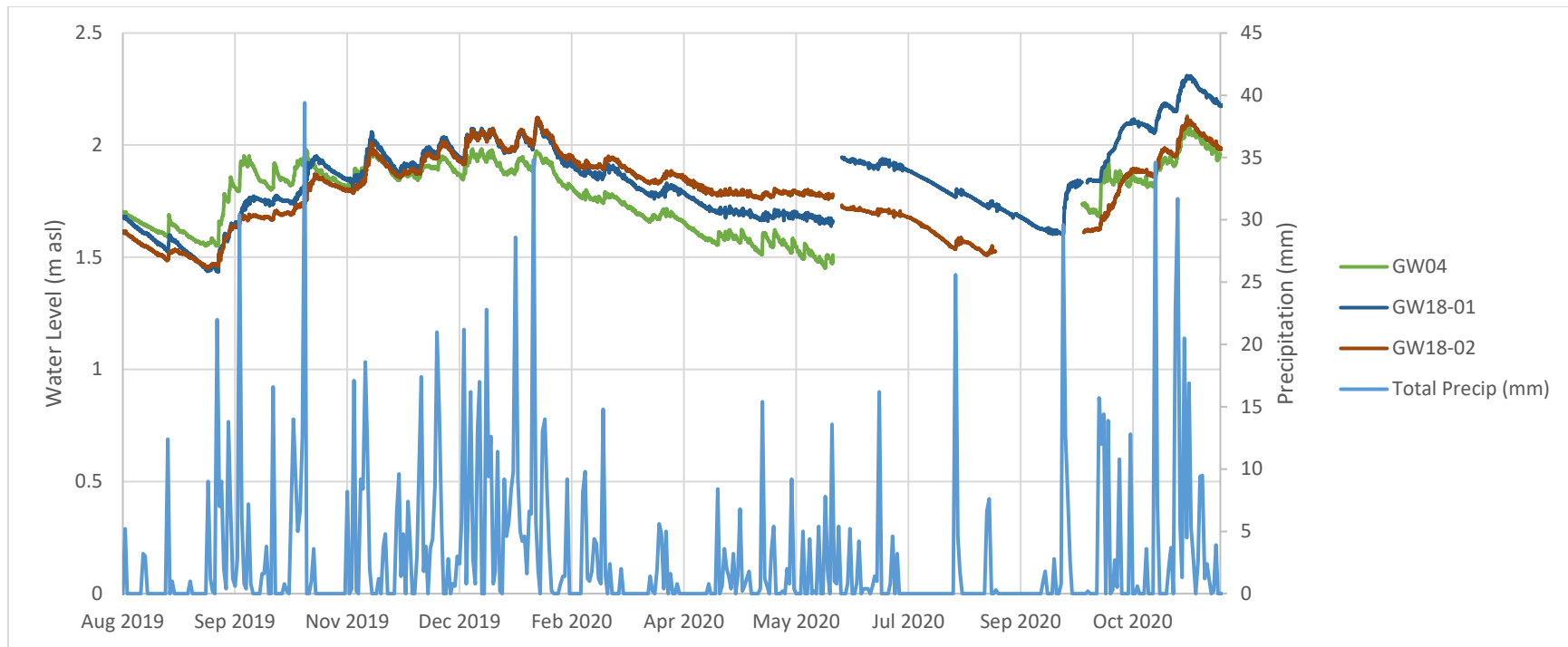


Figure C Groundwater Elevations (m asl) and Precipitation for Group 2

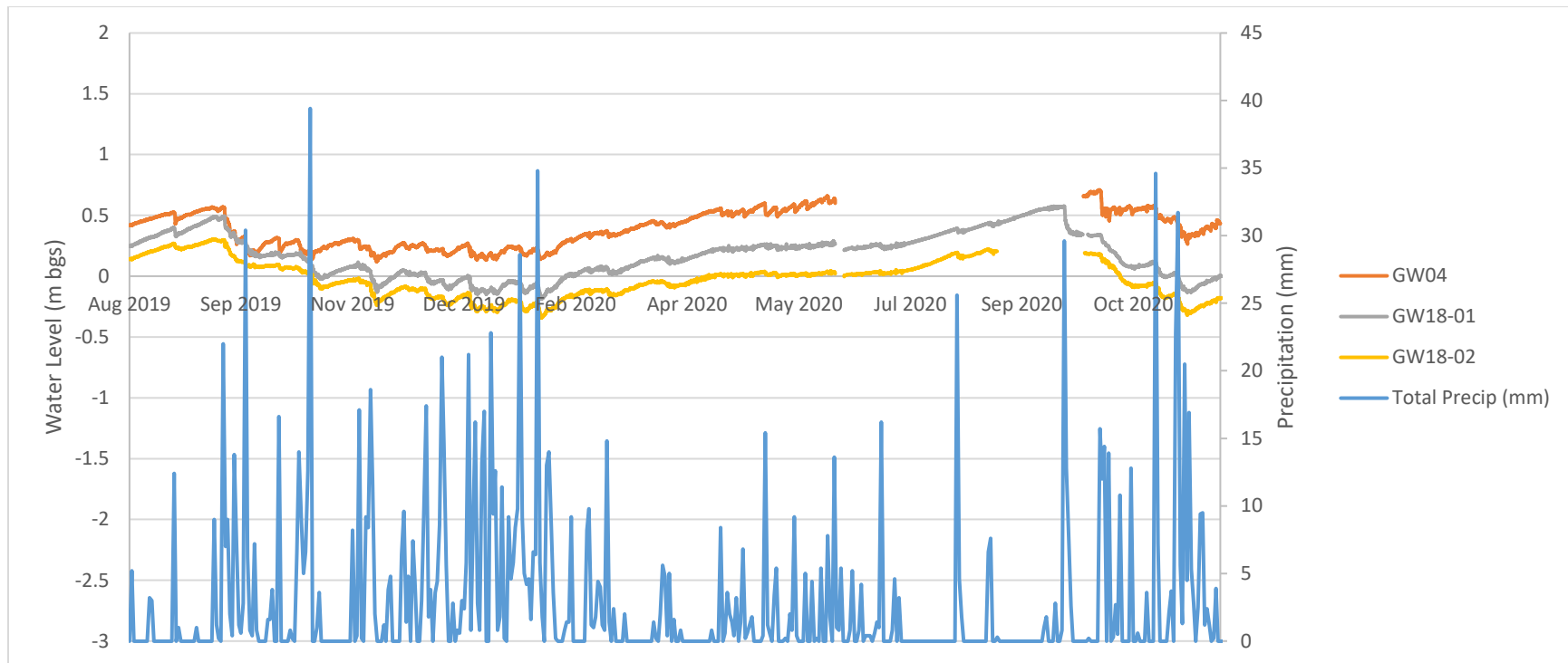


Figure D Groundwater Levels (m bgs) and Precipitation for Group 2

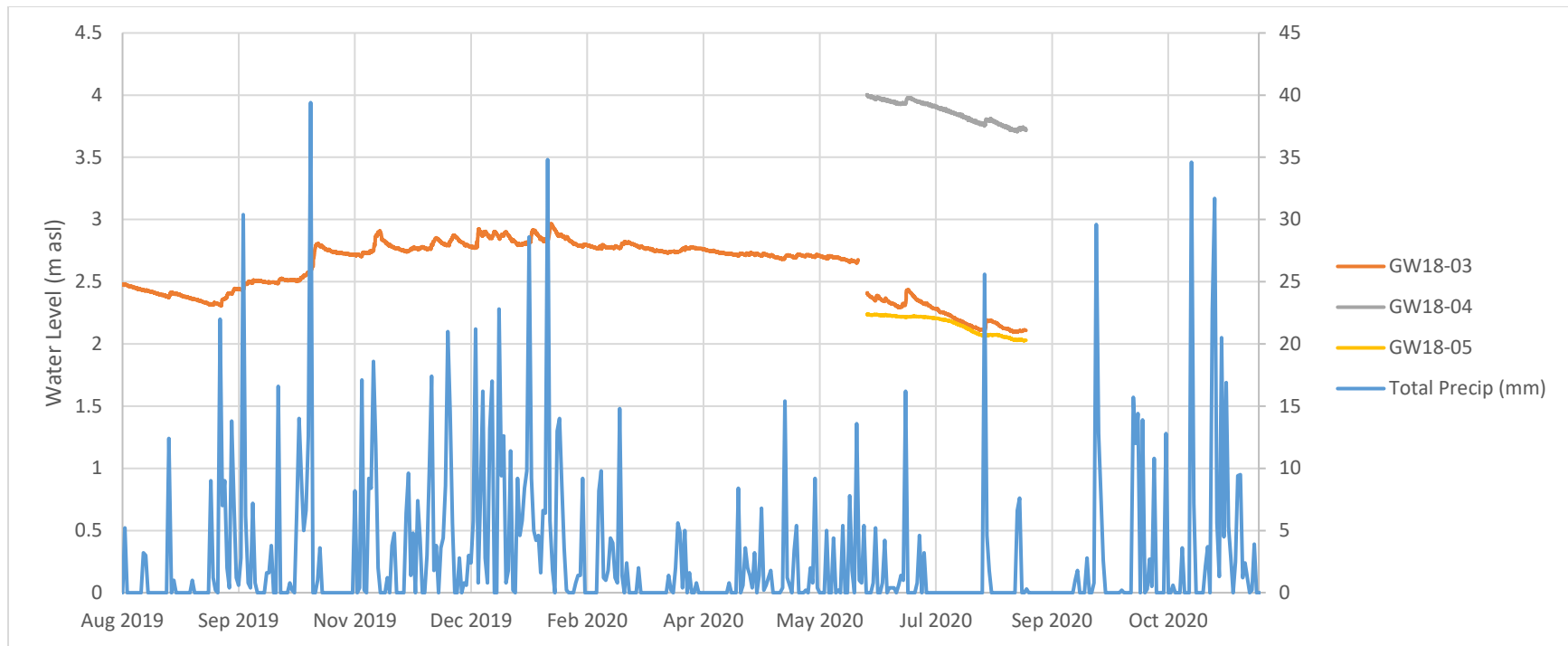


Figure E Groundwater Elevation (m asl) and Precipitation for Group 3

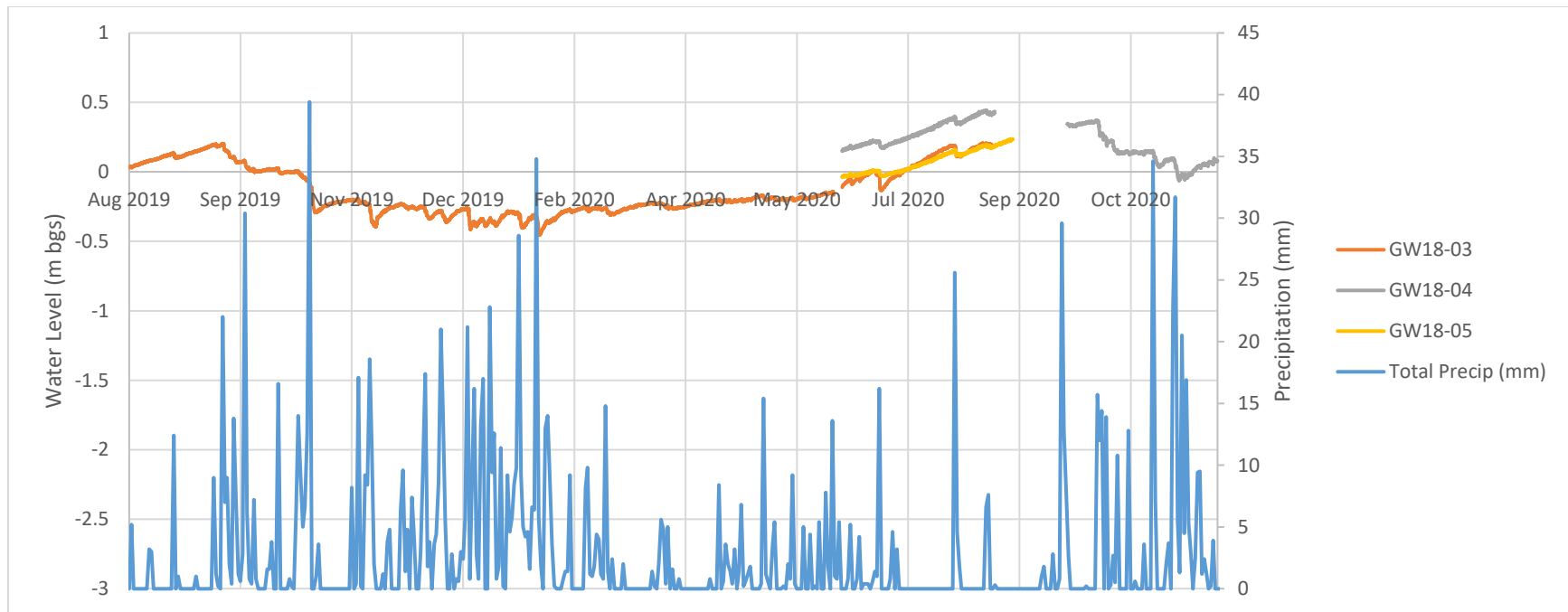


Figure F Groundwater Levels (m bgs) and Precipitation for Group 3

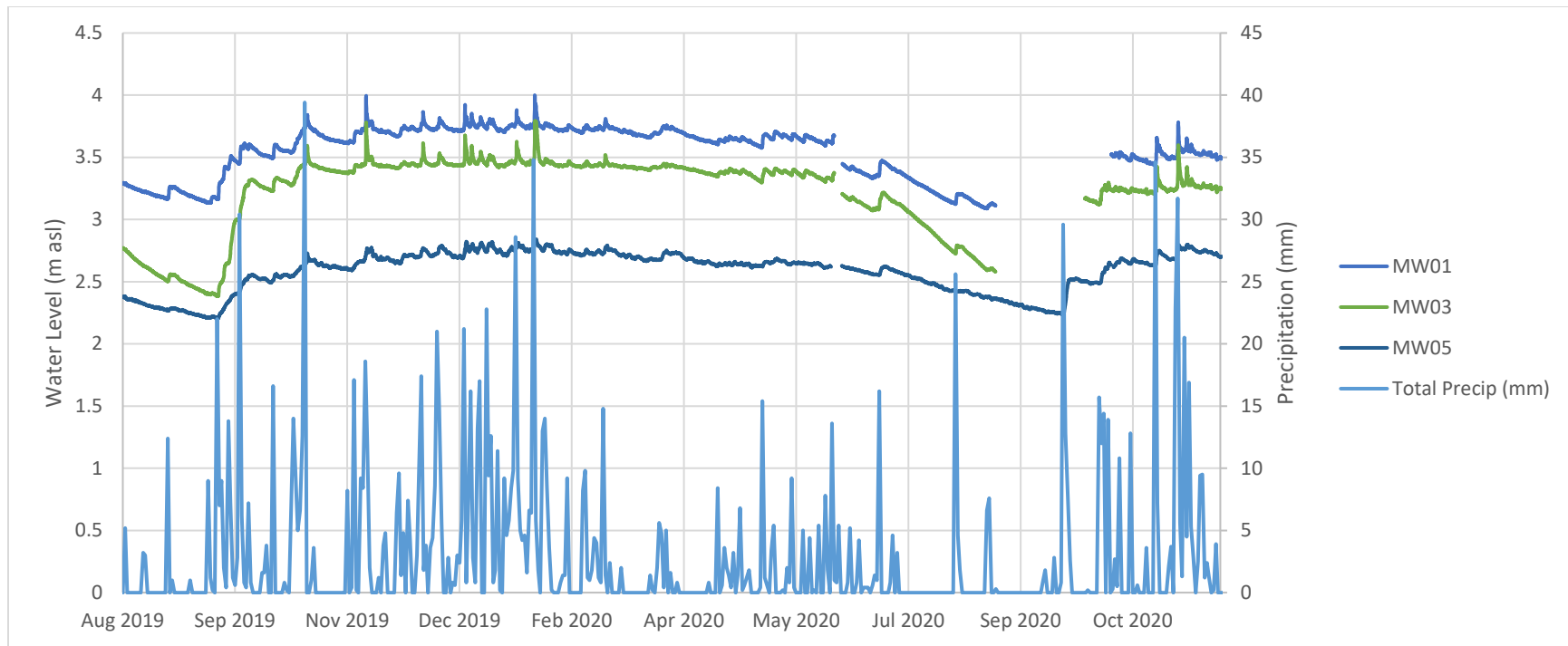


Figure G Groundwater Elevations (m asl) and Precipitation for Group 4

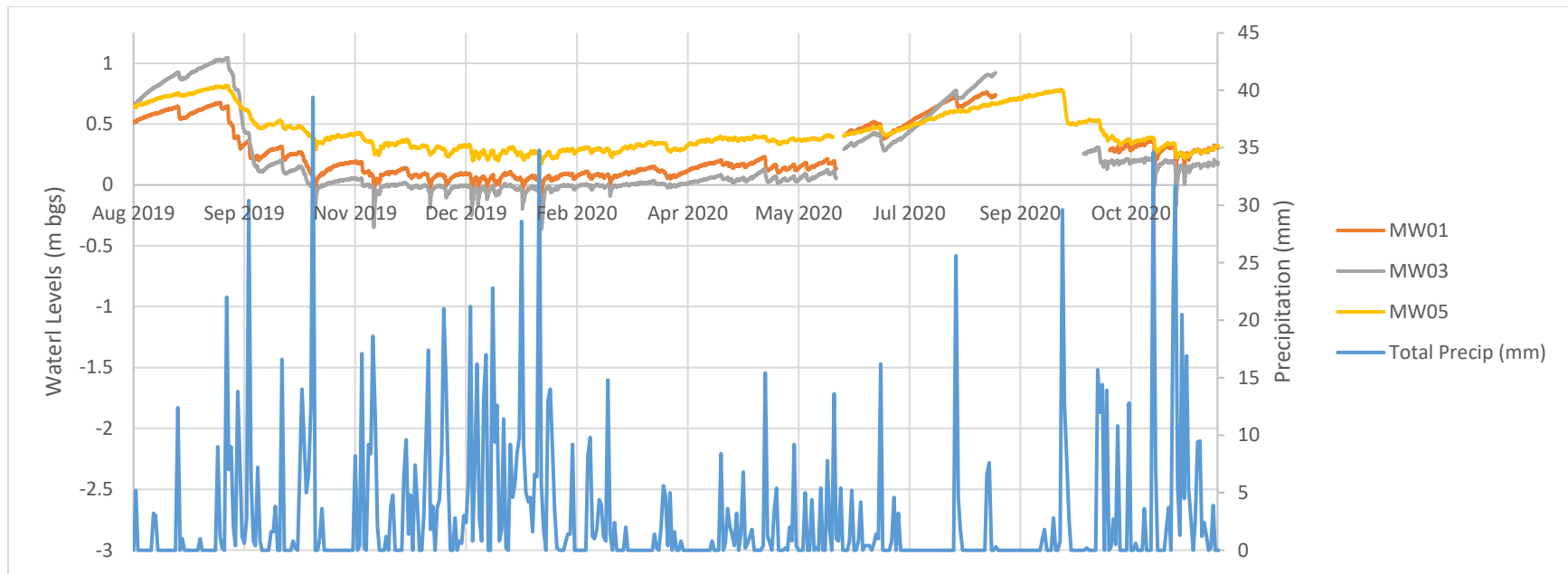


Figure H Groundwater Levels (m bgs) and Precipitation for Group 4

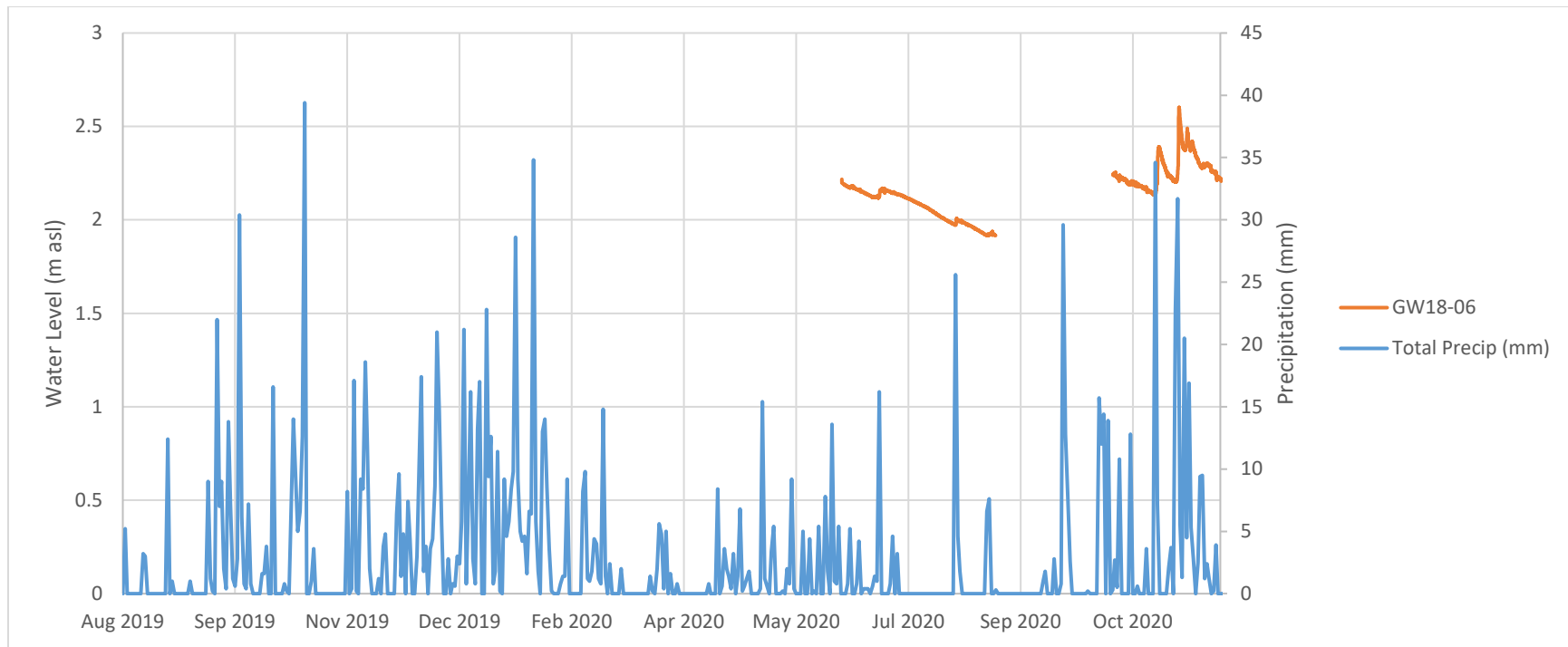


Figure I Groundwater Elevation (m asl) and Precipitation for Group 5

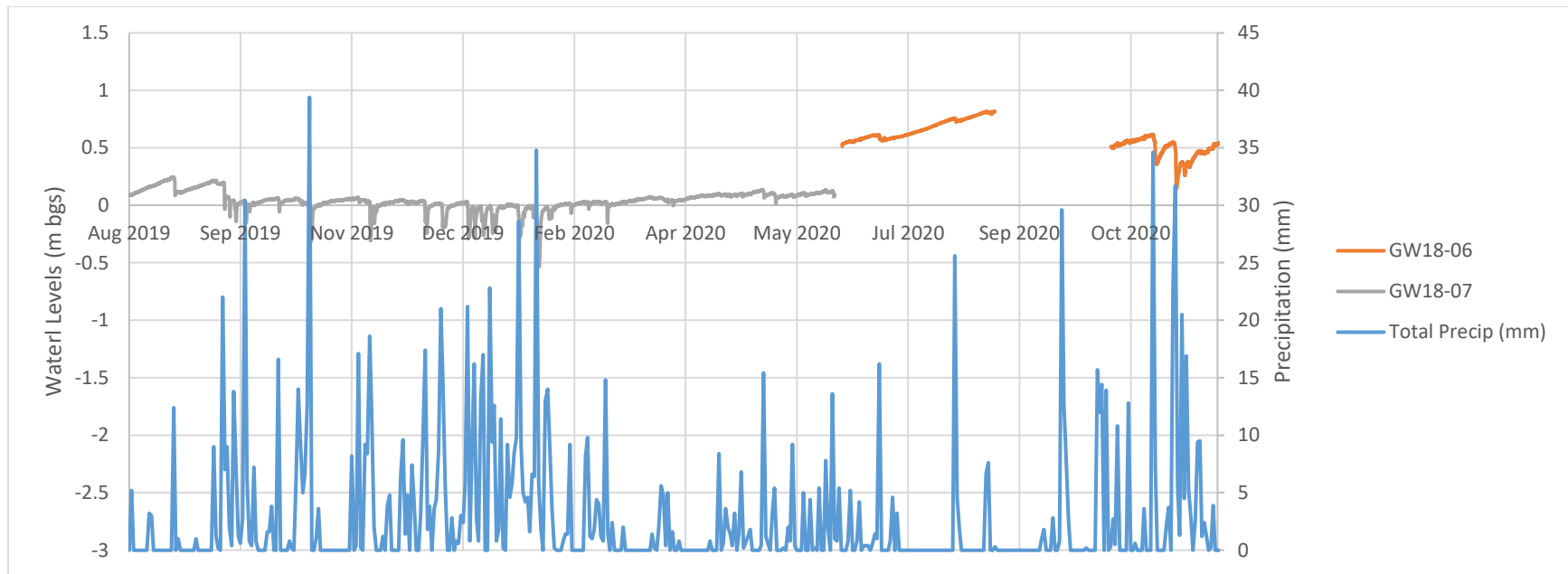


Figure J Groundwater Levels (m bgs) and Precipitation for Group 5

4.2.2 Groundwater Flow Directions

Groundwater water levels are summarized on **Table F**. In general, maximum water levels were observed in February 2020 and minimum water levels were observed in September 2019, coinciding with seasonal variations in precipitation.

Water levels across the Site are likely indicative of a complex flow pattern, with groundwater flow through the peat towards, or away from, the surface water ditches. However, groundwater levels at each station may also reflect the accuracy of the elevation survey, the flat topography of the area, and changes in the elevation of each screen owing to the nature of the peat. Based on the uncertainty of relating water level measurements from each location to each other, the groundwater flow has not been mapped at this time and will be in the future if further surveying of the groundwater and surface water locations is carried out.

4.2.3 Surface Water Levels

Surface water levels from nine surface water stations were analyzed using continuous level measurements from August 2019 to December 2020. The surface water stations are divided into two groups:

- Group A includes stations that are along drainage ditches that ultimately discharge at Gravel Ridge (WQ01, WQ02, WQ03, WS01, and WS03) shown on **Figure 1**.
- Group B includes stations that are along drainage ditches which ultimately discharge at Silda (WS05-E, WS05-W, WQ04, WS02 and WS04) shown on **Figure 1**.

A summary of the range of surface water levels at each station over the monitoring period is provided in **Table G**. Surface water level variations over the monitoring period are generally in the 0.6 to 1.0 m range, which is an increase over the October 2018 to August 2019 monitoring period; WS05-W has a smaller range of 0.3 m, interpreted to be due to culvert blockage, and WS01/WS02 have a range of 1.7 to 1.8 m due to tidal influence.

Figure K, Figure L, Figure M and Figure N show water level height above the Levellogger, m asl and recorded precipitation during the monitoring period. However, water level above sea level for stations WS01, WS02 and WS05-W is not shown as these stations have not been surveyed with high accuracy. As with the groundwater data, issues with barometric compensation have reduced confidence in data from October to December 2020. As such, this data is not included as part of this discussion.

Similar to groundwater levels, the water levels observed at surface water monitoring stations reflected seasonal patterns and responses to precipitation that were generally consistent with those recorded during the previous monitoring period. Water levels at most stations were observed to vary throughout the year, with a general increase beginning in October 2019, and declining in March/April 2020 with a decrease in precipitation events. WS05-W is the exception to this pattern, as it exhibits a relatively dampened response to seasonal variations and precipitation events in comparison to other monitoring stations. This dampened response was inferred by Hatfield to be due to construction and culvert replacement around the Highway 91/72nd Avenue intersection, which may have resulted in obstructions within the ditch.

WS04 was destroyed and rebuilt during the 2019 monitoring program, but the data collected from August 2019 to October 2020 indicates that the surface water in the vicinity of the stations is similarly influenced by seasonal variation and individual precipitation events, it has been included in Group 2.

At WS01 and WS02, located North of the Project at the Gravel Ridge Pump Station and Silda Flood Box, groundwater levels response to seasonal variations and individual precipitation events is evident, though masked by daily water level fluctuations that are strongly tidally influenced. As such, the surface water variation at these stations is different from those installed further south in the Project area.

Table G Surface Water Levels

Group	Station	Minimum Surface Water Level		Maximum Surface Water Level		Water Level Range between Minimum and Maximum (m)
		Date	Level (m)	Date	Level (m)	
A	WQ01	2019-09-07	0.771	2020-02-01	1.492	0.721
	WQ02	2020-07-24	0.366	2020-02-01	1.129	0.762
	WQ03	2019-09-07	0.238	2020-02-01	1.026	0.788
	WS01	2020-10-06	0.148	2020-01-12	1.941	1.793
	WS03	2020-11-03	-0.024	2020-02-01	1.225	1.249
B	WS05-E	2019-08-19	-0.002	2020-02-01	0.611	0.613
	WS05-W	2020-09-22	0.435	2019-11-19	0.729	0.294
	WQ04	2019-09-07	0.545	2020-02-01	1.265	0.721
	WS02	2020-10-12	-0.049	2020-01-23	1.692	1.740
	WS04	2019-09-07	0.157	2020-02-01	1.281	1.124

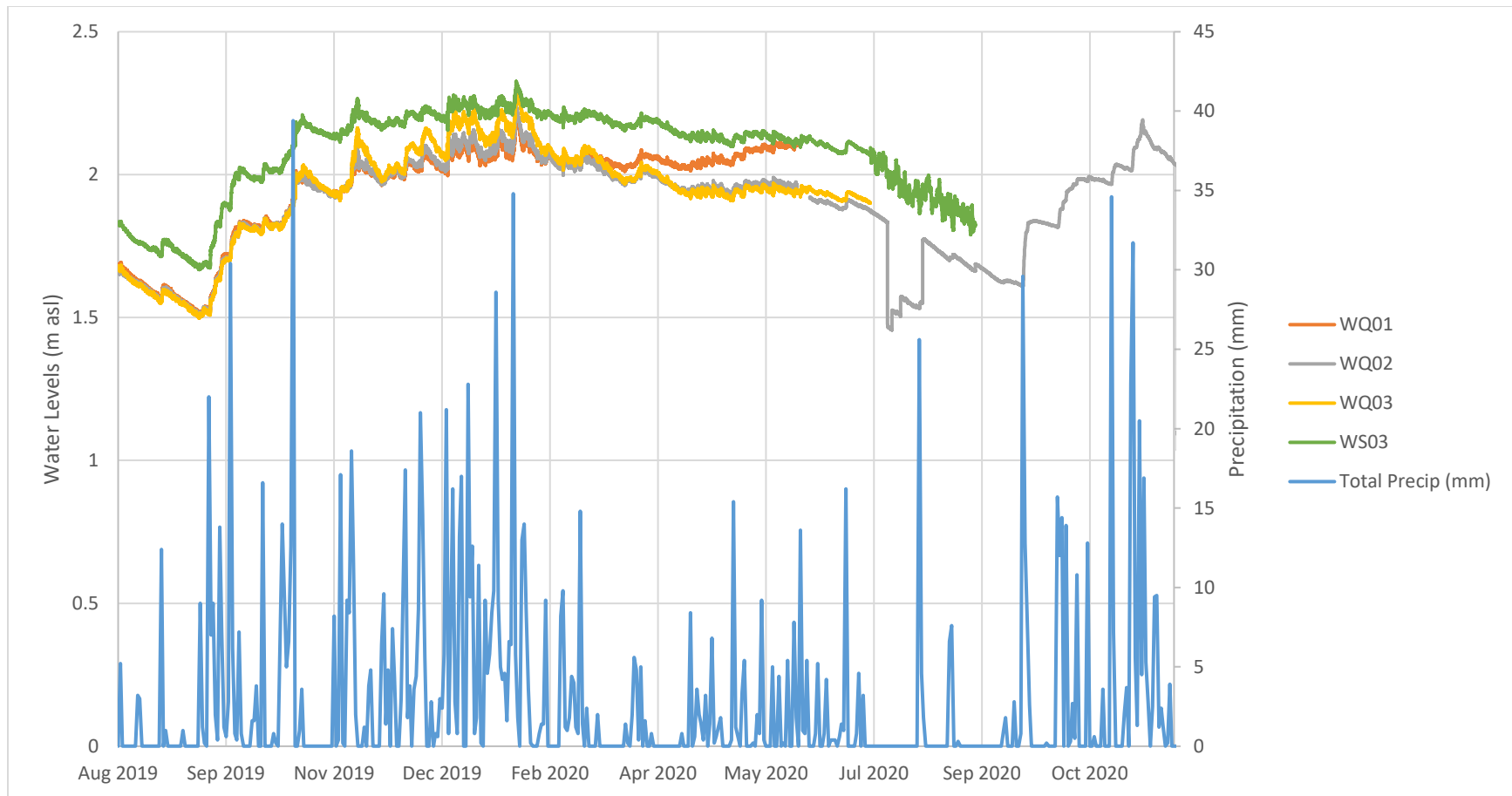


Figure K Surface Water Elevations (m asl) and Precipitation for Group A

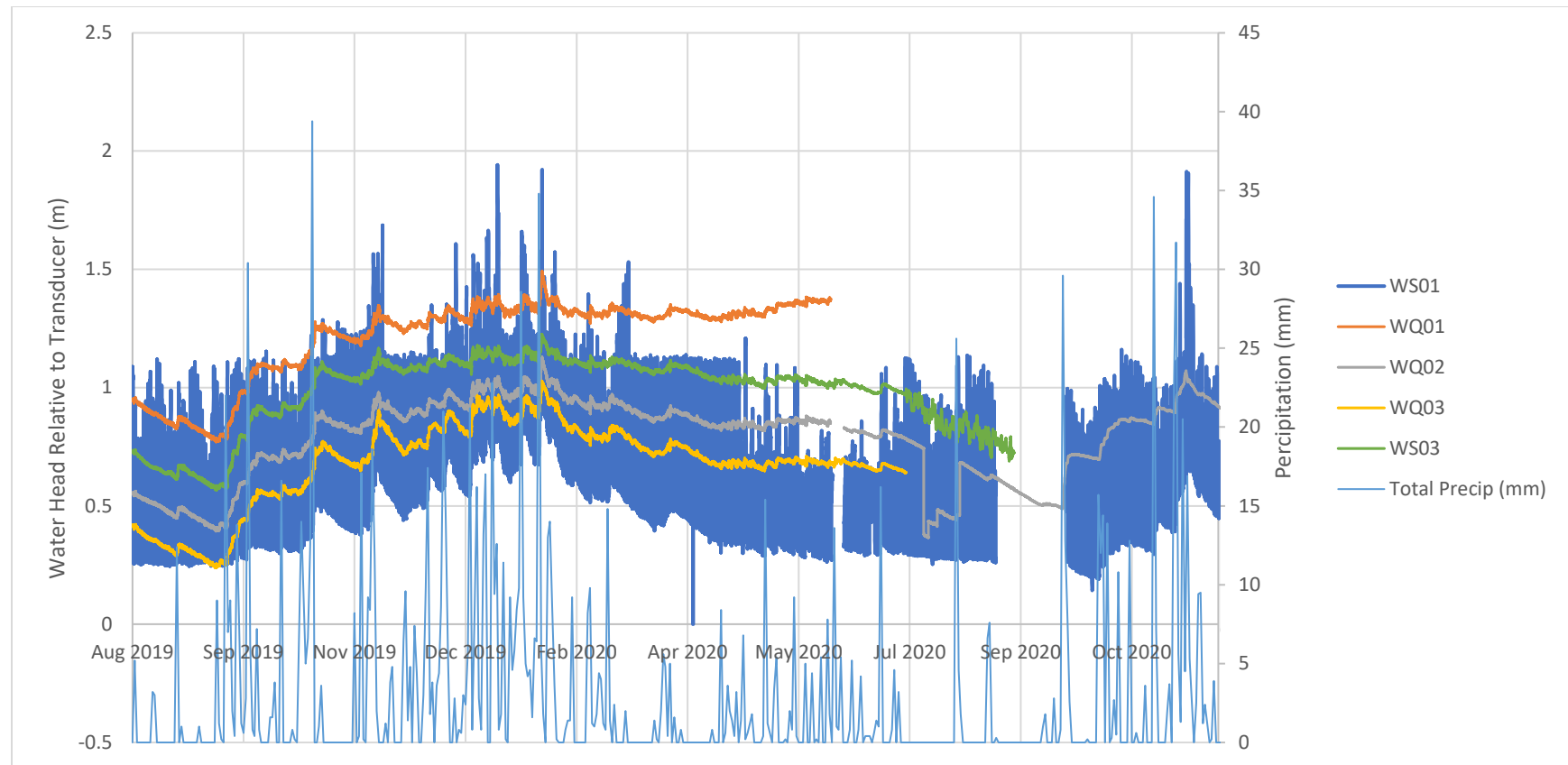


Figure L Water Head Relative to Transducer (m) and Precipitation for Group A

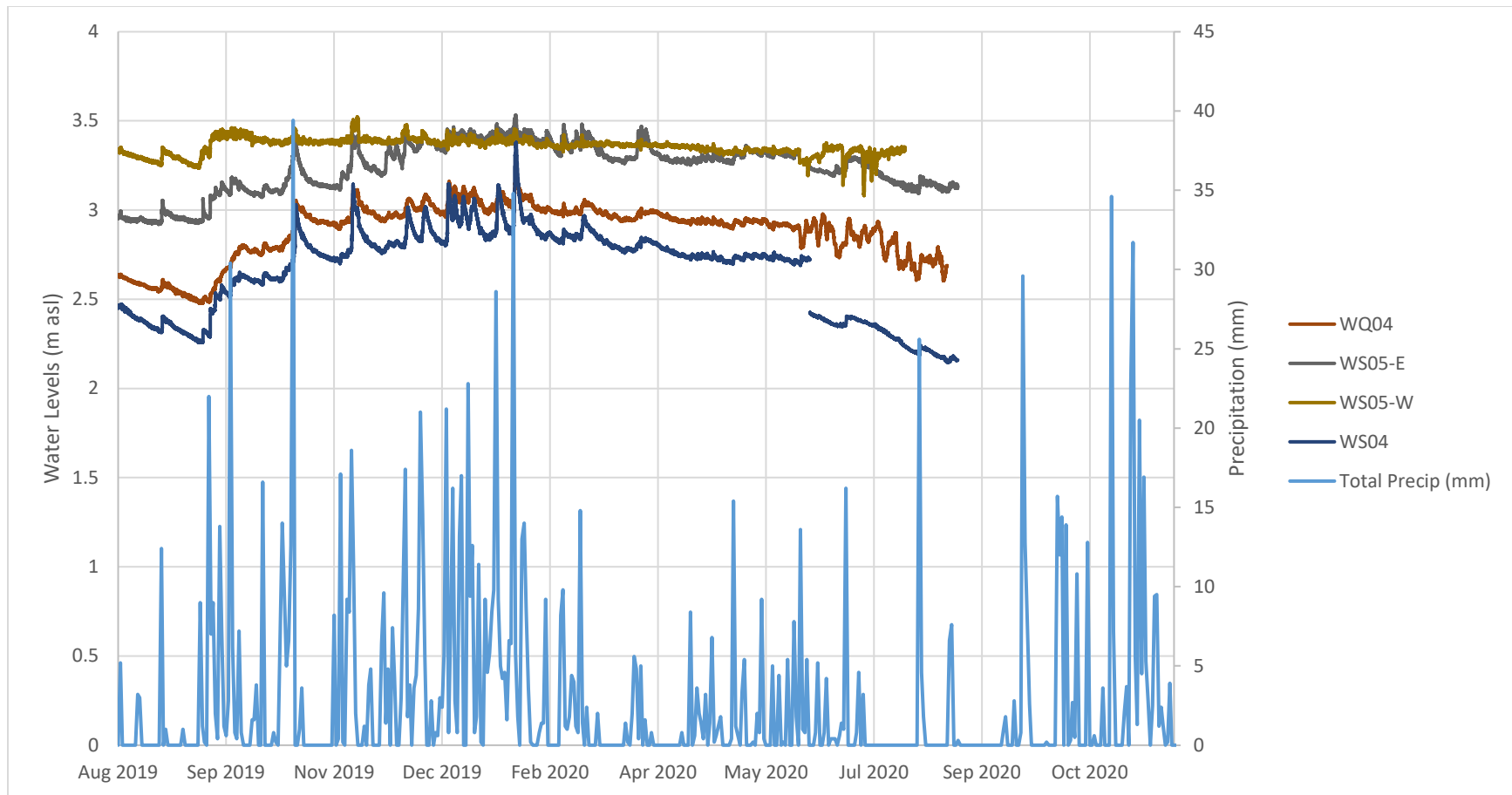


Figure M Surface Water Elevations (m asl) and Precipitation for Group B

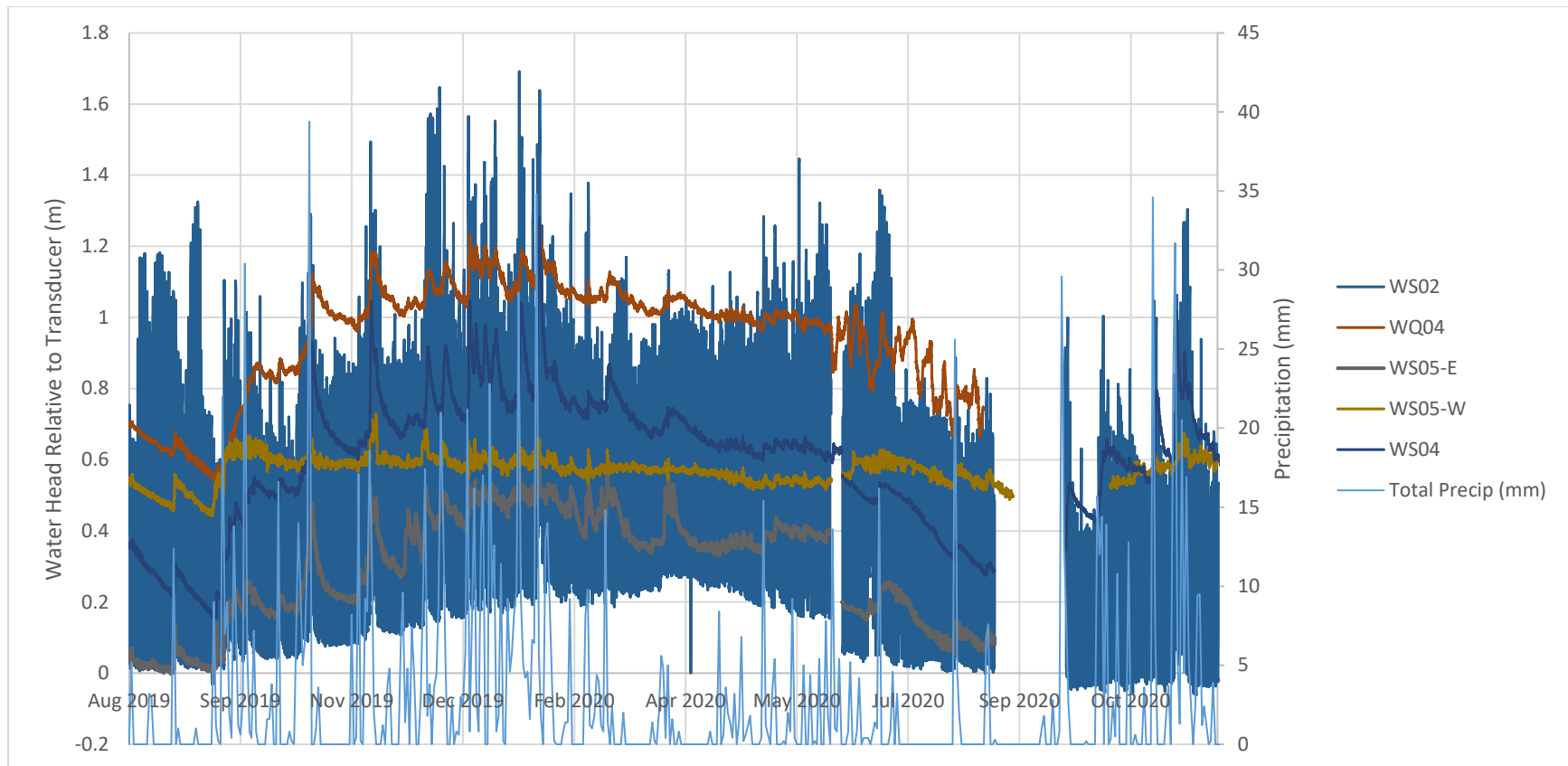


Figure N Water Head Relative to Transducer (m) and Precipitation for Group B

4.3 Bog Water Type

In September 2018, a bog water type survey was conducted using pH and total calcium concentrations based on the classifications outlined below. These data were used to delineate the spatial distribution of bog water (Type I), transitional water in the lagg zone (Type II) and mineralized water (Type III).

Three designated water types were used by Hatfield 2019 based on descriptions from Balfour and Banack, 2000. The three water types to describe the water chemistry in and around Burns Bog were based on observed calcium concentrations and pH values as follows:

- Type I (bog water): with pH values from 3.5 – 5.5 and calcium concentrations ranging from 0 – 3 mg/L.
- Type II (transitional water): with pH values from 4.5 – 6.0 and calcium concentrations ranging between 3 – 10 mg/L.
- Type III (non-bog water): with pH values from 5.0 – 8.0 and calcium concentrations > 10 mg/L.

Based on the 2018 survey, the general extent of the bog water types was identified as follows:

- Type III mineralized water was identified in the drainage network adjacent to the highways and interchanges, extending northward between Highway 91/C and the Fraser River.
- Type II transitional water was variable:
 - To the south of Highway 17 (SFPR), the transitional zone was narrow, approximately 15 m wide.
 - To south of the Highway 91 connector and the Highway 91/Nordel Interchange, the width of the lagg zone was 100 to 400 m.
 - To the west of the 91/72nd Avenue Interchange, the lagg zone narrowed (approximately 50 m wide).
 - To the east of Highway 91, the lagg zone covered most of the DNR area.
- Type I bog water was identified to the west of the lagg zone.

Field and analytical data from the September/October and December 2020 sampling events were used to classify each location into the three categories. The extent of the different types of water is shown on **Figure 2** for these two events. The coloured half circles surrounding each location represent each sampling event, so that seasonal variation of water type, if present, can be investigated.

Table H presents the bog water type by location for each sampling event conducted since October 2018. Note that bog water characteristics were not monitored or sampled by Hatfield in 2020.

Table H Bog Water Type

Location	October 2018	January 2019	April 2019	July 2019	Sept./Oct. 2020	December 2020
	Hatfield Baseline				Hemmera	
GW04	I	I	I	I	-	I
GW18-01	III	II	II	II	II	III
GW18-02	III	II	II	II	I	II
GW18-03	II	II	II	II	II	II
GW18-04	II	II	I	I	II	II
GW18-05	III	II	II	II	-	II
GW18-06	II	I	II	II	II	II
GW18-07	II	II	III	II	III	II
MW01	II	II	II	II	II	II
MW03	III	II	III	III	III	III
MW05	I	I	I	I	III	I
MW06-Q2	I	I	I	I	I	I
MW06-Q3S	I	I	I	I	I	I
MW08-Q4(1)	I	I	I	I	I	I
MW08-Q4(2)	I	I	I	I	I	I
MW08-Q4(3)	III	III	III	III	III	III
DNR01	III	III	III	III	II	III
DNR02	I	I	I	II	II	II
WQ01	II	I	I	II	II	I
WQ02	I	I	I	I	I	I
WQ03	II	I	I	I	II	II
WQ04	III	II	II	III	II	II
WS03	II	I	I	II	II	I
WS04	III	II	II	III	II	II
WS05-E	-	III	-	-	III	III
WS05-W	III	-	-	-	II	III

The bog water types observed in fall 2018 were consistent with fall 2020, with the following exceptions:

- Decreased mineralization¹ at GW18-01, GW18-02, DNR01, WQ04, WS04 and WS05-W.
- Increased mineralization² at GW18-07, MW05 and DNR02.

¹ Decreased mineralization = Bog Water changed from Type III to II, Type III to I or Type II to I.

² Increased mineralization = Bog Water changed from Type I to II, Type I to III or Type II to III.

The bog water types observed in winter 2018 were consistent with winter 2020, with the following exceptions:

- Increased mineralization at GW18-01, GW18-06, MW03, DNR02 and WQ03.

During the comparison of the fall and winter 2020 events, some short-term increases in mineralization were observed in locations GW18-01, GW18-02, DNR01 and WS05-W, while short-term decreases in mineralization were observed in locations MW05, WQ01 and WS03.

Overall, no temporal trends in mineralization (i.e., increasing or decreasing) were identified over the course of the six sampling events available, and short-term increases in mineralization observed in the 2020 sampling events do not seem to be indicative of a longer-term trend. The general spatial extent of bog water types in 2020 was consistent with the 2018 survey.

4.4 Water Quality

Certificates of Analysis (CoAs) from BV are provided in **Appendix C**. The CoAs from the work performed by Hatfield are included in the 2019 Baseline report (Hatfield, 2019). The groundwater and surface water quality results are provided in the following sections.

4.4.1 Groundwater Quality

In the 2019 baseline water quality report, groundwater analytical results were compared to the BC CSR freshwater aquatic life (AWf) standards. Due to the transition between baseline monitoring and annual monitoring, the 2020 Q1 (January) sampling event for groundwater, which was to include extensive analysis of groundwater was not completed in 2020. The groundwater samples analyzed in 2020 were only analyzed for specific conductivity, pH and calcium. These parameters do not have standards under the BC CSR AWf. **Table 1** (following the text) shows the groundwater analytical data including the data from the baseline monitoring report.

4.4.2 Surface Water Quality

Surface water quality analytical results were compared to the BC WQG freshwater guidelines as shown in **Table 2**. WS01 and WS02 were analyzed for the full suite of parameters in September 2019 and April 2020. The samples collected by Hemmera in September/October 2020 and December 2020 were analyzed for specific conductivity, pH and calcium. There are no guidelines for these parameters.

As discussed in the Bridging Period monitoring report (Hatfield, 2020), the following exceedances of the BC WQG AWf were noted:

- Dissolved aluminium at WS01 in April 2020
- Dissolved iron at WS01 in September 2019 and April 2020
- Total iron at both WS01 and WS02 in September 2019 and April 2020
- Total manganese at WS02 in September 2019
- Total zinc at WS01 and WS02 in September 2019

Despite exceeding the applicable guidelines, the concentrations were consistent with exceedances identified by Hatfield (2019) in the baseline monitoring program at both upstream and downstream locations.

In addition to re-screening the analytical data to confirm exceedances, the Biotic Ligand Model (BLM) (BC ENV, 2019) was completed to calculate the appropriate guidelines for copper. The BLM uses temperature, pH, hardness and dissolved organic carbon (DOC) to calculate an appropriate guideline for copper for each sample. The following exceedances of the calculated guidelines for dissolved copper were noted:

- WS01 and its duplicate sample in April 2020, with concentrations of 2.34 and 3.08 µg/L respectively. The guideline calculated for both samples was 0.2 µg/L.

The BLM was not used to calculate guidelines for copper for samples from the baseline monitoring period due to a lack of temperature data which is a required input for the model. Copper concentrations between baseline samples and bridging period samples (WS01 and WS02) were similar.

4.5 Quality Assurance and Quality Control

The relative percent differences were calculated between the duplicates and the parent samples (**Table 3**). Data quality objectives, as outlined in **Section 3.4**, were met with the following exceptions:

- Calcium for the DNR02 duplicate collected on December 12th, 2020, with an RPD value of 26.02%
- Copper for WS02 duplicate collected on September 13th, 2019, with an RPD value of 24.48%
- Chemical Oxygen Demand for WS01 duplicate collected on April 11th, 2020, with an RPD value of 97.21%

The difference in calcium concentration between the parent sample and duplicate at DNR02 did not impact analysis of the bog water type. Both the parent and duplicate samples for WS02 exceed the BCWQG FW for copper. The difference between the parent and duplicate sample for chemical oxygen demand for WS01 may be impacted by difference in turbidity between the samples, or as a result of stirring up sediment and organic matter during the sampling process. While there are no guidelines for chemical oxygen demand, the difference, however, may indicate an issue with sampling protocol/techniques or lab analysis. Despite the RPD values for these three duplicate parameters being greater than the data quality objectives, they do not effect the validity of the samples or the ability to compare the data to guidelines, therefore the data from the samples collected is considered to be valid.

5.0 SUMMARY AND CONCLUSIONS

Groundwater and surface monitoring was completed during four field events (September 2019, April 2020, September/October 2020, and December 2020). During these events, samples were collected, and water level data was downloaded from Leveloggers deployed in the field for continuous measurements.

Water quality samples were collected for WS01 and WS02 and were compared to the BC WQG AWF guidelines and exceedances of dissolved aluminum, total and dissolved iron, dissolved copper, total manganese, and total zinc were identified. The constituents that exceed water quality guidelines are common in the area and, were previously identified in upstream and downstream locations by Hatfield (2019).

Bog water types were classified in 2020 and compared to the existing data. The results indicate that:

- A short-term increase (over the fall to winter 2020 events) in mineralization was observed in locations GW18-01, GW18-02, DNR01 and WS05-W.
- A short-term decrease (over the fall to winter 2020 events) in mineralization was observed in locations MW05, WQ01 and WS03.
- The bog water types in fall 2018 were generally consistent with fall 2020.
- The bog water types in winter 2018 were generally consistent with winter 2020.
- The general spatial extent of bog water types in 2020 was consistent with the 2018 survey.

Considered in the context of previously collected monitoring data, short-term trends in increases in mineralization at some sites during the 2020 sampling events, are not thought to reflect a long-term temporal trend of increasing mineralization. Rather, such temporary increases, which have been observed during previous sampling events and appear to occur on an annual basis during winter months, appear to be reflective of rainy periods. Where similar changes were noted in previous data, the increases were temporary and water chemistry reverted back to the conditions seen previously later in the calendar year. This dynamic has been noted in areas with Type II water, which has the potential to change between Type I, Type II and Type III water, as water levels within and around the bog fluctuate due to seasons patterns of precipitation.

6.0 RECOMMENDATIONS

Based on the Hatfield 2019 baseline water quality report, the recommended future monitoring plans are outlined in **Table I** and **Table J**. By following these recommended sampling plans, including the installation of continuous monitoring equipment, small impacts over time due to the Project could be detected. Locations that do not currently have continuous monitoring equipment are marked in bold.

The following is recommended for the 2021 sampling program, and is currently underway:

- Sampling and monitoring should continue to be conducted quarterly, and analysis should be completed based on the sampling analytical schedule outlined in **Sections 3.2.2.1** and **3.2.2.2**.
- Levellogger data should be downloaded during each quarterly sampling event.
- Field parameters including pH, DO (mg/L), specific conductivity, temperature, oxidation reduction potential (ORP) and turbidity should be collected at each location.
- The depth to water and depth to bottom should be measured at each monitoring well.
- Levelloggers should be set to record data every 60 minutes (on the hour). The Barologger should be set to record data every 60 minutes (on the hour) to be in sync with the Levelloggers.
- Aircraft wire used for installation of Levelloggers should be replaced at all locations and all cable lengths remeasured.

In addition to the programs which are already underway, the following is also recommended:

- Missing Levelloggers and Sondes should be replaced.
- The lifetime of the batteries in the Sondes should be monitored.
- Groundwater stations GW18-04 and GW18-07 along with surface water stations WS01, WS02 and WS05-W should be re-surveyed for elevation.

Table I Groundwater Sampling/Monitoring Plan

Well ID	Location		Sampling Planned	Levellogger Expected
	Easting	Northing		
MW06-Q2	502975	5443744	Y	Y
MW06-Q3S	502976	5443447	Y	Y
MW08-Q4(1)	502988	5443884	Y	Y
MW08-Q4(2)	502988	5443884	N	N
MW08-Q4(3)	502987	5443882	Y	Y
MW01	505458	5442528	Y	Y
MW03	505295	5442451	Y	Y
MW05	505026	5442378	Y	Y
GW04	503481	5443533	Y	Y
GW18-01	503750	5443756	Y	Y
GW18-02	503624	5443641	Y	Y

Well ID	Location		Sampling Planned	Levellogger Expected
	Easting	Northing		
GW18-03	504369	5443395	Y	Y
GW18-04	504182	5443272	Y	Y
GW18-05	503941	5443133	Y	Y
GW18-06	504864	5443303	Y	Y
GW18-07	504913	5443838	Y	Y

Table J Surface Water Sampling/Monitoring Plan

Station ID	Location		Sampling Planned	Levellogger	Water Quality Sonde
	Easting	Northing			
WQ01	503123	5443856	Y	Y	Y
WQ02	503123	5443768	Y	Y	Y
WQ03	503858	5443787	Y	Y	Y
WQ04	504723	5443105	Y	Y	Y
WS01	503128	5444446	Y	Y	N
WS02	503718	5444431	Y	Y	N
WS03	503856	5443556	-	Y	N
WS04	504842	5443013	Y	Y	N
WS05-E	505207	5442448	Y	Y	N
WS05-W	505136	5442409	Y	Y	N
DNR01	504885	5443902	Y	-	-
DNR02	504775	5443185	Y	-	-

7.0 STATEMENT OF LIMITATIONS

This Work was performed in accordance with Contract 089-CS-0001 between Hemmera Envirochem Inc. (Hemmera), a wholly owned subsidiary of Ausenco Engineering Canada Inc. (Ausenco), and Ministry of Transportation and Infrastructure (Client), dated July 6, 2020, amended on November 2, 2020 (Contract). This Report has been prepared by Hemmera, based on fieldwork conducted by Hemmera, for sole benefit and use by Ministry of Transportation and Infrastructure. In performing this Work, Hemmera has relied in good faith on information provided by others, and has assumed that the information provided by those individuals is both complete and accurate. This Work was performed to current industry standard practice for similar environmental work, within the relevant jurisdiction and same locale. The findings presented herein should be considered within the context of the scope of work and project terms of reference; further, the findings are time sensitive and are considered valid only at the time the Report was produced. The conclusions and recommendations contained in this Report are based upon the applicable guidelines, regulations, and legislation existing at the time the Report was produced; any changes in the regulatory regime may alter the conclusions and/or recommendations.

8.0 CLOSURE

We sincerely appreciate the opportunity to have assisted you with this project and if there are any questions, please do not hesitate to contact the undersigned by phone at 604.669.0424.

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TABLES

Table 1	Groundwater Analytical Results
Table 2	Surface Water Analytical Results
Table 3	Relative Percent Difference (RPD) Calculations

Table 1 Groundwater Analytical Results

			Location	GW04		GW18-01			GW18-02			GW18-03				GW18-04			GW18-05		GW18-06		
			Sample ID	GW04	GW04	GW18-01	GW18-01	GW1801	GW18-02	GW1802	GW18-02	GW18-03	GW18-03	GW18-03	GW18-03	GW18-04	GW18-04	GW1804	GW18-05	GW 18 05	GW18-06	GW18-06	GW18 06
			Sample Date	14/01/2019	03/12/2020	18/01/2019	01/10/2020	03/12/2020	18/01/2019	03/12/2020	01/10/2020	15/01/2019	22/09/2020	01/10/2020	08/12/2020	15/01/2019	22/09/2020	09/12/2020	15/01/2019	04/12/2020	21/01/2019	14/10/2020	02/12/2020
			BCCSR 3.2 - AWf																				
Parameter	Units	EQL																					
Field																							
DO (Field)	mg/L			-	-	-	4.94	9.8	-	-	0.51	-	4.9	0.02	3.11	-	1.05	2.41	-	2.2	-	2.91	-
Field ORP (mV)	mV			-	171.4	-	105	-20.2	-	74	116.5	-	164.2	145.5	103.6	-	158.3	27.3	-	27.3	-	127.9	60.1
Field																							
pH (Field)	pH Units			5.56	4.47	5.8	6.22	6.77	6.17	5.89	5.67	6.17	5.38	5.56	5.42	6.41	5.56	5.27	6.58	5.75	6.22	5.54	6.2
EC (field)	µS/cm			32	54	150	294.5	353.3	126	123.6	110.5	154	148.5	77.9	123.1	113	183.3	58.7	167	58.7	94	68.5	99
Temp (Field)	°C			-	5.3	-	13.6	7.2	-	8.9	15.5	-	12.1	14.7	7.4	-	9.8	7.9	-	8.1	-	17.8	8.3
Field																							
Turbidity	NTU			-	130	748	592	-	-	-	95.6	-	203	242	-	-	43.8	169	-	185	-	96.6	-
Inorganics																							
Alkalinity (total as CaCO3)	mg/L		Varies - see Notes	<1	-	15.8	-	-	26	-	-	20.5	-	-	-	11.4	-	-	26.7	-	3.6	-	-
Ammonia (as N)	mg/L			0.247	-	0.144	-	-	2.97	-	-	0.188	-	-	-	2.53	-	-	4.76	-	1.37	-	-
Bromide	mg/L		1500	<0.05	-	<0.05	-	-	<0.05	-	-	<0.05	-	-	-	<0.05	-	-	<0.05	-	<0.05	-	-
Chloride	mg/L			3.7	-	8.2	-	-	4	-	-	2	-	-	-	12.8	-	-	8.2	-	5.7	-	-
Electrical Conductivity (lab)	µS/cm	2	Varies - see Notes	51.5	42	64.9	79	110	68.6	77	51	90.3	110	35	110	87.7	110	61	79	70	43.1	66	58
Fluoride	mg/L			<0.02	-	0.09	-	-	<0.02	-	-	0.07	-	-	-	<0.02	-	-	0.05	-	0.03	-	-
Hardness as CaCO3	mg/L	1	400	5.9	11.2	24.4	-	116	13.2	19.2	-	29.4	-	-	-	14.4	-	-	22.3	-	13.1	-	21.6
Nitrate (as N)	mg/L			<0.005	-	0.012	-	-	0.012	-	-	0.008	-	-	-	0.013	-	-	0.012	-	0.009	-	-
Nitrite (as N)	mg/L		Varies - see Notes	<0.001	-	<0.001	-	-	<0.001	-	-	<0.001	-	-	-	<0.001	-	-	<0.001	-	0.002	-	-
Ortho Phosphate (Filtered)	µg/L			4	-	239	-	-	6	-	-	158	-	-	-	33	-	-	158	-	23	-	-
pH (Lab)	pH Units			4.12	5.14	6.37	6.53	6.24	6.76	6.06	5.82	5.84	6.18	5.22	6.11	5.64	5.72	5.54	6.48	5.79	5.6	4.77	5.49
Phosphorus	µg/L			80	-	760	-	-	90	-	-	250	-	-	-	110	-	-	630	-	120	-	-
Phosphorus (Filtered)	µg/L			10	-	364	-	-	18	-	-	212	-	-	-	78	-	-	243	-	128	-	-
Sulfate as SO4 - turbidimetric	µg/L			<300	-	<300	-	-	<300	-	-	<300	-	-	-	<300	-	-	<300	-	320	-	-
Total Dissolved Solids	mg/L			103	-	259	-	-	169	-	-	218	-	-	-	150	-	-	146	-	142	-	-
Total Kjeldahl Nitrogen	µg/L			3180	-	3300	-	-	3980	-	-	3510	-	-	-	4250	-	-	7240	-	3120	-	-
Organics																							
Total Organic Carbon	µg/L			79,200	-	101,000	-	-	32,300	-	-	65,800	-	-	-	58,600	-	-	100,000	-	59,800	-	-
Metals																							
Aluminium	µg/L			468	-	5590	-	-	355	-	-	1090	-	-	-	1180	-	-	4630	-	1320	-	-
Aluminium (Filtered)	µg/L			202	-	873	-	-	182	-	-	748	-	-	-	874	-	-	431	-	2930	-	-
Antimony	µg/L		90	0.2	-	0.4	-	-	0.1	-	-	0.4	-	-	-	0.2	-	-	0.3	-	0.1	-	-
Antimony (Filtered)	µg/L			0.1	-	0.2	-	-	<0.1	-	-	0.3	-	-	-	0.1	-	-	<0.1	-	0.2	-	-
Arsenic	µg/L		50	1	-	2.7	-	-	0.6	-	-	4.7	-	-	-	1.8	-	-	2.3	-	2.1	-	-
Arsenic (Filtered)	µg/L			0.8	-	1.3	-	-	0.4	-	-	4	-	-	-	1.4	-	-	0.8	-	1.9	-	-
Barium	µg/L		10000	4.7	-	59.1	-	-	17.7	-	-	25.1	-	-	-	19.5	-	-	51.5	-	17.5	-	-
Barium (Filtered)	µg/L			3.7	-	19.1	-	-	16	-	-	23.4	-	-	-	18.2	-	-	16.3	-	44.1	-	-
Beryllium	µg/L		1.5	<0.1	-	0.2	-	-	<0.1	-	-	<0.1	-	-	-	<0.1	-	-	<0.1	-	<0.1	-	-
Beryllium (Filtered)	µg/L			<0.1	-	<0.1	-	-	<0.1	-	-	<0.1	-	-	-	<0.1	-	-	<0.1	-	<0.1	-	-
Bismuth	µg/L			<0.05	-	0.07	-	-	<0.05	-	-	0.08	-	-	-	<0.05	-	-	0.05	-	<0.05	-	-
Bismuth (Filtered)	µg/L			<0.05	-	<0.05	-	-	<0.05	-	-	0.05	-	-	-	<0.05	-	-	<0.05	-	<0.05	-	-
Boron	µg/L		12000	<10	-	<10	-	-	<10	-	-	<10	-	-	-	<10	-	-	<10	-	<10	-	-
Boron (Filtered)	µg/L			<10	-	<10	-	-	<10	-	-	<10	-	-	-	<10	-	-	<10	-	<10	-	-
Cadmium	µg/L		Varies - see Notes	0.013	-	0.068	-	-	0.027	-	-	0.068	-	-	-	0.031	-	-	0.084	-	0.015	-	-
Cadmium (Filtered)	µg/L		Varies - see Notes	<0.005	-	0.019	-	-	<0.005	-	-	0.038	-	-	-	0.023	-	-	<0.005	-	0.044	-	-
Calcium	mg/L	0		1.44	2.39	6.53	7.72	15.9	3.21	3.96	2.46	4.28	4.45	2.14	5.22	3.07	3.51	3.33	5.75	3.27	2.3	2.9	3.86
Calcium (Filtered)	mg/L			1.17	-	5.5	-	-	2.89	-	-	4.57	-	-	-	2.76	-	-	5.33	-	2.83	-	-
Cesium	µg/L			0.03	-	0.33	-	-	0.01	-	-	0.03	-	-	-	0.03	-	-	0.26	-	0.06	-	-
Cesium (Filtered)	µg/L			<0.01	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	0.01	-	-	<0.01	-	0.14	-	-
Chromium	µg/L		10	1.2	-	13.8	-	-	2.2	-	-	5.1	-	-	-	2.7	-	-	10.7	-	3.4	-	-
Chromium (Filtered)	µg/L			10	0.6	-	3.9	-	-	1	-	-	3.9	-	-	-	1.5	-	-	1.7	-	6.4	-
Cobalt	µg/L		40	0.2	-	4.6	-	-	1.7	-	-	2.2	-	-	-	1	-	-	2.8	-	1	-	-
Cobalt (Filtered)	µg/L			40	0.1	-	2.5	-	-	1.4	-	-	1.9	-	-	-	0.7	-	-	0.8	-	1.9	-
Copper	µg/L		Varies - see Notes	2.9	-	14.5	-	-	2	-	-	12.8	-	-	-	1.7	-	-	11.2	-	2.1	-	-
Copper (Filtered)	µg/L		Varies - see Notes	1.4	-	5.9	-	-	0.3	-	-	9.1	-	-	-	1.9	-	-	2.1	-	7.2	-	-
Cyanide	µg/L		50	<10	-	<10	-	-	<10	-	-	<10	-	-	-	<10	-	-	<10	-	<10	-	-
Iron	mg/L				1.92	-	47.1	-	-	50.3	-	-	8.99	-	-	-	9.57	-	-	35.8	-	7.92	-
Iron (Filtered)	mg/L			3.31	-	31.9	-	-	41.8	-	-	9.76	-	-	-	8.06	-	-	23.1	-	12.2	-	-
Lead	µg/L			Varies - see Notes	1.94	-	2.75	-	-	0.21	-	-	5.01	-	-	-	0.24	-	-	2.6	-	0.68	-
Lead (Filtered)	µg/L		Varies - see Notes	0.89	-	0.55	-	-	<0.05	-	-	3.3	-	-	-	0.17	-	-	0.21	-	2.27	-	-

Table 1 Groundwater Analytical Results

			Location	GW18-07			MW01			MW03				MW-05		MW06-Q2		
			Sample ID	GW18-07	GW18-07	GW18 07	MW01	MW-01	MW01	MW03	MW-03	MW03	MW20-200	MW-05	MW05	MW06-Q2	MW06-Q2	MW06-Q2
			Sample Date	21/01/2019	14/10/2020	02/12/2020	17/01/2019	14/10/2020	08/12/2020	17/01/2019	02/10/2020	08/12/2020	08/12/2020	14/10/2020	02/12/2020	16/01/2019	02/10/2020	03/12/2020
			BCCSR 3.2 - AWF															
Parameter	Units	EQL																
Field																		
DO (Field)	mg/L			-	3.01	-	-	2.09	1.58	-	11.55	2.64	2.64	1.78	-	-	3.64	2.49
Field ORP (mV)	mV			-	148.3	67.1	-	124.1	70.4	-	126.7	83.2	83.2	120	92.5	-	80.5	210.5
Field																		
pH (Field)	pH Units			6.05	5.72	5.9	5.93	5.84	5.86	5.9	6.47	5.98	5.98	5.18	5.95	4.56	5.96	4.59
EC (field)	µS/cm			207	75.9	150.1	161	186	175.2	116	333	215.3	215.3	237.7	63.2	24	80.4	39.1
Temp (Field)	°C			-	13.3	8.9	-	12	9	-	15.7	6.9	6.9	12.7	9.7	-	14.2	7.3
Field																		
Turbidity	NTU			37.2	56.5	-	111	19	24.8	105	23.6	24.3	24.3	30.3	65	68.3	40	102
Inorganics																		
Alkalinity (total as CaCO3)	mg/L			43.5	-	-	57.7	-	-	24	-	-	-	-	-	<1	-	-
Ammonia (as N)	mg/L		Varies - see Notes	3.95	-	-	3.18	-	-	0.556	-	-	-	-	-	0.508	-	-
Bromide	mg/L			<0.05	-	-	0.17	-	-	<0.05	-	-	-	-	-	<0.05	-	-
Chloride	mg/L		1500	9.3	-	-	35.4	-	-	19.6	-	-	-	-	-	2.6	-	-
Electrical Conductivity (lab)	µS/cm	2		135	120	120	234	190	180	124	330	230	230	310	34	36.6	33	37
Fluoride	mg/L		Varies - see Notes	<0.02	-	-	0.03	-	-	0.03	-	-	-	-	-	<0.03	-	-
Hardness as CaCO3	mg/L	1		37	-	34.5	23.5	-	-	32.4	-	-	-	-	10	2.6	-	3.46
Nitrate (as N)	mg/L		400	<0.005	-	-	<0.005	-	-	0.006	-	-	-	-	-	<0.005	-	-
Nitrite (as N)	mg/L		Varies - see Notes	<0.001	-	-	<0.001	-	-	0.003	-	-	-	-	-	<0.001	-	-
Ortho Phosphate (Filtered)	µg/L			121	-	-	107	-	-	8	-	-	-	-	-	<1	-	-
pH (Lab)	pH Units			6.77	7.48	6.49	6.68	6.82	6.71	6.62	6.95	6.85	6.75	7.02	5.59	4.48	5.87	4.71
Phosphorus	µg/L			200	-	-	150	-	-	70	-	-	-	-	-	40	-	-
Phosphorus (Filtered)	µg/L			187	-	-	137	-	-	42	-	-	-	-	-	19	-	-
Sulfate as SO4 - turbidimetric	µg/L			<300	-	-	<300	-	-	3930	-	-	-	-	-	<300	-	-
Total Dissolved Solids	mg/L			217	-	-	232	-	-	163	-	-	-	-	-	72	-	-
Total Kjeldahl Nitrogen	µg/L			6870	-	-	4950	-	-	2370	-	-	-	-	-	2490	-	-
Organics																		
Total Organic Carbon	µg/L			106,000	-	-	55,800	-	-	40,100	-	-	-	-	-	42,100	-	-
Metals																		
Aluminium	µg/L			3540	-	-	635	-	-	877	-	-	-	-	-	306	-	-
Aluminium (Filtered)	µg/L			169	-	-	531	-	-	641	-	-	-	-	-	251	-	-
Antimony	µg/L		90	0.2	-	-	<0.1	-	-	0.1	-	-	-	-	-	<0.1	-	-
Antimony (Filtered)	µg/L		90	<0.1	-	-	<0.1	-	-	<0.1	-	-	-	-	-	<0.1	-	-
Arsenic	µg/L		50	1.3	-	-	0.9	-	-	1.6	-	-	-	-	-	0.9	-	-
Arsenic (Filtered)	µg/L		50	1	-	-	0.8	-	-	1.2	-	-	-	-	-	0.8	-	-
Barium	µg/L		10000	13.5	-	-	20.9	-	-	20.6	-	-	-	-	-	4	-	-
Barium (Filtered)	µg/L		10000	10	-	-	19	-	-	20	-	-	-	-	-	4.1	-	-
Beryllium	µg/L		1.5	<0.1	-	-	<0.1	-	-	<0.1	-	-	-	-	-	<0.1	-	-
Beryllium (Filtered)	µg/L		1.5	<0.1	-	-	<0.1	-	-	<0.1	-	-	-	-	-	<0.1	-	-
Bismuth	µg/L			<0.05	-	-	<0.05	-	-	<0.05	-	-	-	-	-	<0.05	-	-
Bismuth (Filtered)	µg/L			<0.05	-	-	<0.05	-	-	<0.05	-	-	-	-	-	<0.05	-	-
Boron	µg/L		12000	<10	-	-	30	-	-	<10	-	-	-	-	-	<10	-	-
Boron (Filtered)	µg/L		12000	<10	-	-	30	-	-	<10	-	-	-	-	-	<10	-	-
Cadmium	µg/L		Varies - see Notes	0.034	-	-	0.009	-	-	0.024	-	-	-	-	-	0.011	-	-
Cadmium (Filtered)	µg/L		Varies - see Notes	0.011	-	-	0.009	-	-	0.007	-	-	-	-	-	0.008	-	-
Calcium	mg/L	0		8.13	12.8	7.92	5.07	5.33	5.67	8.07	15.9	12.3	11.7	17.4	1.31	0.4	1.01	0.577
Calcium (Filtered)	mg/L			7.55	-	-	4.72	-	-	8.16	-	-	-	-	-	0.38	-	-
Cesium	µg/L			0.03	-	-	<0.01	-	-	<0.01	-	-	-	-	-	0.02	-	-
Cesium (Filtered)	µg/L			0.02	-	-	<0.01	-	-	<0.01	-	-	-	-	-	0.02	-	-
Chromium	µg/L		10	2.2	-	-	1.1	-	-	1.3	-	-	-	-	-	1.3	-	-
Chromium (Filtered)	µg/L		10	1.6	-	-	0.9	-	-	0.8	-	-	-	-	-	0.6	-	-
Cobalt	µg/L		40	0.4	-	-	0.7	-	-	0.9	-	-	-	-	-	0.2	-	-
Cobalt (Filtered)	µg/L		40	0.3	-	-	0.6	-	-	0.8	-	-	-	-	-	0.1	-	-
Copper	µg/L		Varies - see Notes	4	-	-	1.3	-	-	4	-	-	-	-	-	7.3	-	-
Copper (Filtered)	µg/L		Varies - see Notes	2.2	-	-	0.7	-	-	1.7	-	-	-	-	-	3.8	-	-
Cyanide	µg/L		50	<10	-	-	<10	-	-	<10	-	-	-	-	-	<10	-	-
Iron	mg/L			6.54	-	-	1.83	-	-	1.13	-	-	-	-	-	4.43	-	-
Iron (Filtered)	mg/L			5.52	-	-	1.5	-	-	0.98	-	-	-	-	-	3.44	-	-
Lead	µg/L		Varies - see Notes	1.73	-	-	0.28	-	-	0.85	-	-	-	-	-	0.47	-	-
Lead (Filtered)	µg/L		Varies - see Notes	0.48	-	-	0.13	-	-	0.34	-	-	-	-	-	0.31	-	-

Table 1 Groundwater Analytical Results

			Location	MW06-Q3S				MW08-Q4 (1)			MW08-Q4(2)			MW08-Q4(3)		
			Sample ID	MW05-Q3S	MW05-Q3S	MW06-Q3	MW06-Q3S	MW08-Q4 (1)	MW08-Q4(1)	MW08-Q4(1)	MW08-Q4(2)	MW08-Q4 (2)	MW08-Q4(2)	MW08-Q4(3)	MW08-Q4 (3)	MW20-100
			Sample Date	16/01/2019	18/01/2019	02/10/2020	03/12/2020	21/09/2020	16/01/2019	04/12/2020	16/01/2019	21/09/2020	04/12/2020	16/01/2019	21/09/2020	21/09/2020
			BCCSR 3.2 - AWF													
Parameter	Units	EQL														
Field																
DO (Field)	mg/L			-	-	4.7	-	4.59	-	-	-	3.01	5.8	-	1.31	1.31
Field ORP (mV)	mV			-	-	51	209.5	311.5	-	283.4	-	283.9	232.4	-	99	99
Field																
pH (Field)	pH Units			6.47	5.19	6.88	4.67	3.32	3.46	3.63	4.7	3.97	4.62	6.61	5.86	5.86
EC (field)	µS/cm			134	41	279.6	39.4	72.4	55	119.6	34	54.5	61.5	182	217	217
Temp (Field)	°C			-	-	16	8.6	15.9	-	9.8	-	14.4	10.5	-	12.9	12.9
Field																
Turbidity	NTU			303	39.7	12.9	104	216	112	24.8	233	40.4	14.8	20.8	-	54.3
Inorganics																
Alkalinity (total as CaCO3)	mg/L			6.2	3.5	-	-	-	<1	-	4.4	-	-	111	-	-
Ammonia (as N)	mg/L		Varies - see Notes	0.592	0.761	-	-	-	0.348	-	1.02	-	-	0.792	-	-
Bromide	mg/L			<0.05	<0.05	-	-	-	<0.05	-	<0.05	-	-	<0.05	-	-
Chloride	mg/L		1500	3.4	4.9	-	-	-	3.2	-	3.7	-	-	2.6	-	-
Electrical Conductivity (lab)	µS/cm	2		34.4	46.6	29	37	95	74.1	100	41.4	47	58	206	170	180
Fluoride	mg/L		Varies - see Notes	<0.03	0.02	-	-	-	0.03	-	0.05	-	-	0.08	-	-
Hardness as CaCO3	mg/L	1		4.6	9.4	-	6.64	-	2.7	-	6.3	-	-	88.4	-	-
Nitrate (as N)	mg/L		400	<0.005	0.009	-	-	-	<0.005	-	<0.005	-	-	<0.005	-	-
Nitrite (as N)	mg/L		Varies - see Notes	<0.001	<0.001	-	-	-	<0.001	-	<0.001	-	-	<0.001	-	-
Ortho Phosphate (Filtered)	µg/L			<1	3	-	-	-	14	-	42	-	-	74	-	-
pH (Lab)	pH Units			5.77	5.09	5.02	4.96	3.92	5.77	3.74	5.4	5.2	4.58	7.05	6.98	7.15
Phosphorus	µg/L			130	40	-	-	-	70	-	170	-	-	120	-	-
Phosphorus (Filtered)	µg/L			19	32	-	-	-	22	-	69	-	-	82	-	-
Sulfate as SO4 - turbidimetric	µg/L			<300	<300	-	-	-	<300	-	<300	-	-	<300	-	-
Total Dissolved Solids	mg/L			87	127	-	-	-	128	-	85	-	-	214	-	-
Total Kjeldahl Nitrogen	µg/L			3430	2160	-	-	-	2730	-	3940	-	-	1940	-	-
Organics																
Total Organic Carbon	µg/L			60,400	67,100	-	-	-	65,100	-	47,500	-	-	14,300	-	-
Metals																
Aluminium	µg/L			2950	201	-	-	-	389	-	1900	-	-	338	-	-
Aluminium (Filtered)	µg/L			429	177	-	-	-	238	-	785	-	-	14	-	-
Antimony	µg/L		90	2	0.2	-	-	-	0.3	-	0.1	-	-	<0.1	-	-
Antimony (Filtered)	µg/L		90	<0.1	<0.1	-	-	-	0.1	-	<0.1	-	-	<0.1	-	-
Arsenic	µg/L		50	1	1.4	-	-	-	1.7	-	0.7	-	-	0.9	-	-
Arsenic (Filtered)	µg/L		50	0.5	1.2	-	-	-	1.4	-	0.5	-	-	0.7	-	-
Barium	µg/L		10000	23	2.7	-	-	-	3.2	-	26.8	-	-	36.3	-	-
Barium (Filtered)	µg/L		10000	9.7	2.3	-	-	-	1.4	-	19.4	-	-	33.8	-	-
Beryllium	µg/L		1.5	<0.1	<0.1	-	-	-	<0.1	-	<0.1	-	-	<0.1	-	-
Beryllium (Filtered)	µg/L		1.5	<0.1	<0.1	-	-	-	<0.1	-	<0.1	-	-	<0.1	-	-
Bismuth	µg/L			<0.05	<0.05	-	-	-	<0.05	-	<0.05	-	-	<0.05	-	-
Bismuth (Filtered)	µg/L			<0.05	<0.05	-	-	-	<0.05	-	<0.05	-	-	<0.05	-	-
Boron	µg/L		12000	<10	<10	-	-	-	<10	-	<10	-	-	<10	-	-
Boron (Filtered)	µg/L		12000	<10	<10	-	-	-	<10	-	<10	-	-	<10	-	-
Cadmium	µg/L		Varies - see Notes	0.082	0.034	-	-	-	0.015	-	0.026	-	-	0.014	-	-
Cadmium (Filtered)	µg/L		Varies - see Notes	0.01	0.023	-	-	-	0.011	-	0.009	-	-	<0.005	-	-
Calcium	mg/L	0		1.19	1.23	0.515	1.24	1.51	0.64	1.1	1.47	1.52	1.7	19.4	15.9	15.5
Calcium (Filtered)	mg/L			0.89	1.27	-	-	-	0.53	-	1.35	-	-	20	-	-
Cesium	µg/L			0.22	0.02	-	-	-	0.03	-	0.1	-	-	0.03	-	-
Cesium (Filtered)	µg/L			0.02	0.02	-	-	-	0.02	-	0.01	-	-	<0.01	-	-
Chromium	µg/L		10	9	1.3	-	-	-	0.9	-	2.6	-	-	9.2	-	-
Chromium (Filtered)	µg/L		10	1.4	0.5	-	-	-	0.5	-	0.6	-	-	7	-	-
Cobalt	µg/L		40	1.4	0.4	-	-	-	0.2	-	0.8	-	-	0.3	-	-
Cobalt (Filtered)	µg/L		40	0.3	0.3	-	-	-	0.1	-	0.4	-	-	<0.1	-	-
Copper	µg/L		Varies - see Notes	12.4	2.1	-	-	-	3.4	-	2.3	-	-	1.6	-	-
Copper (Filtered)	µg/L		Varies - see Notes	1.5	1.5	-	-	-	2.5	-	1.3	-	-	0.3	-	-
Cyanide	µg/L		50	<10	<10	-	-	-	<10	-	<10	-	-	<10	-	-
Iron	mg/L			29.1	13.5	-	-	-	0.37	-	2.31	-	-	16	-	-
Iron (Filtered)	mg/L			9.23	10.8	-	-	-	0.022	-	1.36	-	-	14.6	-	-
Lead	µg/L		Varies - see Notes	1.46	0.42	-	-	-	2.9	-	1.19	-	-	0.25	-	-
Lead (Filtered)	µg/L		Varies - see Notes	0.14	0.36	-	-	-	1.68	-	0.041	-	-	<0.05	-	-

Table 1 Groundwater Analytical Results

			Location	GW04		GW18-01			GW18-02			GW18-03				GW18-04			GW18-05		GW18-06		
			Sample ID	GW04	GW04	GW18-01	GW18-01	GW1801	GW18-02	GW1802	GW18-02	GW18-03	GW18-03	GW18-03	GW18-03	GW18-04	GW18-04	GW1804	GW18-05	GW 18 05	GW18-06	GW18-06	GW18 06
			Sample Date	14/01/2019	03/12/2020	18/01/2019	01/10/2020	03/12/2020	18/01/2019	03/12/2020	01/10/2020	15/01/2019	22/09/2020	01/10/2020	08/12/2020	15/01/2019	22/09/2020	09/12/2020	15/01/2019	04/12/2020	21/01/2019	14/10/2020	02/12/2020
			BCCSR 3.2 - AWf																				
Parameter	Units	EQL																					
Lithium	µg/L			<1	-	4	-	-	<1	-	-	3	-	-	-	<1	-	-	3	-	1	-	-
Lithium (Filtered)	µg/L			<1	-	<1	-	-	<1	-	-	2	-	-	-	<1	-	-	<1	-	2	-	-
Magnesium	mg/L			0.813	-	4.03	-	-	1.58	-	-	4.81	-	-	-	2.11	-	-	3.69	-	0.986	-	-
Magnesium (Filtered)	mg/L			0.71	-	2.59	-	-	1.45	-	-	4.36	-	-	-	1.82	-	-	2.18	-	1.47	-	-
Manganese	µg/L			8.3	-	403	-	-	359	-	-	129	-	-	-	98	-	-	248	-	50.8	-	-
Manganese (Filtered)	µg/L			17.9	-	339	-	-	3450	-	-	140	-	-	-	90	-	-	187	-	85.1	-	-
Mercury	µg/L		0.25	0.1	-	0.05	-	-	0.05	-	-	0.025	-	-	-	0.025	-	-	0.25	-	0.25	-	-
Mercury (Filtered)	µg/L		0.25	<0.005	-	0.025	-	-	<0.005	-	-	0.025	-	-	-	<0.005	-	-	<0.005	-	0.05	-	-
Molybdenum	µg/L		10000	0.08	-	0.75	-	-	0.2	-	-	0.62	-	-	-	0.19	-	-	0.86	-	0.09	-	-
Molybdenum (Filtered)	µg/L		10000	<0.05	-	0.28	-	-	0.05	-	-	0.38	-	-	-	0.09	-	-	2.1	-	0.2	-	-
Nickel	µg/L		Varies - see Notes	0.7	-	17	-	-	4.9	-	-	7.1	-	-	-	3	-	-	8.8	-	2.4	-	-
Nickel (Filtered)	µg/L		Varies - see Notes	<0.5	-	8.5	-	-	4	-	-	5.8	-	-	-	2.2	-	-	1.8	-	4.9	-	-
Potassium	mg/L			<0.05	-	0.43	-	-	0.28	-	-	0.49	-	-	-	0.28	-	-	0.69	-	0.14	-	-
Potassium (Filtered)	mg/L			<0.05	-	<0.05	-	-	0.16	-	-	0.52	-	-	-	0.28	-	-	0.28	-	0.3	-	-
Rubidium	µg/L			<0.2	-	1.7	-	-	0.6	-	-	0.5	-	-	-	0.7	-	-	2.2	-	0.5	-	-
Rubidium (Filtered)	µg/L			<0.2	-	<0.2	-	-	0.5	-	-	0.4	-	-	-	0.6	-	-	0.6	-	1.2	-	-
Selenium	µg/L		20	0.12	-	0.31	-	-	<0.02	-	-	0.22	-	-	-	0.1	-	-	0.31	-	0.09	-	-
Selenium (Filtered)	µg/L		20	0.06	-	0.09	-	-	<0.05	-	-	0.15	-	-	-	0.1	-	-	<0.05	-	0.1	-	-
Silicon	µg/L			1000	-	22,100	-	-	10,900	-	-	13,900	-	-	-	5800	-	-	11,900	-	5600	-	-
Silicon (Filtered)	µg/L			810	-	15,000	-	-	10,000	-	-	13,100	-	-	-	5380	-	-	7810	-	7960	-	-
Silver	µg/L		Varies - see Notes	<0.01	-	0.06	-	-	<0.01	-	-	0.06	-	-	-	<0.01	-	-	0.05	-	0.02	-	-
Silver (Filtered)	µg/L		Varies - see Notes	<0.01	-	0.01	-	-	<0.01	-	-	0.03	-	-	-	<0.01	-	-	<0.01	-	0.02	-	-
Sodium	mg/L			1.86	-	6.01	-	-	3.65	-	-	9.83	-	-	-	8.44	-	-	5.05	-	3.99	-	-
Sodium (Filtered)	mg/L			1.73	-	4.75	-	-	2.85	-	-	10.2	-	-	-	8.15	-	-	4.59	-	4	-	-
Strontium	µg/L			9.8	-	54.3	-	-	32.3	-	-	37.1	-	-	-	28.8	-	-	49.3	-	20.6	-	-
Strontium (Filtered)	µg/L			9.1	-	40.1	-	-	27.9	-	-	35.9	-	-	-	25.1	-	-	36.5	-	26.6	-	-
Sulfur, elemental	µg/L			<500	-	1100	-	-	<500	-	-	700	-	-	-	<500	-	-	1300	-	<500	-	-
Sulfur, elemental (Filtered)	µg/L			<500	-	<500	-	-	<500	-	-	890	-	-	-	<500	-	-	<500	-	<500	-	-
Tellurium	µg/L			<0.2	-	<0.2	-	-	<0.2	-	-	<0.2	-	-	-	<0.2	-	-	<0.2	-	<0.2	-	-
Tellurium (Filtered)	µg/L			<0.2	-	<0.2	-	-	<0.2	-	-	<0.2	-	-	-	<0.2	-	-	<0.2	-	<0.2	-	-
Thallium	µg/L		3	<0.01	-	0.04	-	-	<0.01	-	-	<0.01	-	-	-	<0.01	-	-	0.02	-	0.01	-	-
Thallium (Filtered)	µg/L		3	<0.01	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	0.02	-	-
Thorium	µg/L			<0.1	-	0.4	-	-	<0.1	-	-	<0.1	-	-	-	0.1	-	-	0.3	-	<0.1	-	-
Thorium (Filtered)	µg/L			0.1	-	0.2	-	-	0.1	-	-	0.1	-	-	-	0.1	-	-	0.1	-	0.2	-	-
Tin	µg/L			0.2	-	0.6	-	-	0.3	-	-	0.3	-	-	-	0.2	-	-	2.7	-	0.2	-	-
Tin (Filtered)	µg/L			0.1	-	0.2	-	-	0.2	-	-	0.2	-	-	-	0.1	-	-	0.3	-	0.3	-	-
Titanium	µg/L		1000	17.7	-	195	-	-	15	-	-	38.7	-	-	-	20.1	-	-	141	-	45.7	-	-
Titanium (Filtered)	µg/L		1000	5.9	-	38.2	-	-	3.8	-	-	31.1	-	-	-	11.3	-	-	7.2	-	122	-	-
Tungsten	µg/L			<0.1	-	<0.1	-	-	<0.1	-	-	<0.1	-	-	-	<0.1	-	-	0.1	-	<0.1	-	-
Tungsten (Filtered)	µg/L			0.1	-	0.1	-	-	0.1	-	-	0.1	-	-	-	0.1	-	-	0.2	-	0.1	-	-
Uranium	µg/L		85	0.03	-	0.57	-	-	0.04	-	-	0.09	-	-	-	0.06	-	-	0.38	-	0.06	-	-
Uranium (Filtered)	µg/L		85	0.01	-	0.23	-	-	0.02	-	-	0.07	-	-	-	0.03	-	-	0.04	-	0.28	-	-
Vanadium	µg/L			1.4	-	16.2	-	-	1.3	-	-	4.1	-	-	-	2.4	-	-	10.8	-	3.6	-	-
Vanadium (Filtered)	µg/L			0.7	-	4	-	-	0.7	-	-	3.2	-	-	-	1.7	-	-	1.4	-	9.6	-	-
Zinc	µg/L		Varies - see Notes	86	-	2320	-	-	1530	-	-	230	-	-	-	650	-	-	2930	-	526	-	-
Zinc (Filtered)	µg/L		Varies - see Notes	179	-	1990	-	-	1450	-	-	190	-	-	-	468	-	-	1490	-	765	-	-
Zirconium	µg/L			0.23	-	1.25	-	-	0.18	-	-	0.25	-	-	-	0.13	-	-	0.38	-	0.29	-	-
Zirconium (Filtered)	µg/L			0.19	-	2.7	-	-	0.25	-	-	1.24	-	-	-	0.4	-	-	0.45	-	1.68	-	-
BTEX																							
Benzene	µg/L		400	<0.5	-	<0.5	-	-	<0.5	-	-	<0.5	-	-	-	<0.5	-	-	<0.5	-	<0.5	-	-
Ethylbenzene	µg/L		2000	<0.5	-	<0.5	-	-	<0.5	-	-	<0.5	-	-	-	<0.5	-	-	<0.5	-	<0.5	-	-
Styrene	µg/L		720	<0.5	-	<0.5	-	-	<0.5	-	-	<0.5	-	-	-	<0.5	-	-	<0.5	-	<0.5	-	-
Toluene	µg/L		5	<0.45	-	<0.45	-	-	<0.45	-	-	7.01	-	-	-	<0.45	-	-	1.11	-	<0.45	-	-
Xylene (m & p)	µg/L			<0.5	-	<0.5	-	-	<0.5	-	-	<0.5	-	-	-	<0.5	-	-	<0.5	-	<0.5	-	-
Xylene (o)	µg/L			<0.5	-	<0.5	-	-	<0.5	-	-	<0.5	-	-	-	<0.5	-	-	<0.5	-	<0.5	-	-
EPH																							
EPH C10-C19	µg/L		5000	<250	-	<250	-	-	<250	-	-	<250	-	-	-	<250	-	-	380	-	<250	-	-
EPH C19-C32	µg/L			<250	-	<250	-	-	<250	-	-	<250	-	-	-	<250	-	-	380	-	<250	-	-
LEPH	µg/L		500	<250	-	<250	-	-	<250	-	-	<250	-	-	-	<250	-	-	380	-	<250	-	-
HEPH	µg/L			<250	-	<250	-	-	<250	-	-	<250	-	-	-	<250	-	-	380	-	<250	-	-

Table 1 Groundwater Analytical Results

			Location	GW18-07			MW01			MW03				MW-05		MW06-Q2		
			Sample ID	GW18-07	GW18-07	GW18 07	MW01	MW-01	MW01	MW03	MW-03	MW03	MW20-200	MW-05	MW05	MW06-Q2	MW06-Q2	MW06-Q2
			Sample Date	21/01/2019	14/10/2020	02/12/2020	17/01/2019	14/10/2020	08/12/2020	17/01/2019	02/10/2020	08/12/2020	08/12/2020	14/10/2020	02/12/2020	16/01/2019	02/10/2020	03/12/2020
			BCCSR 3.2 - AWF															
Parameter	Units	EQL																
Lithium	µg/L			2	-	-	<1	-	-	<1	-	-	-	-	-	<1	-	-
Lithium (Filtered)	µg/L			2	-	-	<1	-	-	<1	-	-	-	-	-	<1	-	-
Magnesium	mg/L			4.49	-	-	3.13	-	-	3.03	-	-	-	-	-	0.454	-	-
Magnesium (Filtered)	mg/L			4.41	-	-	2.84	-	-	2.91	-	-	-	-	-	0.401	-	-
Manganese	µg/L			63.3	-	-	41.1	-	-	93.1	-	-	-	-	-	25.6	-	-
Manganese (Filtered)	µg/L			54.9	-	-	36.5	-	-	84	-	-	-	-	-	21	-	-
Mercury	µg/L		0.25	0.25	-	-	<0.005	-	-	0.011	-	-	-	-	-	0.05	-	-
Mercury (Filtered)	µg/L		0.25	0.05	-	-	0.05	-	-	0.009	-	-	-	-	-	0.006	-	-
Molybdenum	µg/L		10000	0.15	-	-	0.07	-	-	0.32	-	-	-	-	-	0.1	-	-
Molybdenum (Filtered)	µg/L		10000	0.06	-	-	<0.05	-	-	0.2	-	-	-	-	-	<0.05	-	-
Nickel	µg/L		Varies - see Notes	1.1	-	-	1.6	-	-	2.2	-	-	-	-	-	1.3	-	-
Nickel (Filtered)	µg/L		Varies - see Notes	0.7	-	-	1.3	-	-	1.8	-	-	-	-	-	0.7	-	-
Potassium	mg/L			1.48	-	-	1.53	-	-	0.91	-	-	-	-	-	0.08	-	-
Potassium (Filtered)	mg/L			1.55	-	-	1.48	-	-	0.85	-	-	-	-	-	0.13	-	-
Rubidium	µg/L			1.2	-	-	1.2	-	-	0.9	-	-	-	-	-	0.3	-	-
Rubidium (Filtered)	µg/L			1.3	-	-	1.4	-	-	0.8	-	-	-	-	-	0.3	-	-
Selenium	µg/L		20	0.15	-	-	0.12	-	-	0.18	-	-	-	-	-	0.07	-	-
Selenium (Filtered)	µg/L		20	0.09	-	-	0.12	-	-	0.23	-	-	-	-	-	<0.05	-	-
Silicon	µg/L			6200	-	-	8300	-	-	5100	-	-	-	-	-	1100	-	-
Silicon (Filtered)	µg/L			6590	-	-	8100	-	-	5250	-	-	-	-	-	1140	-	-
Silver	µg/L		Varies - see Notes	0.05	-	-	0.01	-	-	0.03	-	-	-	-	-	0.03	-	-
Silver (Filtered)	µg/L		Varies - see Notes	0.02	-	-	0.01	-	-	0.01	-	-	-	-	-	<0.01	-	-
Sodium	mg/L			16.1	-	-	39.9	-	-	15	-	-	-	-	-	1.34	-	-
Sodium (Filtered)	mg/L			16.7	-	-	37.3	-	-	15.1	-	-	-	-	-	1.42	-	-
Strontium	µg/L			60.3	-	-	48.1	-	-	59.4	-	-	-	-	-	4.7	-	-
Strontium (Filtered)	µg/L			62.2	-	-	43.2	-	-	64	-	-	-	-	-	4.5	-	-
Sulfur, elemental	µg/L			800	-	-	700	-	-	1300	-	-	-	-	-	<500	-	-
Sulfur, elemental (Filtered)	µg/L			760	-	-	640	-	-	2140	-	-	-	-	-	<500	-	-
Tellurium	µg/L			<0.2	-	-	<0.2	-	-	<0.2	-	-	-	-	-	<0.2	-	-
Tellurium (Filtered)	µg/L			<0.2	-	-	<0.2	-	-	<0.2	-	-	-	-	-	<0.2	-	-
Thallium	µg/L		3	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	-	-	<0.01	-	-
Thallium (Filtered)	µg/L		3	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	-	-	<0.01	-	-
Thorium	µg/L			<0.1	-	-	<0.1	-	-	<0.1	-	-	-	-	-	<0.1	-	-
Thorium (Filtered)	µg/L			0.1	-	-	0.1	-	-	0.1	-	-	-	-	-	0.1	-	-
Tin	µg/L			0.4	-	-	<0.1	-	-	<0.1	-	-	-	-	-	0.6	-	-
Tin (Filtered)	µg/L			0.1	-	-	0.1	-	-	0.1	-	-	-	-	-	0.2	-	-
Titanium	µg/L		1000	11	-	-	5.9	-	-	11.2	-	-	-	-	-	6.8	-	-
Titanium (Filtered)	µg/L		1000	6.3	-	-	3.7	-	-	7.6	-	-	-	-	-	3.8	-	-
Tungsten	µg/L			<0.1	-	-	<0.1	-	-	<0.1	-	-	-	-	-	<0.1	-	-
Tungsten (Filtered)	µg/L			0.1	-	-	0.1	-	-	0.1	-	-	-	-	-	0.1	-	-
Uranium	µg/L		85	0.02	-	-	0.02	-	-	0.03	-	-	-	-	-	<0.01	-	-
Uranium (Filtered)	µg/L		85	0.01	-	-	0.02	-	-	0.03	-	-	-	-	-	0.01	-	-
Vanadium	µg/L			1.1	-	-	1.1	-	-	2.4	-	-	-	-	-	0.7	-	-
Vanadium (Filtered)	µg/L			0.5	-	-	0.7	-	-	1.6	-	-	-	-	-	0.5	-	-
Zinc	µg/L		Varies - see Notes	330	-	-	4	-	-	23	-	-	-	-	-	403	-	-
Zinc (Filtered)	µg/L		Varies - see Notes	284	-	-	3	-	-	14	-	-	-	-	-	339	-	-
Zirconium	µg/L			0.15	-	-	0.02	-	-	0.36	-	-	-	-	-	<0.06	-	-
Zirconium (Filtered)	µg/L			0.16	-	-	0.44	-	-	0.6	-	-	-	-	-	0.14	-	-
BTEX																		
Benzene	µg/L		400	<0.5	-	-	<0.5	-	-	<0.5	-	-	-	-	-	<0.5	-	-
Ethylbenzene	µg/L		2000	<0.5	-	-	<0.5	-	-	<0.5	-	-	-	-	-	<0.5	-	-
Styrene	µg/L		720	<0.5	-	-	<0.5	-	-	<0.5	-	-	-	-	-	<0.5	-	-
Toluene	µg/L		5	<0.45	-	-	<0.45	-	-	<0.45	-	-	-	-	-	<0.45	-	-
Xylene (m & p)	µg/L			<0.5	-	-	<0.5	-	-	<0.5	-	-	-	-	-	<0.5	-	-
Xylene (o)	µg/L			<0.5	-	-	<0.5	-	-	<0.5	-	-	-	-	-	<0.5	-	-
EPH																		
EPH C10-C19	µg/L		5000	<250	-	-	<250	-	-	<250	-	-	-	-	-	<250	-	-
EPH C19-C32	µg/L			<250	-	-	<250	-	-	<250	-	-	-	-	-	<250	-	-
LEPH	µg/L		500	<250	-	-	<250	-	-	<250	-	-	-	-	-	<250	-	-
HEPH	µg/L			<250	-	-	<250	-	-	<250	-	-	-	-	-	<250	-	-

Table 1 Groundwater Analytical Results

			Location	MW06-Q3S				MW08-Q4 (1)			MW08-Q4(2)			MW08-Q4(3)		
			Sample ID	MW05-Q3S	MW05-Q3S	MW06-Q3	MW06-Q3S	MW08-Q4 (1)	MW08-Q4(1)	MW08-Q4(1)	MW08-Q4(2)	MW08-Q4 (2)	MW08-Q4(2)	MW08-Q4(3)	MW08-Q4 (3)	MW20-100
			Sample Date	16/01/2019	18/01/2019	02/10/2020	03/12/2020	21/09/2020	16/01/2019	04/12/2020	16/01/2019	21/09/2020	04/12/2020	16/01/2019	21/09/2020	21/09/2020
			BCCSR 3.2 - AWF													
Parameter	Units	EQL														
Lithium	µg/L			2	<1	-	-	-	<1	-	1	-	-	2	-	-
Lithium (Filtered)	µg/L			<1	<1	-	-	-	<1	-	<1	-	-	2	-	-
Magnesium	mg/L			1.29	1.57	-	-	-	0.428	-	1.07	-	-	9.13	-	-
Magnesium (Filtered)	mg/L			0.582	1.51	-	-	-	0.321	-	0.714	-	-	9.32	-	-
Manganese	µg/L			16.6	111	-	-	-	2.5	-	25.5	-	-	416	-	-
Manganese (Filtered)	µg/L			61	101	-	-	-	1.7	-	15.6	-	-	389	-	-
Mercury	µg/L		0.25	0.1	0.05	-	-	-	0.1	-	0.1	-	-	<0.005	-	-
Mercury (Filtered)	µg/L		0.25	<0.005	0.025	-	-	-	0.05	-	<0.005	-	-	<0.005	-	-
Molybdenum	µg/L		10000	0.4	0.08	-	-	-	0.07	-	0.1	-	-	0.08	-	-
Molybdenum (Filtered)	µg/L		10000	0.06	<0.05	-	-	-	<0.05	-	<0.05	-	-	<0.05	-	-
Nickel	µg/L		Varies - see Notes	5.2	1.4	-	-	-	0.7	-	3.7	-	-	1.4	-	-
Nickel (Filtered)	µg/L		Varies - see Notes	1.2	1.2	-	-	-	<0.5	-	1.8	-	-	<0.5	-	-
Potassium	mg/L			0.28	0.21	-	-	-	0.18	-	0.31	-	-	0.37	-	-
Potassium (Filtered)	mg/L			0.15	0.15	-	-	-	0.19	-	0.26	-	-	0.36	-	-
Rubidium	µg/L			1.8	0.3	-	-	-	0.4	-	1.1	-	-	1.1	-	-
Rubidium (Filtered)	µg/L			0.5	0.3	-	-	-	0.4	-	0.6	-	-	0.8	-	-
Selenium	µg/L		20	0.13	0.1	-	-	-	0.14	-	0.06	-	-	<0.05	-	-
Selenium (Filtered)	µg/L		20	<0.05	0.07	-	-	-	0.11	-	<0.05	-	-	<0.05	-	-
Silicon	µg/L			5200	1300	-	-	-	500	-	7100	-	-	28,300	-	-
Silicon (Filtered)	µg/L			2840	1230	-	-	-	480	-	6550	-	-	32,100	-	-
Silver	µg/L		Varies - see Notes	0.03	<0.01	-	-	-	0.04	-	0.04	-	-	<0.01	-	-
Silver (Filtered)	µg/L		Varies - see Notes	<0.01	<0.01	-	-	-	0.01	-	<0.01	-	-	<0.01	-	-
Sodium	mg/L			1.71	2.85	-	-	-	1.7	-	2.48	-	-	8.44	-	-
Sodium (Filtered)	mg/L			1.91	2.41	-	-	-	1.75	-	2.62	-	-	8.93	-	-
Strontium	µg/L			14.2	10.2	-	-	-	4.5	-	20.1	-	-	110	-	-
Strontium (Filtered)	µg/L			10.7	9.1	-	-	-	3.4	-	17.2	-	-	106	-	-
Sulfur, elemental	µg/L			<500	<500	-	-	-	<500	-	<500	-	-	<500	-	-
Sulfur, elemental (Filtered)	µg/L			<500	<500	-	-	-	<500	-	<500	-	-	<500	-	-
Tellurium	µg/L			<0.2	<0.2	-	-	-	<0.2	-	<0.2	-	-	<0.2	-	-
Tellurium (Filtered)	µg/L			<0.2	<0.2	-	-	-	<0.2	-	<0.2	-	-	<0.2	-	-
Thallium	µg/L		3	0.2	<0.01	-	-	-	<0.01	-	<0.01	-	-	<0.01	-	-
Thallium (Filtered)	µg/L		3	<0.01	<0.01	-	-	-	<0.01	-	<0.01	-	-	<0.01	-	-
Thorium	µg/L			0.2	<0.1	-	-	-	<0.1	-	<0.1	-	-	0.3	-	-
Thorium (Filtered)	µg/L			0.1	0.1	-	-	-	0.1	-	0.1	-	-	0.1	-	-
Tin	µg/L			0.7	0.2	-	-	-	0.1	-	0.5	-	-	<0.1	-	-
Tin (Filtered)	µg/L			0.2	0.1	-	-	-	0.1	-	0.2	-	-	0.1	-	-
Titanium	µg/L		1000	99.5	5.2	-	-	-	19.3	-	43.2	-	-	31.8	-	-
Titanium (Filtered)	µg/L		1000	7.2	3.2	-	-	-	10.9	-	10.2	-	-	7.4	-	-
Tungsten	µg/L			0.2	<0.1	-	-	-	<0.1	-	<0.1	-	-	<0.1	-	-
Tungsten (Filtered)	µg/L			0.1	0.1	-	-	-	0.1	-	0.1	-	-	0.1	-	-
Uranium	µg/L		85	0.17	<0.01	-	-	-	0.01	-	0.08	-	-	0.1	-	-
Uranium (Filtered)	µg/L		85	0.01	0.01	-	-	-	0.01	-	0.02	-	-	0.05	-	-
Vanadium	µg/L			6	<0.5	-	-	-	1.3	-	3.3	-	-	11.4	-	-
Vanadium (Filtered)	µg/L			0.7	0.5	-	-	-	0.7	-	1.1	-	-	8.2	-	-
Zinc	µg/L		Varies - see Notes	901	321	-	-	-	<3	-	18	-	-	<3	-	-
Zinc (Filtered)	µg/L		Varies - see Notes	331	300	-	-	-	3	-	18	-	-	1	-	-
Zirconium	µg/L			0.19	0.12	-	-	-	0.24	-	0.16	-	-	1.83	-	-
Zirconium (Filtered)	µg/L			0.15	0.11	-	-	-	0.28	-	0.35	-	-	1.62	-	-
BTEX																
Benzene	µg/L		400	<0.5	<0.5	-	-	-	<0.5	-	<0.5	-	-	<0.5	-	-
Ethylbenzene	µg/L		2000	<0.5	<0.5	-	-	-	<0.5	-	<0.5	-	-	<0.5	-	-
Styrene	µg/L		720	<0.5	<0.5	-	-	-	<0.5	-	<0.5	-	-	<0.5	-	-
Toluene	µg/L		5	<0.45	<0.45	-	-	-	<0.45	-	<0.45	-	-	<0.45	-	-
Xylene (m & p)	µg/L			<0.5	<0.5	-	-	-	<0.5	-	<0.5	-	-	<0.5	-	-
Xylene (o)	µg/L			<0.5	<0.5	-	-	-	<0.5	-	<0.5	-	-	<0.5	-	-
EPH																
EPH C10-C19	µg/L		5000	<250	<250	-	-	-	<250	-	<250	-	-	<250	-	-
EPH C19-C32	µg/L			<250	<250	-	-	-	<250	-	<250	-	-	<250	-	-
LEPH	µg/L		500	<250	<250	-	-	-	<250	-	<250	-	-	<250	-	-
HEPH	µg/L			<250	<250	-	-	-	<250	-	<250	-	-	<250	-	-

Table 1 Groundwater Analytical Results

			Location	GW04		GW18-01			GW18-02			GW18-03				GW18-04			GW18-05		GW18-06				
			Sample ID	GW04	GW04	GW18-01	GW18-01	GW1801	GW18-02	GW1802	GW18-02	GW18-03	GW18-03	GW18-03	GW18-03	GW18-04	GW18-04	GW1804	GW18-05	GW 18 05	GW18-06	GW18-06	GW18 06		
			Sample Date	14/01/2019	03/12/2020	18/01/2019	01/10/2020	03/12/2020	18/01/2019	03/12/2020	01/10/2020	15/01/2019	22/09/2020	01/10/2020	08/12/2020	15/01/2019	22/09/2020	09/12/2020	15/01/2019	04/12/2020	21/01/2019	14/10/2020	02/12/2020		
			BCCSR 3.2 - AWf																						
Parameter	Units	EQL																							
VOCs																									
Methyl tert-butyl ether [MTBE]	µg/L		34000	<0.5	-	<0.5	-	-	<0.5	-	-	<0.5	-	-	-	<0.5	-	-	<0.5	-	<0.5	-	-		
PAH																									
Acenaphthene	µg/L		60	<0.01	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	<0.01	-	-		
Acenaphthylene	µg/L			<0.01	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	<0.01	-	-		
Acridine	µg/L		0.5	<0.01	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	<0.01	-	-		
Anthracene	µg/L		1	<0.01	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	<0.01	-	-		
Benz(a)anthracene	µg/L		1	<0.01	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	<0.01	-	-		
Benzo(a)pyrene	µg/L		0.1	<0.005	-	<0.005	-	-	<0.005	-	-	<0.005	-	-	-	<0.005	-	-	<0.005	-	<0.005	-	-		
Benzo(b+j)fluoranthenes	µg/L			<0.01	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	<0.01	-	-		
Benzo(b+j+k)fluoranthene	µg/L			<0.015	-	<0.015	-	-	<0.015	-	-	<0.015	-	-	-	<0.015	-	-	<0.015	-	<0.015	-	-		
Benzo(g,h,i)perylene	µg/L			<0.01	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	<0.01	-	-		
Benzo(k)fluoranthene	µg/L			<0.01	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	<0.01	-	-		
Chrysene	µg/L		1	<0.01	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	<0.01	-	-		
Dibenz(a,h)anthracene	µg/L			<0.01	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	<0.01	-	-		
Fluoranthene	µg/L		2	<0.01	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	<0.01	-	-		
Fluorene	µg/L		120	<0.01	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	<0.01	-	-		
Indeno(1,2,3-cd)pyrene	µg/L			<0.01	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	<0.01	-	-		
Methylnaphthalene, 1-	µg/L			<0.05	-	<0.05	-	-	<0.05	-	-	<0.05	-	-	-	<0.05	-	-	<0.05	-	<0.05	-	-		
Methylnaphthalene, 2-	µg/L			<0.05	-	<0.05	-	-	<0.05	-	-	<0.05	-	-	-	<0.05	-	-	<0.05	-	<0.05	-	-		
Naphthalene	µg/L		10	<0.05	-	<0.05	-	-	<0.05	-	-	<0.05	-	-	-	<0.05	-	-	<0.05	-	<0.05	-	-		
Phenanthrene	µg/L		3	<0.02	-	<0.02	-	-	<0.02	-	-	<0.02	-	-	-	<0.02	-	-	<0.02	-	<0.02	-	-		
Pyrene	µg/L		0.2	<0.01	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	<0.01	-	-		
Quinoline	µg/L		34	<0.05	-	<0.05	-	-	<0.05	-	-	<0.05	-	-	-	<0.05	-	-	<0.05	-	<0.05	-	-		
Biota																									
Tannin & lignin	µg/L			14,300	-	13,200	-	-	12,700	-	-	18,100	-	-	-	14,700	-	-	22,100	-	13,600	-	-		

Table 1 Groundwater Analytical Results

			Location	GW18-07			MW01			MW03			MW-05		MW06-Q2		
			Sample ID	GW18-07	GW18-07	GW18 07	MW01	MW-01	MW01	MW03	MW-03	MW03	MW20-200	MW-05	MW05	MW06-Q2	MW06-Q2
			Sample Date	21/01/2019	14/10/2020	02/12/2020	17/01/2019	14/10/2020	08/12/2020	17/01/2019	02/10/2020	08/12/2020	08/12/2020	14/10/2020	02/12/2020	16/01/2019	02/10/2020
			BCCSR 3.2 - AWf														
Parameter	Units	EQL															
VOCs																	
Methyl tert-butyl ether [MTBE]	µg/L		34000	<0.5	-	-	<0.5	-	-	<0.5	-	-	-	-	-	<0.5	-
PAH																	
Acenaphthene	µg/L		60	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	-	-	<0.01	-
Acenaphthylene	µg/L			<0.01	-	-	<0.01	-	-	<0.01	-	-	-	-	-	<0.01	-
Acridine	µg/L		0.5	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	-	-	<0.01	-
Anthracene	µg/L		1	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	-	-	<0.01	-
Benz(a)anthracene	µg/L		1	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	-	-	<0.01	-
Benzo(a)pyrene	µg/L		0.1	<0.005	-	-	<0.005	-	-	<0.005	-	-	-	-	-	<0.005	-
Benzo(b+j)fluoranthenes	µg/L			<0.01	-	-	<0.01	-	-	<0.01	-	-	-	-	-	<0.01	-
Benzo(b+j+k)fluoranthene	µg/L			<0.015	-	-	<0.015	-	-	<0.015	-	-	-	-	-	<0.015	-
Benzo(g,h,i)perylene	µg/L			<0.01	-	-	<0.01	-	-	<0.01	-	-	-	-	-	<0.01	-
Benzo(k)fluoranthene	µg/L			<0.01	-	-	<0.01	-	-	<0.01	-	-	-	-	-	<0.01	-
Chrysene	µg/L		1	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	-	-	<0.01	-
Dibenz(a,h)anthracene	µg/L			<0.01	-	-	<0.01	-	-	<0.01	-	-	-	-	-	<0.01	-
Fluoranthene	µg/L		2	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	-	-	<0.01	-
Fluorene	µg/L		120	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	-	-	<0.01	-
Indeno(1,2,3-cd)pyrene	µg/L			<0.01	-	-	<0.01	-	-	<0.01	-	-	-	-	-	<0.01	-
Methylnaphthalene, 1-	µg/L			<0.05	-	-	<0.05	-	-	<0.05	-	-	-	-	-	<0.05	-
Methylnaphthalene, 2-	µg/L			<0.05	-	-	<0.05	-	-	<0.05	-	-	-	-	-	<0.05	-
Naphthalene	µg/L		10	<0.05	-	-	<0.05	-	-	<0.05	-	-	-	-	-	<0.05	-
Phenanthrene	µg/L		3	<0.02	-	-	<0.02	-	-	<0.02	-	-	-	-	-	<0.02	-
Pyrene	µg/L		0.2	<0.01	-	-	<0.01	-	-	<0.01	-	-	-	-	-	<0.01	-
Quinoline	µg/L		34	<0.05	-	-	<0.05	-	-	<0.05	-	-	-	-	-	<0.05	-
Biota																	
Tannin & lignin	µg/L			17,700	-	-	10,700	-	-	5600	-	-	-	-	-	16,800	-

Table 1 Groundwater Analytical Results

			Location	MW06-Q3S				MW08-Q4 (1)			MW08-Q4(2)			MW08-Q4(3)			
			Sample ID	MW05-Q3S	MW05-Q3S	MW06-Q3	MW06-Q3S	MW08-Q4 (1)	MW08-Q4(1)	MW08-Q4(1)	MW08-Q4(2)	MW08-Q4 (2)	MW08-Q4(2)	MW08-Q4(3)	MW08-Q4 (3)	MW20-100	MW08-Q4(3)
			Sample Date	16/01/2019	18/01/2019	02/10/2020	03/12/2020	21/09/2020	16/01/2019	04/12/2020	16/01/2019	21/09/2020	04/12/2020	16/01/2019	21/09/2020	21/09/2020	04/12/2020
			BCCSR 3.2 - AWf														
Parameter	Units	EQL															
VOCs																	
Methyl tert-butyl ether [MTBE]	µg/L		34000	<0.5	<0.5	-	-	-	<0.5	-	<0.5	-	-	<0.5	-	-	-
PAH																	
Acenaphthene	µg/L		60	<0.01	<0.01	-	-	-	<0.01	-	0.02	-	-	<0.01	-	-	-
Acenaphthylene	µg/L			<0.01	<0.01	-	-	-	<0.01	-	<0.01	-	-	<0.01	-	-	-
Acridine	µg/L		0.5	<0.01	<0.01	-	-	-	<0.01	-	<0.01	-	-	<0.01	-	-	-
Anthracene	µg/L		1	<0.01	<0.01	-	-	-	<0.01	-	<0.01	-	-	<0.01	-	-	-
Benz(a)anthracene	µg/L		1	<0.01	<0.01	-	-	-	<0.01	-	<0.01	-	-	<0.01	-	-	-
Benzo(a)pyrene	µg/L		0.1	<0.005	<0.005	-	-	-	<0.005	-	<0.005	-	-	<0.005	-	-	-
Benzo(b+j)fluoranthenes	µg/L			<0.01	<0.01	-	-	-	<0.01	-	<0.01	-	-	<0.01	-	-	-
Benzo(b+j+k)fluoranthene	µg/L			<0.015	<0.015	-	-	-	<0.015	-	<0.015	-	-	<0.015	-	-	-
Benzo(g,h,i)perylene	µg/L			<0.01	<0.01	-	-	-	<0.01	-	<0.01	-	-	<0.01	-	-	-
Benzo(k)fluoranthene	µg/L			<0.01	<0.01	-	-	-	<0.01	-	<0.01	-	-	<0.01	-	-	-
Chrysene	µg/L		1	<0.01	<0.01	-	-	-	<0.01	-	<0.01	-	-	<0.01	-	-	-
Dibenz(a,h)anthracene	µg/L			<0.01	<0.01	-	-	-	<0.01	-	<0.01	-	-	<0.01	-	-	-
Fluoranthene	µg/L		2	<0.01	<0.01	-	-	-	<0.01	-	<0.01	-	-	<0.01	-	-	-
Fluorene	µg/L		120	<0.01	<0.01	-	-	-	<0.01	-	<0.01	-	-	<0.01	-	-	-
Indeno(1,2,3-cd)pyrene	µg/L			<0.01	<0.01	-	-	-	<0.01	-	<0.01	-	-	<0.01	-	-	-
Methylnaphthalene, 1-	µg/L			<0.05	<0.05	-	-	-	<0.05	-	<0.05	-	-	<0.05	-	-	-
Methylnaphthalene, 2-	µg/L			<0.05	<0.05	-	-	-	<0.05	-	<0.05	-	-	<0.05	-	-	-
Naphthalene	µg/L		10	<0.05	<0.05	-	-	-	<0.05	-	<0.05	-	-	<0.05	-	-	-
Phenanthrene	µg/L		3	<0.02	<0.02	-	-	-	<0.02	-	<0.02	-	-	<0.02	-	-	-
Pyrene	µg/L		0.2	<0.01	<0.01	-	-	-	<0.01	-	<0.01	-	-	<0.01	-	-	-
Quinoline	µg/L		34	<0.05	<0.05	-	-	-	<0.05	-	<0.05	-	-	<0.05	-	-	-
Biota																	
Tannin & lignin	µg/L			2700	19,700	-	-	-	32,200	-	14,400	-	-	2800	-	-	-

Notes - Table 1

- (1) All values are reported as µg/L unless otherwise noted.
- (2) - = No standard or not analyzed.
- (3) BCCSR = BC *Environmental Management Act*, Contaminated Sites Regulation, B.C. Reg. 375/96 - includes amendments up to B.C. Reg. 13/2019, January 1, 2019.
- (4) BC CSR Freshwater Aquatic Life (AW_F) = Schedule 3.2 Generic Numerical Water Standards, Column 3, excluding superscript 6.
- (5) BC CSR Drinking Water (DW) = Schedule 3.2 Generic Numerical Water Standards, Column 6.

Table 2 Surface Water Analytical Results

			Location	DNR01				DNR02				WQ01			WQ02			WQ03			WQ04		
			Sample Date	21/01/2019	14/10/2020	02/12/2020	21/01/2019	23/09/2020	08/12/2020	08/12/2020	16/01/2019	21/09/2020	04/12/2020	17/01/2019	02/10/2020	03/12/2020	14/01/2019	01/10/2020	04/12/2020	15/01/2019	14/10/2020	09/12/2020	
Parameter	Units	EQL	BC WQG - FW																				
Field																							
DO (Field)	mg/L		Varies - see Notes	-	2.51	-	-	1.11	1.95	1.95	-	0.23	-	-	7.82	-	-	6.6	1.87	-	1.12	5.59	
Field ORP (mV)	mV		-	-	132.9	78.9	-	270.6	89.3	89.3	-	281.9	266.9	-	208.8	229.4	-	154.4	83.6	-	160.8	128.3	
Field																							
pH (Field)	pH Units		6.5-9	6.4	6.11	6.51	4.9	4.94	5.5	5.5	3.4	4.7	3.76	3.5	3.93	3.83	3.8	4.74	6.08	5.6	4.75	4.39	
EC (field)	µS/cm		-	243	106.7	182.7	40	63	70.7	70.7	22	54.5	52	27	94.7	58	37	90.3	94.6	32	65.4	188.2	
Temp (Field)	°C		-	-	12.1	2.9	-	15.2	7.1	7.1	-	14.8	3.2	-	13.9	2.9	-	12.6	8.1	-	10.1	8.2	
Field																							
Turbidity	NTU		-	8.7	7.53	168	5	12.7	6.51	6.51	9.7	5.7	1.56	1.4	3.56	1.62	3.1	7.42	20.5	4.7	0.97	2.11	
Inorganics																							
Alkalinity (bicarbonate as CaCO3)	µg/L		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Alkalinity (carbonate as CaCO3)	µg/L		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Alkalinity (hydroxide) as CaCO3	µg/L		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Alkalinity (total as CaCO3)	mg/L		-	57	-	-	7	-	-	-	<1	-	-	<1	-	-	<1	-	-	7	-	-	
Biochemical Oxygen Demand (BOD)	µg/L		-	<2000	-	-	10,000	-	-	-	<2000	-	-	<2000	-	-	2000	-	-	<2000	-	-	
Bromide	mg/L		-	<0.05	-	-	<0.05	-	-	-	<0.05	-	-	<0.05	-	-	<0.05	-	-	<0.05	-	-	
Chloride	mg/L		150	<0.5	-	-	7.2	-	-	-	2.9	-	-	2.8	-	-	6.6	-	-	7.6	-	-	
Chemical Oxygen Demand (COD)	µg/L		-	52,000	-	-	42,000	-	-	-	82,000	-	-	91,000	-	-	93,000	-	-	73,000	-	-	
Dissolved Hardness (Filtered)	µg/L		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Electrical Conductivity (lab)	µS/cm	2	-	240	92	180	41	44	73	74	36	48	46	42	70	51	54	72	94	53	93	57	
Fluoride	mg/L		Varies - see Notes	<0.02	-	-	0.04	-	-	-	<0.02	-	-	<0.02	-	-	0.03	-	-	0.04	-	-	
Hardness as CaCO3	mg/L	1	-	71.4	-	86.8	6.54	-	-	-	4.61	-	-	4.12	-	6.63	7.26	-	-	13.6	-	-	
Nitrate (as N)	mg/L		3	<0.005	-	-	<0.005	-	-	-	0.006	-	-	<0.005	-	-	<0.005	-	-	0.034	-	-	
Nitrite (as N)	mg/L		Varies - see Notes	<0.001	-	-	<0.001	-	-	-	<0.001	-	-	<0.001	-	-	<0.001	-	-	<0.001	-	-	
pH (Lab)	pH Units		-	7.5	6.37	7.14	6.5	6.4	6.27	6.27	4.3	5.27	4.3	4.1	4.25	4.23	4.3	4.88	6.61	6.2	5.86	5.97	
Phosphorus	µg/L		-	110	-	-	230	-	-	-	<50	-	-	<50	-	-	<50	-	-	60	-	-	
Phosphorus (Filtered)	µg/L		-	<50	-	-	<50	-	-	-	<50	-	-	<50	-	-	<50	-	-	<50	-	-	
Salinity	g/L		-	0.001	-	-	0.001	-	-	-	0.001	-	-	0.001	-	-	0.001	-	-	0.001	-	-	
Sulfate as SO4 - turbidimetric	µg/L		-	<300	-	-	1200	-	-	-	<300	-	-	<300	-	-	1200	-	-	1700	-	-	
Total Dissolved Solids	mg/L		-	166	-	-	64	-	-	-	61	-	-	70	-	-	85	-	-	89	-	-	
Total Suspended Solids	mg/l		-	29	-	-	125	-	-	-	5	-	-	3	-	-	3	-	-	28	-	-	
Organics																							
Dissolved Organic Carbon	mg/L		-	13	-	-	16	-	-	-	25	-	-	28	-	-	32	-	-	29	-	-	
Total Organic Carbon	µg/L		-	16,000	-	-	17,000	-	-	-	28,000	-	-	30,000	-	-	47,000	-	-	30,000	-	-	
Metals																							
Aluminium	µg/L		-	647	-	-	496	-	-	-	109	-	-	187	-	-	290	-	-	714	-	-	
Aluminium (Filtered)	µg/L		Varies - see Notes	165	-	-	162	-	-	-	126	-	-	166	-	-	319	-	-	411	-	-	
Antimony	µg/L		9	0.3	-	-	0.7	-	-	-	0.1	-	-	0.1	-	-	0.2	-	-	0.3	-	-	
Antimony (Filtered)	µg/L		9	0.2	-	-	0.2	-	-	-	0.1	-	-	0.1	-	-	0.1	-	-	0.2	-	-	
Arsenic	µg/L		5	3.4	-	-	1.2	-	-	-	0.5	-	-	0.8	-	-	1.1	-	-	1.6	-	-	
Arsenic (Filtered)	µg/L		-	3.1	-	-	0.8	-	-	-	0.7	-	-	0.7	-	-	0.9	-	-	1.1	-	-	
Barium	µg/L		1000	32.8	-	-	8.8	-	-	-	1.7	-	-	2.1	-	-	3	-	-	14.2	-	-	
Barium (Filtered)	µg/L		1000	28.6	-	-	6.6	-	-	-	2.6	-	-	2	-	-	3.8	-	-	10.5	-	-	
Beryllium	µg/L		0.13	<0.1	-	-	<0.1	-	-	-	<0.1	-	-	<0.1	-	-	<0.1	-	-	<0.1	-	-	
Beryllium (Filtered)	µg/L		0.13	<0.1	-	-	<0.1	-	-	-	<0.1	-	-	<0.1	-	-	<0.1	-	-	<0.1	-	-	
Bismuth	µg/L		-	<0.05	-	-	0.06	-	-	-	<0.05	-	-	<0.05	-	-	<0.05	-	-	<0.05	-	-	
Bismuth (Filtered)	µg/L		-	<0.05	-	-	<0.05	-	-	-	<0.05	-	-	<0.05	-	-	<0.05	-	-	<0.05	-	-	
Boron	µg/L		1200	<10	-	-	<10	-	-	-	<10	-	-	<10	-	-	<10	-	-	<10	-	-	
Boron (Filtered)	µg/L		-	<10	-	-	<10	-	-	-	<10	-	-	<10	-	-	<10	-	-	<10	-	-	
Cadmium	µg/L		-	0.037	-	-	0.038	-	-	-	0.007	-	-	0.016	-	-	0.013	-	-	0.061	-	-	
Cadmium (Filtered)	µg/L		-	0.013	-	-	0.022	-	-	-	0.013	-	-	0.011	-	-	0.02	-	-	0.027	-	-	
Calcium	mg/L	0	-	19.4	8.4	26.3	1.75	2.21	3.54	6.03	0.95	3.91	1.7	0.81	1.76	1.22	1.62	3.19	6.05	4.08	8.64	3.64	
Calcium (Filtered)	mg/L		-	21.1	-	-	1.71	-	-	-	1.04	-	-	0.76	-	-	1.47	-	-	3.66	-	-	
Cesium	µg/L		-	0.02	-	-	0.02	-	-	-	0.01	-	-	0.01	-	-	0.01	-	-	0.02	-	-	
Cesium (Filtered)	µg/L		-	<0.01	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	-	0.01	-	-	<0.01	-	-	
Chromium	µg/L		1	2	-	-	2	-	-	-	0.4	-	-	0.5	-	-	0.7	-	-	1.4	-	-	
Chromium (Filtered)	µg/L		-	0.9	-	-	0.6	-	-	-	0.3	-	-	0.4	-	-	0.8	-	-	0.7	-	-	
Cobalt	µg/L		4	3	-	-	0.7	-	-	-	0.1	-	-	0.1	-	-	0.2	-	-	0.5	-	-	
Cobalt (Filtered)	µg/L		-	3	-	-	0.4	-	-	-	0.1	-	-	0.1	-	-	0.3	-	-	0.3	-	-	
Copper	µg/L		-	5.2	-	-	5.2	-	-	-	1.5	-	-	1.9	-	-	2	-	-	5	-	-	

Table 2 Surface Water Analytical Results

			Location	WS01					WS02				WS03		WS04		WS05-E			WS05-W		
			Sample Date	11/09/2019	09/04/2020	09/04/2020	02/12/2020	14/01/2019	11/09/2019	11/09/2019	09/04/2020	02/12/2020	01/10/2020	04/12/2020	23/09/2020	08/12/2020	23/09/2020	08/12/2020	08/12/2020	14/10/2020	02/12/2020	
Parameter	Units	EQL	BC WQG - FW																			
Field																						
DO (Field)	mg/L		Varies - see Notes	4.95	5.00	5.00	-	-	4.25	4.25	8.30	-	14.1	-	6.26	4.95	2.43	5.79	5.79	0.1	1	
Field ORP (mV)	mV			-	147.5	84.1	84.1	228.8	-	52.2	52.2	10.3	126.4	104.1	110.2	263.1	74.1	262.5	78.1	78.1	60.5	-15.6
Field																						
pH (Field)	pH Units		6.5-9	6.72	5.85	5.85	3.72	3.8	7.06	7.06	8.16	6.7	4.1	4.39	6.04	6.08	5.65	6.26	6.26	6.37	6.26	
EC (field)	µS/cm		-	210	60	60	47.2	37	750	750	380	291.3	105	29.3	186.3	79.6	258.6	149.8	149.8	344.4	904	
Temp (Field)	°C		-	16.98	9.6	9.6	3.4	-	16.7	16.7	7.3	3.7	15.1	3.6	16.6	8	15.3	8.4	8.4	14.1	9.7	
Field																						
Turbidity	NTU		-	10.3	1.23	1.39	2.08	10.9	74.5	66	15	12.9	3.5	7.81	6.83	5.78	17.7	9.53	9.53	24.6	99.2	
Inorganics																						
Alkalinity (bicarbonate as CaCO3)	µg/L		-	57,800	-	-	-	-	135,000	139,000	-	-	-	-	-	-	-	-	-	-	-	
Alkalinity (carbonate as CaCO3)	µg/L		-	<1000	-	-	-	-	<1000	<1000	-	-	-	-	-	-	-	-	-	-	-	
Alkalinity (hydroxide) as CaCO3	µg/L		-	<1000	-	-	-	-	<1000	<1000	-	-	-	-	-	-	-	-	-	-	-	
Alkalinity (total as CaCO3)	mg/L		-	57.8	-	-	-	<1	135	139	-	-	-	-	-	-	-	-	-	-	-	
Biochemical Oxygen Demand (BOD)	µg/L		-	<2000	<2000	<2000	-	<2000	3000	2700	<2000	-	-	-	-	-	-	-	-	-	-	
Bromide	mg/L		-	<0.05	<0.05	<0.05	-	<0.05	<0.25	<0.25	<0.05	-	-	-	-	-	-	-	-	-	-	
Chloride	mg/L		150	11.4	7.78	7.81	-	6.6	147	147	7.04	-	-	-	-	-	-	-	-	-	-	
Chemical Oxygen Demand (COD)	µg/L		-	37,000	106,000	1500	-	110,000	39,000	47,000	<20,000	-	-	-	-	-	-	-	-	-	-	
Dissolved Hardness (Filtered)	µg/L		-	-	23,000	23,100	-	-	-	-	64,300	-	-	-	-	-	-	-	-	-	-	
Electrical Conductivity (lab)	µS/cm	2	-	205	61	60.3	46	52	721	724	162	220	91	71	160	82	210	150	150	44	530	
Fluoride	mg/L		Varies - see Notes	0.05	0.03	0.03	-	0.03	<0.1	<0.1	0.046	-	-	-	-	-	-	-	-	-	-	
Hardness as CaCO3	mg/L	1	-	77.6	23.6	23.2	10.6	6.63	129	132	69.2	77.3	-	-	-	-	-	-	-	-	113	
Nitrate (as N)	mg/L		3	0.0436	0.0108	0.0087	-	<0.005	<0.025	<0.025	0.122	-	-	-	-	-	-	-	-	-	-	
Nitrite (as N)	mg/L		Varies - see Notes	0.003	<0.001	<0.001	-	<0.001	<0.005	<0.005	0.0023	-	-	-	-	-	-	-	-	-	-	
pH (Lab)	pH Units		-	7.88	6.77	6.83	4.96	4.4	8.15	8.13	7.83	7.43	4.19	4.14	6.86	6.65	6.76	7.02	7.06	5.86	6.93	
Phosphorus	µg/L		-	<50	<50	<50	-	150	<50	58	59	-	-	-	-	-	-	-	-	-	-	
Phosphorus (Filtered)	µg/L		-	<50	<50	<50	-	<50	<50	<50	<50	-	-	-	-	-	-	-	-	-	-	
Salinity	g/L		-	<0.001	<0.001	<0.001	-	0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-	-	-	
Sulfate as SO4 - turbidimetric	µg/L		-	27,500	750	770	-	1100	<1500	<1500	10,600	-	-	-	-	-	-	-	-	-	-	
Total Dissolved Solids	mg/L		-	156	107	108	-	82	439	432	104	-	-	-	-	-	-	-	-	-	-	
Total Suspended Solids	mg/l		-	<3	<3	<3	-	130	54.4	49	16.3	-	-	-	-	-	-	-	-	-	-	
Organics																						
Dissolved Organic Carbon	mg/L		-	12	36	39.1	-	32	11.9	12.1	3.38	-	-	-	-	-	-	-	-	-	-	
Total Organic Carbon	µg/L		-	12,000	40,100	41,800	-	34,000	13,400	15,700	3360	-	-	-	-	-	-	-	-	-	-	
Metals																						
Aluminium	µg/L		-	165	326	314	-	662	1590	1880	587	-	-	-	-	-	-	-	-	-	-	
Aluminium (Filtered)	µg/L		Varies - see Notes	61.7	274	272	-	159	8.5	8.7	12	-	-	-	-	-	-	-	-	-	-	
Antimony	µg/L		9	0.13	0.14	0.18	-	0.2	0.19	0.2	<0.1	-	-	-	-	-	-	-	-	-	-	
Antimony (Filtered)	µg/L		9	0.11	0.13	0.13	-	<0.1	0.12	0.13	<0.1	-	-	-	-	-	-	-	-	-	-	
Arsenic	µg/L		5	1.54	1.67	1.7	-	1.2	1.37	1.44	0.68	-	-	-	-	-	-	-	-	-	-	
Arsenic (Filtered)	µg/L		-	1.3	1.77	1.82	-	0.5	0.76	0.77	0.39	-	-	-	-	-	-	-	-	-	-	
Barium	µg/L		1000	22.3	8.51	8.06	-	6.9	97	100	23.2	-	-	-	-	-	-	-	-	-	-	
Barium (Filtered)	µg/L		1000	21.8	8.4	9.1	-	22.6	88.2	88	17.3	-	-	-	-	-	-	-	-	-	-	
Beryllium	µg/L		0.13	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	
Beryllium (Filtered)	µg/L		0.13	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	
Bismuth	µg/L		-	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	<0.05	-	-	-	-	-	-	-	-	-	-	
Bismuth (Filtered)	µg/L		-	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	<0.05	-	-	-	-	-	-	-	-	-	-	
Boron	µg/L		1200	19	11	11	-	<10	29	29	<10	-	-	-	-	-	-	-	-	-	-	
Boron (Filtered)	µg/L		-	20	12	13	-	30	34	33	<10	-	-	-	-	-	-	-	-	-	-	
Cadmium	µg/L		-	0.0115	0.0171	0.0138	-	0.027	0.0432	0.0468	0.0257	-	-	-	-	-	-	-	-	-	-	
Cadmium (Filtered)	µg/L		-	0.0072	0.0154	0.0166	-	0.019	0.0122	0.0143	0.0162	-	-	-	-	-	-	-	-	-	-	
Calcium	mg/L	0	-	22.1	6.39	6.28	2.53	1.78	35.2	34.8	18.8	21.6	3.61	2.31	6.38	5.73	10.5	11.4	10.8	1.11	30.5	
Calcium (Filtered)	mg/L		-	21.3	6.22	6.29	-	1.65	33.7	34.6	17.4	-	-	-	-	-	-	-	-	-	-	
Cesium	µg/L		-	0.015	0.012	0.013	-	0.07	0.125	0.138	0.044	-	-	-	-	-	-	-	-	-	-	
Cesium (Filtered)	µg/L		-	0.01	0.01	<0.01	-	0.03	0.033	0.036	<0.01	-	-	-	-	-	-	-	-	-	-	
Chromium	µg/L		1	0.78	0.91	0.85	-	2.3	3.48	4.04	1.31	-	-	-	-	-	-	-	-	-	-	
Chromium (Filtered)	µg/L		-	0.65	0.76	0.76	-	0.4	0.33	0.38	0.12	-	-	-	-	-	-	-	-	-	-	
Cobalt	µg/L		4	0.24	0.4	0.39	-	0.5	1.45	1.57	0.52	-	-	-	-	-	-	-	-	-	-	
Cobalt (Filtered)	µg/L		-	0.18	0.37	0.36	-	0.2	0.92	0.91	0.12	-	-	-	-	-	-	-	-	-	-	
Copper	µg/L		-	1.35	2.19	2.14	-	3.8	3.68	4.16	2.08	-	-	-	-	-	-	-	-	-	-	

Table 2 Surface Water Analytical Results

Parameter	Units	EQL	Location	DNR01			DNR02				WQ01			WQ02			WQ03			WQ04		
			Sample Date	21/01/2019	14/10/2020	02/12/2020	21/01/2019	23/09/2020	08/12/2020	08/12/2020	16/01/2019	21/09/2020	04/12/2020	17/01/2019	02/10/2020	03/12/2020	14/01/2019	01/10/2020	04/12/2020	15/01/2019	14/10/2020	09/12/2020
			BC WQG - FW																			
Copper (Filtered)	µg/L		BLM - see Notes	1	-	-	2.7	-	-	-	3.7	-	-	1.7	-	-	2.1	-	-	2.5	-	-
Iron	mg/L		1	5.97	-	-	0.95	-	-	-	0.25	-	-	0.35	-	-	0.41	-	-	1.09	-	-
Iron (Filtered)	mg/L		0.35	5.15	-	-	0.33	-	-	-	0.27	-	-	0.31	-	-	0.6	-	-	0.71	-	-
Lead	µg/L		Varies - see Notes	4.54	-	-	1.04	-	-	-	1	-	-	1.24	-	-	2.33	-	-	2.15	-	-
Lead (Filtered)	µg/L		-	0.64	-	-	0.56	-	-	-	1.25	-	-	1.25	-	-	2.12	-	-	0.78	-	-
Lithium	µg/L		-	<1	-	-	<1	-	-	-	<1	-	-	<1	-	-	<1	-	-	<1	-	-
Lithium (Filtered)	µg/L		-	<1	-	-	<1	-	-	-	<1	-	-	<1	-	-	<1	-	-	<1	-	-
Magnesium	mg/L		-	4.42	-	-	0.693	-	-	-	0.413	-	-	0.644	-	-	0.737	-	-	1.31	-	-
Magnesium (Filtered)	mg/L		-	4.54	-	-	0.554	-	-	-	0.489	-	-	0.54	-	-	0.72	-	-	1.08	-	-
Manganese	µg/L		-	694	-	-	57	-	-	-	12.3	-	-	11.3	-	-	15.1	-	-	50	-	-
Manganese (Filtered)	µg/L		-	863	-	-	42.9	-	-	-	15.3	-	-	9.8	-	-	20.5	-	-	43.2	-	-
Mercury	µg/L		-	0.025	-	-	0.025	-	-	-	0.007	-	-	<0.005	-	-	0.006	-	-	0.05	-	-
Mercury (Filtered)	µg/L		-	<0.005	-	-	<0.005	-	-	-	0.006	-	-	<0.005	-	-	0.025	-	-	0.007	-	-
Molybdenum	µg/L		1000	0.3	-	-	0.36	-	-	-	<0.05	-	-	<0.05	-	-	0.06	-	-	0.27	-	-
Molybdenum (Filtered)	µg/L		-	0.27	-	-	0.12	-	-	-	<0.05	-	-	<0.05	-	-	0.07	-	-	0.14	-	-
Nickel	µg/L		Varies - see Notes	3	-	-	2.4	-	-	-	<0.5	-	-	<0.5	-	-	1.1	-	-	2.4	-	-
Nickel (Filtered)	µg/L		-	2.5	-	-	1.7	-	-	-	<0.5	-	-	<0.5	-	-	1.2	-	-	1.6	-	-
Potassium	mg/L		-	1.58	-	-	0.8	-	-	-	0.09	-	-	0.1	-	-	0.4	-	-	0.81	-	-
Potassium (Filtered)	mg/L		-	1.68	-	-	0.72	-	-	-	0.14	-	-	0.05	-	-	0.42	-	-	0.71	-	-
Rubidium	µg/L		-	1.5	-	-	1.1	-	-	-	<0.2	-	-	<0.2	-	-	0.3	-	-	1.1	-	-
Rubidium (Filtered)	µg/L		-	1.4	-	-	0.8	-	-	-	<0.2	-	-	<0.2	-	-	0.7	-	-	0.9	-	-
Selenium	µg/L		2	0.11	-	-	0.07	-	-	-	<0.05	-	-	0.07	-	-	0.09	-	-	0.1	-	-
Selenium (Filtered)	µg/L		2	0.08	-	-	0.05	-	-	-	<0.05	-	-	0.07	-	-	0.9	-	-	0.09	-	-
Silicon	µg/L		-	5100	-	-	1900	-	-	-	200	-	-	<100	-	-	1500	-	-	2500	-	-
Silicon (Filtered)	µg/L		-	4500	-	-	1430	-	-	-	250	-	-	80	-	-	1740	-	-	2200	-	-
Silver	µg/L		Varies - see Notes	0.01	-	-	0.03	-	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	0.02	-	-
Silver (Filtered)	µg/L		-	<0.01	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-
Sodium	mg/L		-	18.7	-	-	5.48	-	-	-	1.23	-	-	1.61	-	-	4.88	-	-	6.84	-	-
Sodium (Filtered)	mg/L		-	20.1	-	-	5.79	-	-	-	1.64	-	-	1.52	-	-	4.84	-	-	6.43	-	-
Strontium	µg/L		-	111	-	-	12.4	-	-	-	5.5	-	-	4.6	-	-	9.7	-	-	31.7	-	-
Strontium (Filtered)	µg/L		-	122	-	-	11.3	-	-	-	5.8	-	-	4.4	-	-	9.2	-	-	27	-	-
Sulfur, elemental	µg/L		-	700	-	-	700	-	-	-	<500	-	-	<500	-	-	<500	-	-	800	-	-
Sulfur, elemental (Filtered)	µg/L		-	600	-	-	600	-	-	-	<500	-	-	<500	-	-	800	-	-	800	-	-
Tellurium	µg/L		-	<0.2	-	-	<0.2	-	-	-	<0.2	-	-	<0.2	-	-	<0.2	-	-	<0.2	-	-
Tellurium (Filtered)	µg/L		-	<0.2	-	-	<0.2	-	-	-	<0.2	-	-	<0.2	-	-	<0.2	-	-	<0.2	-	-
Thallium	µg/L		0.8	<0.01	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-
Thallium (Filtered)	µg/L		-	<0.01	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-
Thorium	µg/L		-	0.2	-	-	<0.1	-	-	-	<0.1	-	-	<0.1	-	-	<0.1	-	-	<0.1	-	-
Thorium (Filtered)	µg/L		-	<0.1	-	-	<0.1	-	-	-	<0.1	-	-	<0.1	-	-	<0.1	-	-	<0.1	-	-
Tin	µg/L		-	0.2	-	-	0.8	-	-	-	<0.1	-	-	<0.1	-	-	<0.1	-	-	0.1	-	-
Tin (Filtered)	µg/L		-	<0.1	-	-	<0.1	-	-	-	<0.1	-	-	<0.1	-	-	<0.1	-	-	<0.1	-	-
Titanium	µg/L		-	27.2	-	-	15.3	-	-	-	3.4	-	-	4.6	-	-	6	-	-	14.9	-	-
Titanium (Filtered)	µg/L		-	5.5	-	-	2.7	-	-	-	3.9	-	-	4.4	-	-	9	-	-	5.9	-	-
Tungsten	µg/L		-	<0.1	-	-	0.2	-	-	-	<0.1	-	-	<0.1	-	-	<0.1	-	-	<0.1	-	-
Tungsten (Filtered)	µg/L		-	<0.1	-	-	<0.1	-	-	-	<0.1	-	-	<0.1	-	-	<0.1	-	-	<0.1	-	-
Uranium	µg/L		8.5	0.06	-	-	0.02	-	-	-	<0.01	-	-	<0.01	-	-	0.02	-	-	0.03	-	-
Uranium (Filtered)	µg/L		-	0.03	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	-	0.02	-	-	0.02	-	-
Vanadium	µg/L		-	3.7	-	-	2	-	-	-	0.6	-	-	0.8	-	-	1.5	-	-	2.9	-	-
Vanadium (Filtered)	µg/L		-	2.3	-	-	0.9	-	-	-	0.6	-	-	0.6	-	-	1.4	-	-	1.6	-	-
Zinc	µg/L		Varies - see Notes	18	-	-	20	-	-	-	4	-	-	6	-	-	5	-	-	66	-	-
Zinc (Filtered)	µg/L		-	13	-	-	13	-	-	-	6	-	-	6	-	-	6	-	-	40	-	-
Zirconium	µg/L		-	0.46	-	-	0.52	-	-	-	0.1	-	-	0.16	-	-	0.26	-	-	0.29	-	-
Zirconium (Filtered)	µg/L		-	0.4	-	-	0.24	-	-	-	0.12	-	-	0.16	-	-	0.37	-	-	0.31	-	-
PHCs																						
Oil and grease	µg/L		-	<5000	-	-	<5000	-	-	-	<5000	-	-	<5000	-	-	<5000	-	-	7000	-	-

Table 2 Surface Water Analytical Results

			Location	WS01				WS02				WS03		WS04		WS05-E			WS05-W		
			Sample Date	11/09/2019	09/04/2020	09/04/2020	02/12/2020	14/01/2019	11/09/2019	11/09/2019	09/04/2020	02/12/2020	01/10/2020	04/12/2020	23/09/2020	08/12/2020	23/09/2020	08/12/2020	08/12/2020	14/10/2020	02/12/2020
Parameter	Units	EQL	BC WQG - FW																		
Copper (Filtered)	µg/L		BLM - see Notes	1.11	2.34	3.08	-	1.9	1.78	1.08	1.59	-	-	-	-	-	-	-	-	-	-
Iron	mg/L		1	2.06	1.25	1.23	-	1.08	5.72	6.29	1.11	-	-	-	-	-	-	-	-	-	-
Iron (Filtered)	mg/L		0.35	1.31	1.06	1.06	-	0.2	0.321	0.292	0.094	-	-	-	-	-	-	-	-	-	-
Lead	µg/L		Varies - see Notes	0.342	1.51	1.5	-	4.32	0.559	0.674	0.277	-	-	-	-	-	-	-	-	-	-
Lead (Filtered)	µg/L		-	0.152	1.32	1.3	-	1.91	<0.05	<0.05	<0.05	-	-	-	-	-	-	-	-	-	-
Lithium	µg/L		-	1.2	<1	<1	-	<1	3.5	3.9	1.3	-	-	-	-	-	-	-	-	-	-
Lithium (Filtered)	µg/L		-	1.2	<1	<1	-	<1	3.2	3.2	<1	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L		-	5.77	1.85	1.84	-	0.852	10.8	10.3	5.39	-	-	-	-	-	-	-	-	-	-
Magnesium (Filtered)	mg/L		-	5.93	1.82	1.8	-	0.764	11	11.1	5.09	-	-	-	-	-	-	-	-	-	-
Manganese	µg/L		-	163	164	163	-	31.6	2110	2080	133	-	-	-	-	-	-	-	-	-	-
Manganese (Filtered)	µg/L		-	170	153	153	-	16.3	2420	2480	100	-	-	-	-	-	-	-	-	-	-
Mercury	µg/L		-	<0.005	0.0061	0.0058	-	0.1	<0.005	<0.005	<0.005	-	-	-	-	-	-	-	-	-	-
Mercury (Filtered)	µg/L		-	<0.025	0.0067	0.0069	-	0.006	<0.025	<0.025	<0.005	-	-	-	-	-	-	-	-	-	-
Molybdenum	µg/L		1000	0.711	0.058	0.055	-	0.15	1.37	1.36	0.858	-	-	-	-	-	-	-	-	-	-
Molybdenum (Filtered)	µg/L		-	0.69	0.055	0.082	-	<0.05	1.45	1.41	0.92	-	-	-	-	-	-	-	-	-	-
Nickel	µg/L		Varies - see Notes	1.12	1.11	1.17	-	1.8	4.27	4.72	2.1	-	-	-	-	-	-	-	-	-	-
Nickel (Filtered)	µg/L		-	1.12	1.02	1.04	-	0.9	2	1.97	0.69	-	-	-	-	-	-	-	-	-	-
Potassium	mg/L		-	1.2	0.455	0.452	-	0.47	3.01	2.97	1.17	-	-	-	-	-	-	-	-	-	-
Potassium (Filtered)	mg/L		-	1.26	0.453	0.457	-	0.45	3.18	3.17	1.06	-	-	-	-	-	-	-	-	-	-
Rubidium	µg/L		-	1.35	0.44	0.37	-	1	3.34	3.48	1.38	-	-	-	-	-	-	-	-	-	-
Rubidium (Filtered)	µg/L		-	1.3	0.41	0.41	-	0.6	3.2	3.3	0.84	-	-	-	-	-	-	-	-	-	-
Selenium	µg/L		2	0.082	0.106	0.128	-	0.14	0.084	0.111	0.105	-	-	-	-	-	-	-	-	-	-
Selenium (Filtered)	µg/L		2	0.091	0.059	0.073	-	<0.05	0.062	0.073	0.131	-	-	-	-	-	-	-	-	-	-
Silicon	µg/L		-	3970	830	780	-	2400	9070	9630	4670	-	-	-	-	-	-	-	-	-	-
Silicon (Filtered)	µg/L		-	4260	721	719	-	1470	7860	7790	3260	-	-	-	-	-	-	-	-	-	-
Silver	µg/L		Varies - see Notes	<0.01	<0.01	<0.01	-	0.02	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-	-
Silver (Filtered)	µg/L		-	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-	-
Sodium	mg/L		-	9.83	5.48	5.45	-	4.83	82.7	79.9	7.26	-	-	-	-	-	-	-	-	-	-
Sodium (Filtered)	mg/L		-	10.3	5.05	5.28	-	5.22	92.7	94.6	6.65	-	-	-	-	-	-	-	-	-	-
Strontium	µg/L		-	129	36.4	35.4	-	11.4	219	219	97.9	-	-	-	-	-	-	-	-	-	-
Strontium (Filtered)	µg/L		-	123	37.7	38.5	-	10.7	205	210	98.8	-	-	-	-	-	-	-	-	-	-
Sulfur, elemental	µg/L		-	2640	570	620	-	700	1340	1250	3850	-	-	-	-	-	-	-	-	-	-
Sulfur, elemental (Filtered)	µg/L		-	2840	510	590	-	800	1050	1240	3430	-	-	-	-	-	-	-	-	-	-
Tellurium	µg/L		-	<0.2	<2	<2	-	<0.2	<0.2	<0.2	<0.2	-	-	-	-	-	-	-	-	-	-
Tellurium (Filtered)	µg/L		-	<0.2	<0.2	<0.2	-	<0.2	<0.2	<0.2	<0.2	-	-	-	-	-	-	-	-	-	-
Thallium	µg/L		0.8	<0.01	<0.01	<0.01	-	0.02	0.011	0.012	<0.01	-	-	-	-	-	-	-	-	-	-
Thallium (Filtered)	µg/L		-	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-	-
Thorium	µg/L		-	<0.1	<0.1	<0.1	-	<0.1	0.17	0.19	<0.1	-	-	-	-	-	-	-	-	-	-
Thorium (Filtered)	µg/L		-	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-
Tin	µg/L		-	0.11	<0.1	<0.1	-	0.1	<0.1	0.15	<0.1	-	-	-	-	-	-	-	-	-	-
Tin (Filtered)	µg/L		-	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-
Titanium	µg/L		-	7.47	9.08	8.48	-	25.7	60.8	75.6	26.2	-	-	-	-	-	-	-	-	-	-
Titanium (Filtered)	µg/L		-	3.07	6.65	6.6	-	2.9	0.33	0.37	<0.3	-	-	-	-	-	-	-	-	-	-
Tungsten	µg/L		-	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-
Tungsten (Filtered)	µg/L		-	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-
Uranium	µg/L		8.5	0.156	0.027	0.026	-	0.06	0.289	0.297	0.287	-	-	-	-	-	-	-	-	-	-
Uranium (Filtered)	µg/L		-	1.43	0.021	0.021	-	<0.01	0.218	0.215	0.257	-	-	-	-	-	-	-	-	-	-
Vanadium	µg/L		-	1.09	1.08	1.06	-	2.6	4.91	5.47	1.72	-	-	-	-	-	-	-	-	-	-
Vanadium (Filtered)	µg/L		-	0.67	0.9	0.91	-	1	<0.5	<0.5	<0.5	-	-	-	-	-	-	-	-	-	-
Zinc	µg/L		Varies - see Notes	<3	7.5	6.2	-	9	9.7	12.2	4.8	-	-	-	-	-	-	-	-	-	-
Zinc (Filtered)	µg/L		-	1.4	10	9.2	-	19	2.7	2.7	3.1	-	-	-	-	-	-	-	-	-	-
Zirconium	µg/L		-	0.23	0.3	0.28	-	0.42	0.91	1.04	0.5	-	-	-	-	-	-	-	-	-	-
Zirconium (Filtered)	µg/L		-	<0.2	0.27	0.29	-	0.15	<0.2	<0.2	<0.2	-	-	-	-	-	-	-	-	-	-
PHCs																					
Oil and grease	µg/L		-	<5000	<5000	<5000	-	<5000	<5000	<5000	<5000	-	-	-	-	-	-	-	-	-	-

Table 2 Surface Water Analytical Results

			Location	DNR01			DNR02				WQ01			WQ02			WQ03			WQ04		
			Sample Date	21/01/2019	14/10/2020	02/12/2020	21/01/2019	23/09/2020	08/12/2020	08/12/2020	16/01/2019	21/09/2020	04/12/2020	17/01/2019	02/10/2020	03/12/2020	14/01/2019	01/10/2020	04/12/2020	15/01/2019	14/10/2020	09/12/2020
Parameter	Units	EQL	BC WQG - FW																			
PAH																						
Acenaphthene	µg/L		6	<0.01	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-
Acenaphthylene	µg/L		-	<0.01	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-
Acridine	µg/L		0.05	0.02	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-
Anthracene	µg/L		0.1	<0.01	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-
Benz(a)anthracene	µg/L		0.1	0.01	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-
Benzo(a)pyrene	µg/L		0.01	0.021	-	-	<0.005	-	-	-	<0.005	-	-	<0.005	-	-	<0.005	-	-	<0.005	-	-
Benzo(b+j)fluoranthenes	µg/L		-	0.4	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-
Benzo(b+j+k)fluoranthene	µg/L		-	0.049	-	-	<0.015	-	-	-	<0.015	-	-	<0.015	-	-	<0.015	-	-	<0.015	-	-
Benzo(g,h,i)perylene	µg/L		-	0.03	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-
Benzo(k)fluoranthene	µg/L		-	0.02	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-
Chrysene	µg/L		-	0.3	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-
Dibenz(a,h)anthracene	µg/L		-	<0.005	-	-	<0.005	-	-	-	<0.005	-	-	<0.005	-	-	<0.005	-	-	<0.005	-	-
Fluoranthene	µg/L		0.2	0.05	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-
Fluorene	µg/L		12	<0.01	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-
Indeno(1,2,3-cd)pyrene	µg/L		-	0.03	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-
Methylnaphthalene, 1-	µg/L		-	<0.05	-	-	<0.05	-	-	-	<0.05	-	-	<0.05	-	-	<0.05	-	-	<0.05	-	-
Methylnaphthalene, 2-	µg/L		-	<0.05	-	-	<0.05	-	-	-	<0.05	-	-	<0.05	-	-	<0.05	-	-	<0.05	-	-
Naphthalene	µg/L		1	<0.05	-	-	<0.05	-	-	-	<0.05	-	-	<0.05	-	-	<0.05	-	-	<0.05	-	-
Phenanthrene	µg/L		0.3	0.02	-	-	<0.02	-	-	-	<0.02	-	-	<0.02	-	-	<0.02	-	-	<0.02	-	-
Pyrene	µg/L		0.02	0.05	-	-	<0.01	-	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-
Quinoline	µg/L		3.4	<0.05	-	-	<0.05	-	-	-	<0.05	-	-	<0.05	-	-	<0.05	-	-	<0.05	-	-
Biota																						
Total Coliform	CFU/100mL		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coliform Bacteria - Fecal	CFU/100mL		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tannin & lignin	µg/L		-	2000	-	-	3000	-	-	-	10,000	-	-	10,000	-	-	8000	-	-	5000	-	-

Table 2 Surface Water Analytical Results

			Location	WS01				WS02				WS03		WS04		WS05-E			WS05-W		
			Sample Date	11/09/2019	09/04/2020	09/04/2020	02/12/2020	14/01/2019	11/09/2019	11/09/2019	09/04/2020	02/12/2020	01/10/2020	04/12/2020	23/09/2020	08/12/2020	23/09/2020	08/12/2020	08/12/2020	14/10/2020	02/12/2020
Parameter	Units	EQL	BC WQG - FW																		
PAH																					
Acenaphthene	µg/L		6	0.021	<10	<10	-	<0.01	<0.01	<0.01	<10	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	µg/L		-	<0.01	<10	<10	-	<0.01	<0.01	<0.01	<10	-	-	-	-	-	-	-	-	-	-
Acridine	µg/L		0.05	<0.01	<10	<10	-	<0.01	<0.01	<0.01	<10	-	-	-	-	-	-	-	-	-	-
Anthracene	µg/L		0.1	<0.01	<10	<10	-	<0.01	<0.01	<0.01	<10	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	µg/L		0.1	-	-	-	-	<0.01	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	µg/L		0.01	<0.005	<5	<5	-	<0.005	<0.005	<0.005	<5	-	-	-	-	-	-	-	-	-	-
Benzo(b+j)fluoranthenes	µg/L		-	<0.01	<10	<10	-	<0.01	<0.01	<0.01	<10	-	-	-	-	-	-	-	-	-	-
Benzo(b+j+k)fluoranthene	µg/L		-	<0.015	<15	<15	-	<0.015	<0.015	<0.015	<15	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	µg/L		-	<0.01	<10	<10	-	<0.01	<0.01	<0.01	<10	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	µg/L		-	<0.01	<10	<10	-	<0.01	<0.01	<0.01	<10	-	-	-	-	-	-	-	-	-	-
Chrysene	µg/L		-	<0.01	<10	<10	-	<0.01	<0.01	<0.01	<10	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	µg/L		-	<0.005	<5	<5	-	<0.005	<0.005	<0.005	<5	-	-	-	-	-	-	-	-	-	-
Fluoranthene	µg/L		0.2	<0.01	<10	<10	-	<0.01	<0.01	<0.01	<10	-	-	-	-	-	-	-	-	-	-
Fluorene	µg/L		12	<0.01	<10	<10	-	<0.01	<0.01	<0.01	<10	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	µg/L		-	<0.01	<10	<10	-	<0.01	<0.01	<0.01	<10	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 1-	µg/L		-	<0.05	<10	<10	-	<0.05	<0.05	<0.05	<10	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	µg/L		-	<0.05	<10	<10	-	<0.05	<0.05	<0.05	<10	-	-	-	-	-	-	-	-	-	-
Naphthalene	µg/L		1	<0.05	<50	<50	-	<0.05	<0.05	<0.05	<50	-	-	-	-	-	-	-	-	-	-
Phenanthrene	µg/L		0.3	<0.02	<20	<20	-	<0.02	<0.02	<0.02	<20	-	-	-	-	-	-	-	-	-	-
Pyrene	µg/L		0.02	<0.01	<10	<10	-	<0.01	<0.01	<0.01	<10	-	-	-	-	-	-	-	-	-	-
Quinoline	µg/L		3.4	<0.05	<50	<50	-	<0.05	<0.05	<0.05	<50	-	-	-	-	-	-	-	-	-	-
Biota																					
Total Coliform	CFU/100mL		-	-	<800	500	-	-	-	-	500	-	-	-	-	-	-	-	-	-	-
Coliform Bacteria - Fecal	CFU/100mL		-	106	-	-	-	-	41	42	-	-	-	-	-	-	-	-	-	-	-
Tannin & lignin	µg/L		-	-	-	-	-	9000	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes - Table 2 - Surface Water Analytical Results

- (1) All values are reported as µg/L unless otherwise noted.
- (2) - = No guideline or not analyzed.
- (3) BC WQG - Approved = Approved - BC Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture Summary Report.
Water Protection & Sustainability Branch, MOE & Climate Change Strategy. August 2019.
- (4) BC WQG - Working = Working - BC Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture.
Water Protection & Sustainability Branch, MOE & Climate Change Strategy. June 2017.
- (5) Long-term chronic WQGs are intended to protect the most sensitive species and life stages against sub-lethal and lethal effects for indefinte exposures. An averagin perious is used for these WQGs (e.g., 5 samples in 30 days).
- (6) Short-term acute (i.e., "maximum") WQGs are set to protect against severe effects such as lethality or other equivalent measures to the most sensitive species and lifes stages over a defined short-term exposure period (e.g., 96 hours).
- (7) For working guideline sources, refer to BC Working Water Quality Guidelines document.
- (8) Aluminum (dissolved) - Guideline is based on pH
- (9) Cadmium (dissolved) - Guideline is based on water hardness
- (10) Copper (dissolved) - Calculated using BC Biotic Ligand Model (BLM). Water chemistry (e.g. pH, DOC and hardness) is needed to calculate Cu WQGs using BC BLM. Examples of calculated Cu WQGs are provided in Table 12b.
- (11) Copper - If natural background levels exceed the WQGs for aquatic life, then any allowed increase in total Cu above natural levels should be based on site-specific data.
- (12) Fluoride (F-) - Guideline is hardness dependent.
- (13) Lead - Guideline is based on water hardness
- (14) Manganese - Guideline is based on water hardness
- (15) Mercury - When MeHg ≤ 0.5% of total Hg, WQG 0.02
- (16) Nickel - Working Guideline is based on water hardness
- (17) Naphthalene - Ambient Water Quality Guideline for Naphthalene to Protect Freshwater Life: Overview Report – First Update (2007).
- (18) Nitrite WQG is based on Cl⁻ concentration, see Table 26B.
- (19) Ammonia Nitrogen to protect freshwater aquatic life - BC Approved long-term chronic WQG, Table 26C. No more than 1 of 5 of the measured values can exceed 1.5 times the corresponding WQG.
- (20) Ammonia Nitrogen to protect freshwater aquatic life - BC Approved short-term acute WQG, Table 26D.
- (21) Organic Carbon - The 30-day median for both DOC and TOC shall be within 20% of seasonally adjusted median background levels.
- (22) Dissolved oxygen - the most stringent life stage guideline was used.
- (23) Dissolved oxygen - Ambient Water Quality Criteria for Dissolved Oxygen: Overview Report (1997).
- (24) Silver - Guideline is based on water hardness.
- (25) Sulphate - Guideline is based on water hardness.
- (26) Temperature - Refer to BC Approved WQG, Table 42A & 42B.
- (27) Turbidity (clear flow) - Change of 2 NTU from background level at any one time for a duration of 30 d during clear flows or in clear water.
- (28) Turbidity (clear flow) - Change of 8 NTU from background level at any one time for a duration of 24 h in clear flows or in clear waters.
- (29) Turbidity (turbid flow) - Change of 5 NTU from background level when background is 8-50 NTU during high flows or turbid waters.
- (30) Turbidity (turbid flow) - Change from background of 10% when background is > 50 NTU at any time during high flows or turbid waters.
- (31) Total Suspended Solids (clear flow) - Change of 5 mg/L from background level at any one time for a duration of 30 d during clear flows or in clear water.
- (32) Total Suspended Solids (clear flow) - Change of 25 mg/L from background level at any one time for a duration of 24 h during clear flows or in clear water.
- (33) Total Suspended Solids (turbid flow) - Change of 10 mg/L from background level when background is 25-100 mg/L during high flows or turbid waters.
- (34) Total Suspended Solids (turbid flow) - Change from background of 10% when background is > 100 mg/L at any time during high flows or turbid waters.
- (35) Turbidity, and suspended and benthic sediments - Ambient Water Quality Guidelines (Criteria) for Suspended and Benthic Sediments: Overview Report (2001).
- (36) Zinc - Guideline is based on water hardness.
- (37) Zinc - When the ambient Zn concentration exceeds the WQG, further degradation of the ambient or existing water quality should be avoided

Table 3 RPD Table

Parameter	Sample ID	Location	DNR02	DNR02	RPD (%)	MW03	MW03	RPD (%)	MW08-Q4 (3)	MW08-Q4 (3)	RPD (%)	WS01	WS01	RPD (%)	WS02	WS02	RPD (%)	WS05-E	WS05-E	RPD (%)
		DNR02	SW20-101	MW03		MW20-200	MW08-Q4 (3)		MW20-100	SW-BINN854		SW-BINN854	SW-BINN854		SW-BINN854	SW20-100		WS05-E		
		Sample Date	08/12/2020	08/12/2020		08/12/2020	08/12/2020		21/09/2020	21/09/2020		11/04/2020	11/04/2020		13/09/2019	13/09/2019		08/12/2020	08/12/2020	
Units																				
Inorganics																				
Alkalinity (bicarbonate as CaCO3)	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	135,000	139,000	1.46%	-	-	-
Alkalinity (carbonate as CaCO3)	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	<1000	<1000	-	-	-	-
Alkalinity (hydroxide) as CaCO3	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	<1000	<1000	-	-	-	-
Alkalinity (total as CaCO3)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	135	139	1.46%	-	-	-
Biochemical Oxygen Demand (BOD)	µg/L	-	-	-	-	-	-	-	-	-	-	<2000	<2000	-	3000	2700	5.26%	-	-	-
Bromide	mg/L	-	-	-	-	-	-	-	-	-	-	<0.05	<0.05	-	<0.25	<0.25	-	-	-	-
Chloride	mg/L	-	-	-	-	-	-	-	-	-	-	7.78	7.81	0.19%	147	147	0.00%	-	-	-
Chemical Oxygen Demand (COD)	µg/L	-	-	-	-	-	-	-	-	-	-	106,000	1500	97.21%	39,000	47,000	9.30%	-	-	-
Dissolved Hardness (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	23,000	23,100	0.22%	-	-	-	-	-	-
Electrical Conductivity (lab)	µS/cm	73	74	0.68%	230	230	0.00%	170	180	2.86%	61	60.3	0.58%	721	724	0.21%	150	150	0.00%	-
Fluoride	mg/L	-	-	-	-	-	-	-	-	-	-	0.03	0.03	0.00%	<0.1	<0.1	-	-	-	-
Hardness as CaCO3	mg/L	-	-	-	-	-	-	-	-	-	-	23.6	23.2	0.85%	129	132	1.15%	-	-	-
Nitrate (as N)	mg/L	-	-	-	-	-	-	-	-	-	-	0.0108	0.0087	10.77%	<0.025	<0.025	-	-	-	-
Nitrite (as N)	mg/L	-	-	-	-	-	-	-	-	-	-	<0.001	<0.001	-	<0.005	<0.005	-	-	-	-
pH (Lab)	pH Units	6.27	6.27	0.00%	6.85	6.75	0.74%	6.98	7.15	1.20%	6.77	6.83	0.44%	8.15	8.13	0.12%	7.02	7.06	0.28%	-
Phosphorus	µg/L	-	-	-	-	-	-	-	-	-	-	<50	<50	-	<50	58	-	-	-	-
Phosphorus (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	<50	<50	-	<50	<50	-	-	-	-
Salinity	g/L	-	-	-	-	-	-	-	-	-	-	<0.001	<0.001	-	<0.001	<0.001	-	-	-	-
Sulfate as SO4 - turbidimetric	µg/L	-	-	-	-	-	-	-	-	-	-	750	770	1.32%	<1500	<1500	-	-	-	-
Total Dissolved Solids	mg/L	-	-	-	-	-	-	-	-	-	-	107	108	0.47%	439	432	0.80%	-	-	-
Total Suspended Solids	mg/l	-	-	-	-	-	-	-	-	-	-	<3	<3	-	54.4	49	5.22%	-	-	-
Organics																				
Dissolved Organic Carbon	mg/L	-	-	-	-	-	-	-	-	-	-	35.7	39.1	4.55%	11.9	12.1	0.83%	-	-	-
Total Organic Carbon	µg/L	-	-	-	-	-	-	-	-	-	-	40,100	41,800	2.08%	13,400	15,700	7.90%	-	-	-
Metals																				
Aluminium	µg/L	-	-	-	-	-	-	-	-	-	-	326	314	1.88%	1590	1880	8.36%	-	-	-
Aluminium (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	274	272	0.37%	8.5	8.7	1.16%	-	-	-
Antimony	µg/L	-	-	-	-	-	-	-	-	-	-	0.14	0.18	12.50%	0.19	0.2	2.56%	-	-	-
Antimony (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	0.13	0.13	0.00%	0.12	0.13	4.00%	-	-	-
Arsenic	µg/L	-	-	-	-	-	-	-	-	-	-	1.67	1.7	0.89%	1.37	1.44	2.49%	-	-	-
Arsenic (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	1.77	1.82	1.39%	0.76	0.77	0.65%	-	-	-
Barium	µg/L	-	-	-	-	-	-	-	-	-	-	8.51	8.06	2.72%	97	100	1.52%	-	-	-
Barium (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	8.4	9.1	4.00%	88.2	88	0.11%	-	-	-
Beryllium	µg/L	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	-	<0.1	<0.1	-	-	-	-
Beryllium (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	-	<0.1	<0.1	-	-	-	-
Bismuth	µg/L	-	-	-	-	-	-	-	-	-	-	<0.05	<0.05	-	<0.05	<0.05	-	-	-	-
Bismuth (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	<0.05	<0.05	-	<0.05	<0.05	-	-	-	-
Boron	µg/L	-	-	-	-	-	-	-	-	-	-	11	11	0.00%	29	29	0.00%	-	-	-
Boron (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	12	13	4.00%	34	33	1.49%	-	-	-
Cadmium	µg/L	-	-	-	-	-	-	-	-	-	-	0.0171	0.0138	10.68%	0.0432	0.0468	4.00%	-	-	-
Cadmium (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	0.0154	0.0166	3.75%	0.0122	0.0143	7.92%	-	-	-
Calcium	mg/L	3.54	6.03	26.02%	12.3	11.7	2.50%	15.9	15.5	1.27%	6.39	6.28	0.87%	35.2	34.8	0.57%	11.4	10.8	2.70%	-
Calcium (Filtered)	mg/L	-	-	-	-	-	-	-	-	-	-	6.22	6.29	0.56%	33.7	34.6	1.32%	-	-	-
Cesium	µg/L	-	-	-	-	-	-	-	-	-	-	0.012	0.013	4.00%	0.125	0.138	4.94%	-	-	-
Cesium (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	0.01	<0.01	-	0.033	0.036	4.35%	-	-	-
Chromium	µg/L	-	-	-	-	-	-	-	-	-	-	0.91	0.85	3.41%	3.48	4.04	7.45%	-	-	-
Chromium (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	0.76	0.76	0.00%	0.33	0.38	7.04%	-	-	-
Cobalt	µg/L	-	-	-	-	-	-	-	-	-	-	0.4	0.39	1.27%	1.45	1.57	3.97%	-	-	-
Cobalt (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	0.37	0.36	1.37%	0.92	0.91	0.55%	-	-	-
Copper	µg/L	-	-	-	-	-	-	-	-	-	-	2.19	2.14	1.15%	3.68	4.16	6.12%	-	-	-
Copper (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	2.34	3.08	13.65%	1.78	1.08	24.48%	-	-	-
Iron	mg/L	-	-	-	-	-	-	-	-	-	-	1.25	1.23	0.81%	5.72	6.29	4.75%	-	-	-
Iron (Filtered)	mg/L	-	-	-	-	-	-	-	-	-	-	1.06	1.06	0.00%	0.321	0.292	4.73%	-	-	-
Lead	µg/L	-	-	-	-	-	-	-	-	-	-	1.51	1.5	0.33%	0.559	0.674	9.33%	-	-	-
Lead (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	1.32	1.3	0.76%	<0.05	<0.05	-	-	-	-
Lithium	µg/L	-	-	-	-	-	-	-	-	-	-	<1	<1	-	3.5	3.9	5.41%	-	-	-
Lithium (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	<1	<1	-	3.2	3.2	0.00%	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	-	-	-	-	1.85	1.84	0.27%	10.8	10.3	2.37%	-	-	-
Magnesium (Filtered)	mg/L	-	-	-	-	-	-	-	-	-	-	1.82	1.8	0.55%	11	11.1	0.45%	-	-	-
Manganese	µg/L	-	-	-	-	-	-	-	-	-	-	164	163	0.31%	2110	2080	0.72%	-	-	-
Manganese (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	153	153	0.00%	2420	2480	1.22%	-	-	-
Mercury	µg/L	-	-	-	-	-	-	-	-	-	-	0.0061	0.0058	2.52%	<0.005	<0.005	-	-	-	-
Mercury (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	0.0067	0.0069	1.47%	<0.025	<0.025	-	-	-	-

Table 3 RPD Table

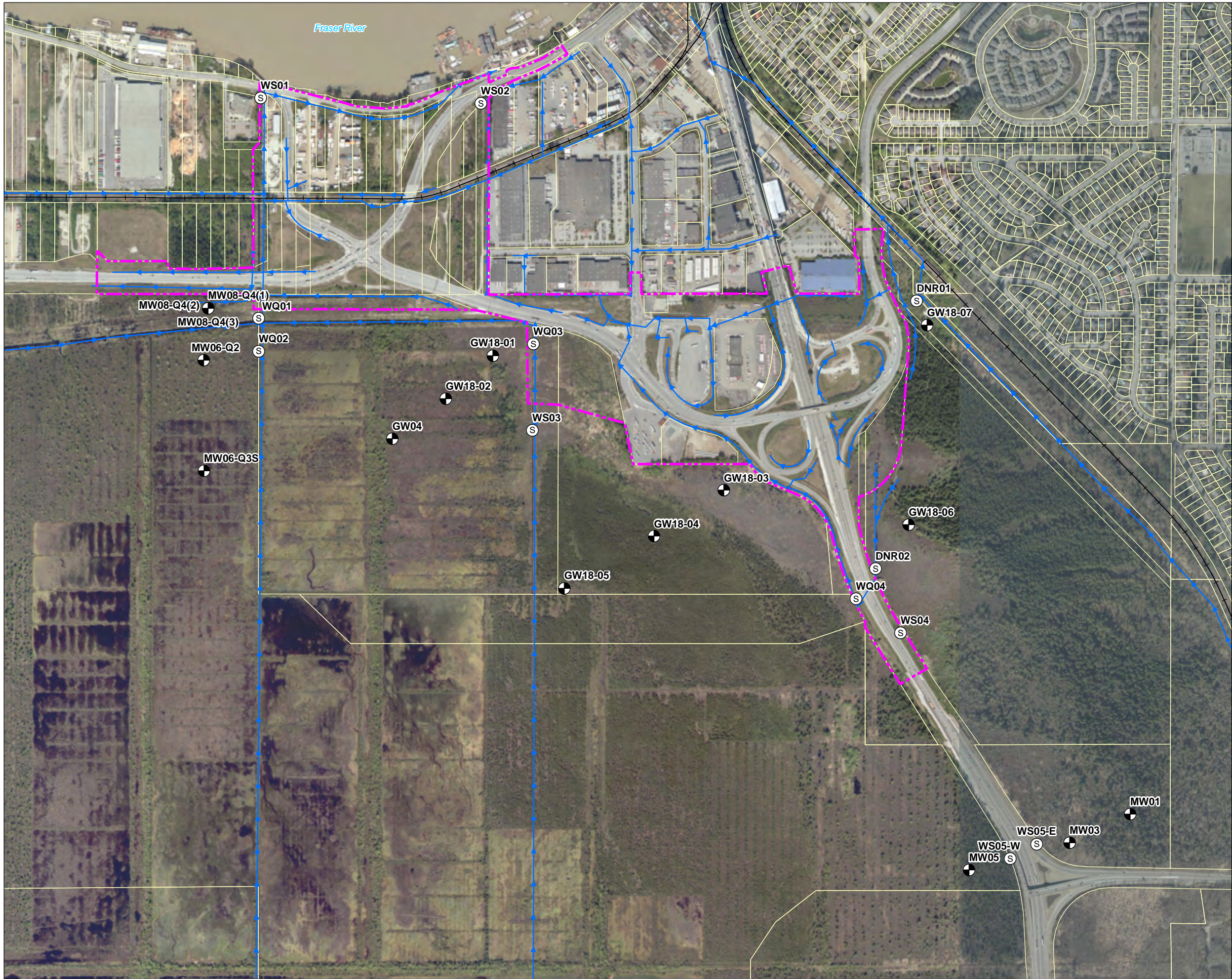
Parameter	Units	Location	DNR02	DNR02	RPD (%)	MW03	MW03	RPD (%)	MW08-Q4 (3)	MW08-Q4 (3)	RPD (%)	WS01	WS01	RPD (%)	WS02	WS02	RPD (%)	WS05-E	WS05-E	RPD (%)
		Sample ID	DNR02	SW20-101		MW03	MW20-200		MW08-Q4 (3)	MW20-100		SW-BINN854	SW-BINN854		SW-BINN854	SW-BINN854		SW20-100	WS05-E	
		Sample Date	08/12/2020	08/12/2020		08/12/2020	08/12/2020		21/09/2020	21/09/2020		11/04/2020	11/04/2020		13/09/2019	13/09/2019		08/12/2020	08/12/2020	
Molybdenum	µg/L	-	-	-	-	-	-	-	-	-	-	0.058	0.055	2.65%	1.37	1.36	0.37%	-	-	-
Molybdenum (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	0.055	0.082	19.71%	1.45	1.41	1.40%	-	-	-
Nickel	µg/L	-	-	-	-	-	-	-	-	-	-	1.11	1.17	2.63%	4.27	4.72	5.01%	-	-	-
Nickel (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	1.02	1.04	0.97%	2	1.97	0.76%	-	-	-
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	0.455	0.452	0.33%	3.01	2.97	0.67%	-	-	-
Potassium (Filtered)	mg/L	-	-	-	-	-	-	-	-	-	-	0.453	0.457	0.44%	3.18	3.17	0.16%	-	-	-
Rubidium	µg/L	-	-	-	-	-	-	-	-	-	-	0.44	0.37	8.64%	3.34	3.48	2.05%	-	-	-
Rubidium (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	0.41	0.41	0.00%	3.2	3.3	1.54%	-	-	-
Selenium	µg/L	-	-	-	-	-	-	-	-	-	-	0.106	0.128	9.40%	0.084	0.111	13.85%	-	-	-
Selenium (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	0.059	0.073	10.61%	0.062	0.073	8.15%	-	-	-
Silicon	µg/L	-	-	-	-	-	-	-	-	-	-	830	780	3.11%	9070	9630	2.99%	-	-	-
Silicon (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	721	719	0.14%	7860	7790	0.45%	-	-	-
Silver	µg/L	-	-	-	-	-	-	-	-	-	-	<0.01	<0.01	-	<0.01	<0.01	-	-	-	-
Silver (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	<0.01	<0.01	-	<0.01	<0.01	-	-	-	-
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	5.48	5.45	0.27%	82.7	79.9	1.72%	-	-	-
Sodium (Filtered)	mg/L	-	-	-	-	-	-	-	-	-	-	5.05	5.28	2.23%	92.7	94.6	1.01%	-	-	-
Strontium	µg/L	-	-	-	-	-	-	-	-	-	-	36.4	35.4	1.39%	219	219	0.00%	-	-	-
Strontium (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	37.7	38.5	1.05%	205	210	1.20%	-	-	-
Sulfur, elemental	µg/L	-	-	-	-	-	-	-	-	-	-	570	620	4.20%	1340	1250	3.47%	-	-	-
Sulfur, elemental (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	510	590	7.27%	1050	1240	8.30%	-	-	-
Tellurium	µg/L	-	-	-	-	-	-	-	-	-	-	<2	<2	-	<0.2	<0.2	-	-	-	-
Tellurium (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	<0.2	<0.2	-	<0.2	<0.2	-	-	-	-
Thallium	µg/L	-	-	-	-	-	-	-	-	-	-	<0.01	<0.01	-	0.011	0.012	4.35%	-	-	-
Thallium (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	<0.01	<0.01	-	<0.01	<0.01	-	-	-	-
Thorium	µg/L	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	-	0.17	0.19	5.56%	-	-	-
Thorium (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	-	<0.1	<0.1	-	-	-	-
Tin	µg/L	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	-	<0.1	0.15	-	-	-	-
Tin (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	-	<0.1	<0.1	-	-	-	-
Titanium	µg/L	-	-	-	-	-	-	-	-	-	-	9.08	8.48	3.42%	60.8	75.6	10.85%	-	-	-
Titanium (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	6.65	6.6	0.38%	0.33	0.37	5.71%	-	-	-
Tungsten	µg/L	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	-	<0.1	<0.1	-	-	-	-
Tungsten (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	-	<0.1	<0.1	-	-	-	-
Uranium	µg/L	-	-	-	-	-	-	-	-	-	-	0.027	0.026	1.89%	0.289	0.297	1.37%	-	-	-
Uranium (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	0.021	0.021	0.00%	0.218	0.215	0.69%	-	-	-
Vanadium	µg/L	-	-	-	-	-	-	-	-	-	-	1.08	1.06	0.93%	4.91	5.47	5.39%	-	-	-
Vanadium (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	0.9	0.91	0.55%	<0.5	<0.5	-	-	-	-
Zinc	µg/L	-	-	-	-	-	-	-	-	-	-	7.5	6.2	9.49%	9.7	12.2	11.42%	-	-	-
Zinc (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	10	9.2	4.17%	2.7	2.7	0.00%	-	-	-
Zirconium	µg/L	-	-	-	-	-	-	-	-	-	-	0.3	0.28	3.45%	0.91	1.04	6.67%	-	-	-
Zirconium (Filtered)	µg/L	-	-	-	-	-	-	-	-	-	-	0.27	0.29	3.57%	<0.2	<0.2	-	-	-	-
PHCs																				
Oil and grease	µg/L	-	-	-	-	-	-	-	-	-	-	<5000	<5000	-	<5000	<5000	-	-	-	-
PAH																				
Acenaphthene	µg/L	-	-	-	-	-	-	-	-	-	-	<10	<10	-	<0.01	<0.01	-	-	-	-
Acenaphthylene	µg/L	-	-	-	-	-	-	-	-	-	-	<10	<10	-	<0.01	<0.01	-	-	-	-
Acridine	µg/L	-	-	-	-	-	-	-	-	-	-	<10	<10	-	<0.01	<0.01	-	-	-	-
Anthracene	µg/L	-	-	-	-	-	-	-	-	-	-	<10	<10	-	<0.01	<0.01	-	-	-	-
Benzo(a)pyrene	µg/L	-	-	-	-	-	-	-	-	-	-	<5	<5	-	<0.005	<0.005	-	-	-	-
Benzo(b+j)fluoranthenes	µg/L	-	-	-	-	-	-	-	-	-	-	<10	<10	-	<0.01	<0.01	-	-	-	-
Benzo(b+j+k)fluoranthene	µg/L	-	-	-	-	-	-	-	-	-	-	<15	<15	-	<0.015	<0.015	-	-	-	-
Benzo(g,h,i)perylene	µg/L	-	-	-	-	-	-	-	-	-	-	<10	<10	-	<0.01	<0.01	-	-	-	-
Benzo(k)fluoranthene	µg/L	-	-	-	-	-	-	-	-	-	-	<10	<10	-	<0.01	<0.01	-	-	-	-
Chrysene	µg/L	-	-	-	-	-	-	-	-	-	-	<10	<10	-	<0.01	<0.01	-	-	-	-
Dibenz(a,h)anthracene	µg/L	-	-	-	-	-	-	-	-	-	-	<5	<5	-	<0.005	<0.005	-	-	-	-
Fluoranthene	µg/L	-	-	-	-	-	-	-	-	-	-	<10	<10	-	<0.01	<0.01	-	-	-	-
Fluorene	µg/L	-	-	-	-	-	-	-	-	-	-	<10	<10	-	<0.01	<0.01	-	-	-	-
Indeno(1,2,3-cd)pyrene	µg/L	-	-	-	-	-	-	-	-	-	-	<10	<10	-	<0.01	<0.01	-	-	-	-
Methylnaphthalene, 1-	µg/L	-	-	-	-	-	-	-	-	-	-	<10	<10	-	<0.05	<0.05	-	-	-	-
Methylnaphthalene, 2-	µg/L	-	-	-	-	-	-	-	-	-	-	<10	<10	-	<0.05	<0.05	-	-	-	-
Naphthalene	µg/L	-	-	-	-	-	-	-	-	-	-	<50	<50	-	<0.05	<0.05	-	-	-	-
Phenanthrene	µg/L	-	-	-	-	-	-	-	-	-	-	<20	<20	-	<0.02	<0.02	-	-	-	-
Pyrene	µg/L	-	-	-	-	-	-	-	-	-	-	<10	<10	-	<0.01	<0.01	-	-	-	-
Quinoline	µg/L	-	-	-	-	-	-	-	-	-	-	<50	<50	-	<0.05	<0.05	-	-	-	-
Biota																				
Total Coliform	CFU/100mL	-	-	-	-	-	-	-	-	-	-	<800	500	-	-	-	-	-	-	-
Coliform Bacteria - Fecal	CFU/100mL	-	-	-	-	-	-	-	-	-	-	-	-	-	41	42	-	-	-	-

FIGURES

Figure 1 Groundwater and Surface Water Sampling Locations

Figure 2 Spatial Distribution of Bog Water Types

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Groundwater and Surface
Water Monitoring Locations



Legend

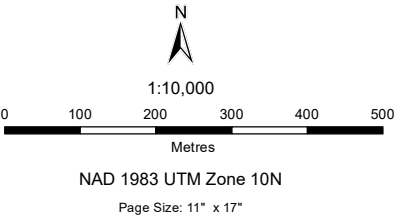
- Groundwater Sampling Location (Hatfield, 2019)
- Surface Water Sampling Location (Hatfield, 2019)
- Drainage Flow Direction
- Railway
- Highway 91/17 Upgrade Project Footprint
- Property Line

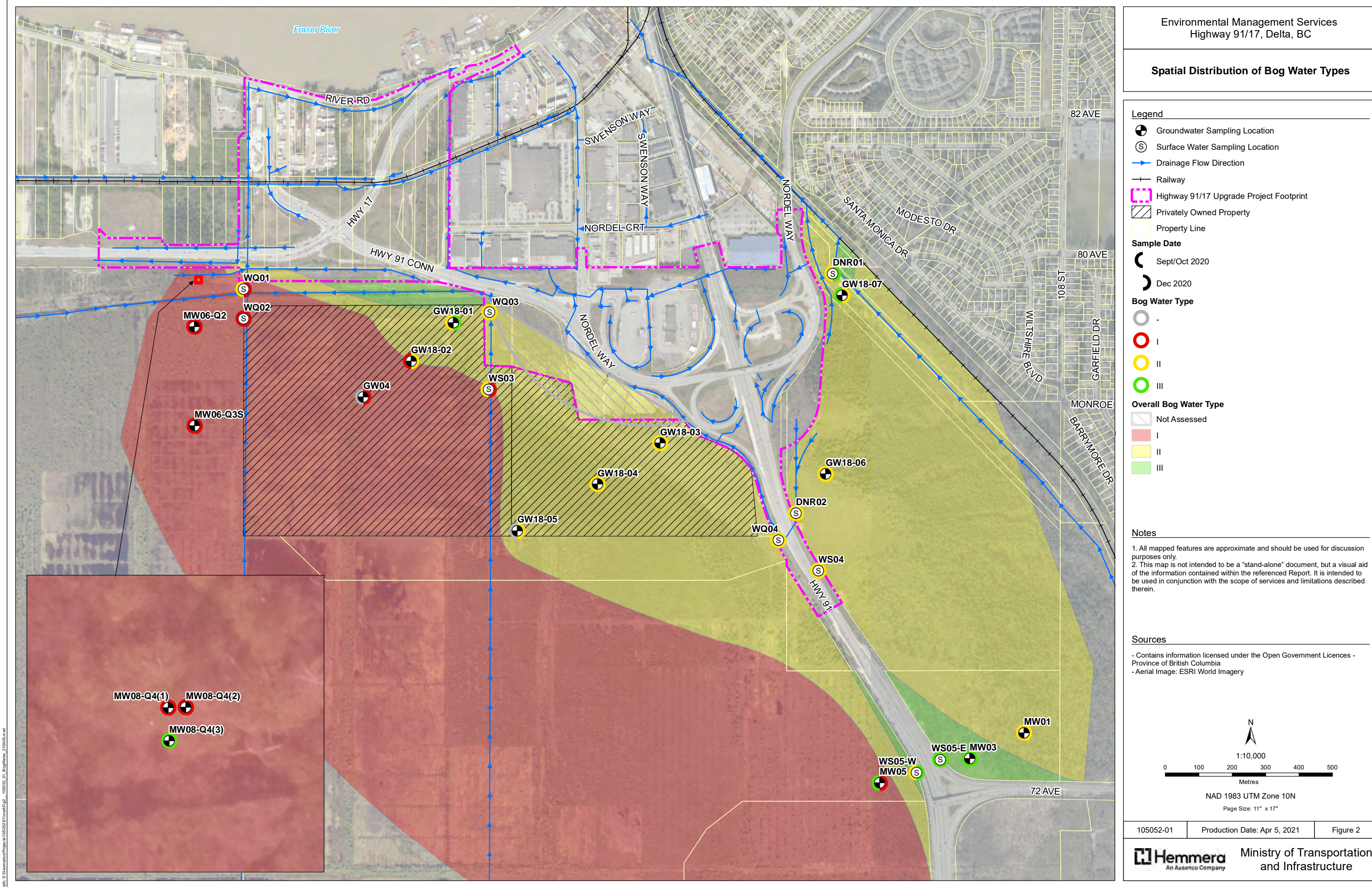
Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Contains information licensed under the Open Government Licences - Province of British Columbia
- Aerial Image: ESRI World Imagery
- Inset Basemap: ESRI World Topographic Map





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APPENDIX A

Field Photographs



Photo 1 MW06-Q2, October 2020



Photo 2 MW06-Q3S, October 2020



Photo 3 MW08-Q4, September 2020



Photo 4 MW01, October 2020



Photo 5 MW03, October 2020



Photo 6 MW05, October 2020



Photo 7 GW04, October 2020



Photo 8 GW18-01, October 2020



Photo 9 GW18-02, October 2020



Photo 10 GW18-03, September 2020



Photo 11 GW18-04, September 2020



Photo 12 GW18-06, December 2020



Photo 13 GW18-07, October 2020



Photo 14 WQ01, September 2020



Photo 15 WQ02, October 2020



Photo 16 WQ04, October 2020



Photo 17 WS01 located below access bridge, September 2020



Photo 18 WS02, December 2020



Photo 19 WS03, October 2020



Photo 20 WS04, September 2020



Photo 21 WS05-E (stilling well located at back of storm drain cover), September 2020



Photo 22 WS05-W, December 2020



Photo 23 DNR01, December 2020



Photo 24 DNR02, September

Not photographed: WQ03, GW18-05

APPENDIX B

Sampling Event Summary

The following tables provide a summary of the sampling completed at the groundwater and surface water locations as well as the locations of continuous monitoring equipment (Levelloggers and Sondes).

Table A 2020 Groundwater Sampling Summary

Well ID	Sampling Planned ²	Sampled in January (Hatfield)	Sampled in April (Hatfield)	Sampled in October (Hemmera)	Sampled in December (Hemmera)	Levellogger Expected (Y/N)	Levellogger Located ² (Y/N)
MW06-Q2	Y	N	N	Y	Y	Y	Y
MW06-Q3S	Y	N	N	Y	Y	Y	Y
MW08-Q4(1)	Y	N	N	Y	Y	Y	Y
MW08-Q4(2)	Y	N	N	Y	Y	N	N
MW08-Q4(3)	Y	N	N	Y	Y	Y	Y
MW01	Y	N	N	Y	Y	Y	Y
MW03	Y	N	N	Y	Y	Y	Y
MW05	Y	N	N	Y	Y	Y	Y
GW04	Y	N	N	N	Y	Y	Y
GW18-01	Y	N	N	Y	Y	Y	Y
GW18-02	Y	N	N	Y	Y	Y	Y
GW18-03	Y	N	N	Y	N	Y	Y
GW18-04	Y	N	N	Y	Y	Y	Y
GW18-05	Y	N	N	N	Y	Y	Y
GW18-06	Y	N	N	Y	Y	Y	Y
GW18-07 ¹	Y	N	N	Y	Y	Y	N

Notes:

1. In addition to a Levellogger, GW18-07 also had a Barologger installed to measure atmospheric pressure changes.
2. Located by Hemmera during October or December field events.

Table B Surface Water 2020 Sampling Summary

Station ID	Sampling Planned ¹	Sept 2019 (Hatfield)	April 2020 (Hatfield)	Sept/ October 2020 (Hemmera)	December 2020 (Hemmera)	Levellogger Expected (Y/N)	Levellogger Located ³ (Y/N)	Water Quality Sonde Expected (Y/N)	Sonde Located/ Deployed (Y/N)
WQ01	Y	N	N	Y	Y	Y	Y	Y	N
WQ02	Y	N	N	Y	Y	Y	Y	Y	N
WQ03	Y	N	N	Y	Y	Y	Y	Y	N
WQ04	Y	N	N	Y	Y	Y	Y	Y	N
WS01	Y	Y	Y	N	Y	Y	Y	N	-
WS02	Y	Y	Y	N	Y	Y	Y	N	-
WS03	Y	N	N	Y	Y	Y	Y	N	-
WS04	Y	N	N	Y	Y	Y	Y	N	-
WS05-E	Y	N	N	Y	Y	Y	Y	N	-
WS05-W	Y	N	N	Y	Y	Y	Y	N	-
DNR01	Y	N	N	Y	Y	-	-	-	-
DNR02	Y	N	N	Y	Y	-	-	-	-

Notes:

1. All coordinates are shown in NAD 83 UTM Zone 10.
2. There are no stilling wells at DNR01 and DNR02 and therefore Levelloggers cannot be installed at these locations.
3. Located by Hemmera during October or December field events.

APPENDIX C

Laboratory Certificates of Analysis



HATFIELD CONSULTANTS
ATTN: Paul Kobler
200-850 Harbourside Drive
North Vancouver BC V7P 0A3

Date Received: 11-SEP-19
Report Date: 24-SEP-19 10:27 (MT)
Version: FINAL

Client Phone: 604-926-3261

Certificate of Analysis

Lab Work Order #: L2345591
Project P.O. #: NOT SUBMITTED
Job Reference: BINN8545
C of C Numbers: 17-763289
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L2345591-1 SW 11-SEP-19 09:30 SW-BINN8545- 11092019-BS-01	L2345591-2 SW 11-SEP-19 09:30 SW-BINN8545- 11092019-BS-02	L2345591-3 SW 11-SEP-19 12:30 SW-BINN8545- 11092019-BS-03		
Grouping	Analyte						
WATER							
Physical Tests	Colour, True (CU)	36.1	36.3	125			
	Conductivity (uS/cm)	721	724	205			
	Hardness (as CaCO3) (mg/L)	129	132	77.6			
	pH (pH)	8.15	8.13	7.88			
	Salinity (psu)	<1.0	<1.0	<1.0			
	Total Suspended Solids (mg/L)	54.4	49.0	<3.0			
	Total Dissolved Solids (mg/L)	437	432	156			
	Turbidity (NTU)	74.5	66.0	10.3			
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	135	139	57.8			
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0			
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0			
	Alkalinity, Total (as CaCO3) (mg/L)	135	139	57.8			
	Bromide (Br) (mg/L)	<0.25 ^{DLDS}	<0.25 ^{DLDS}	<0.050			
	Chloride (Cl) (mg/L)	147	147	11.4			
	Fluoride (F) (mg/L)	<0.10 ^{DLDS}	<0.10 ^{DLDS}	0.050			
	Nitrate (as N) (mg/L)	<0.025 ^{DLDS}	<0.025 ^{DLDS}	0.0436			
	Nitrite (as N) (mg/L)	<0.0050 ^{DLDS}	<0.0050 ^{DLDS}	0.0030			
	Sulfate (SO4) (mg/L)	<1.5 ^{DLDS}	<1.5 ^{DLDS}	27.5			
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	11.9	12.1	11.9			
	Total Organic Carbon (mg/L)	13.4	15.7	12.0			
Bacteriological Tests	Coliform Bacteria - Fecal (CFU/100mL)	41	42	106			
	Coliform Bacteria - Total (CFU/100mL)	15300 ^{MBER}	11600 ^{MBER}	5900			
Total Metals	Aluminum (Al)-Total (mg/L)	1.59	1.88	0.165			
	Antimony (Sb)-Total (mg/L)	0.00019	0.00020	0.00013			
	Arsenic (As)-Total (mg/L)	0.00137	0.00144	0.00154			
	Barium (Ba)-Total (mg/L)	0.0970	0.100	0.0223			
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010			
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050			
	Boron (B)-Total (mg/L)	0.029	0.029	0.019			
	Cadmium (Cd)-Total (mg/L)	0.0000432	0.0000468	0.0000115			
	Calcium (Ca)-Total (mg/L)	35.2	34.8	22.1			
	Cesium (Cs)-Total (mg/L)	0.000125	0.000138	0.000015			
	Chromium (Cr)-Total (mg/L)	0.00348	0.00404	0.00078			
	Cobalt (Co)-Total (mg/L)	0.00145	0.00157	0.00024			
	Copper (Cu)-Total (mg/L)	0.00368	0.00416	0.00135			
	Iron (Fe)-Total (mg/L)	5.72	6.29	2.06			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L2345591-1 SW 11-SEP-19 09:30 SW-BINN8545- 11092019-BS-01	L2345591-2 SW 11-SEP-19 09:30 SW-BINN8545- 11092019-BS-02	L2345591-3 SW 11-SEP-19 12:30 SW-BINN8545- 11092019-BS-03		
Grouping	Analyte						
WATER							
Total Metals	Lead (Pb)-Total (mg/L)	0.000559	0.000674	0.000342			
	Lithium (Li)-Total (mg/L)	0.0035	0.0039	0.0012			
	Magnesium (Mg)-Total (mg/L)	10.8	10.3	5.77			
	Manganese (Mn)-Total (mg/L)	2.11	2.08	0.163			
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050			
	Molybdenum (Mo)-Total (mg/L)	0.00137	0.00136	0.000711			
	Nickel (Ni)-Total (mg/L)	0.00427	0.00472	0.00112			
	Phosphorus (P)-Total (mg/L)	<0.050	0.058	<0.050			
	Potassium (K)-Total (mg/L)	3.01	2.97	1.20			
	Rubidium (Rb)-Total (mg/L)	0.00334	0.00348	0.00135			
	Selenium (Se)-Total (mg/L)	0.000084	0.000111	0.000082			
	Silicon (Si)-Total (mg/L)	9.07	9.63	3.87			
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010			
	Sodium (Na)-Total (mg/L)	82.7	79.9	9.83			
	Strontium (Sr)-Total (mg/L)	0.219	0.219	0.129			
	Sulfur (S)-Total (mg/L)	1.34	1.25	2.64			
	Tellurium (Te)-Total (mg/L)	<0.00020	<0.00020	<0.00020			
	Thallium (Tl)-Total (mg/L)	0.000011	0.000012	<0.000010			
	Thorium (Th)-Total (mg/L)	0.00017	0.00019	<0.00010			
	Tin (Sn)-Total (mg/L)	<0.00010	0.00015	0.00011			
	Titanium (Ti)-Total (mg/L)	0.0608	0.0756	0.00747			
	Tungsten (W)-Total (mg/L)	<0.00010	<0.00010	<0.00010			
	Uranium (U)-Total (mg/L)	0.000289	0.000297	0.000156			
	Vanadium (V)-Total (mg/L)	0.00491	0.00547	0.00109			
	Zinc (Zn)-Total (mg/L)	0.0097	0.0122	<0.0030			
	Zirconium (Zr)-Total (mg/L)	0.00091	0.00104	0.00023			
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD			
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD			
	Aluminum (Al)-Dissolved (mg/L)	0.0085	0.0087	0.0617			
	Antimony (Sb)-Dissolved (mg/L)	0.00012	0.00013	0.00011			
	Arsenic (As)-Dissolved (mg/L)	0.00076	0.00077	0.00130			
	Barium (Ba)-Dissolved (mg/L)	0.0882	0.0880	0.0218			
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010			
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050			
	Boron (B)-Dissolved (mg/L)	0.034	0.033	0.020			
	Cadmium (Cd)-Dissolved (mg/L)	0.0000122	0.0000143	0.0000072			
	Calcium (Ca)-Dissolved (mg/L)	33.7	34.6	21.3			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L2345591-1 SW 11-SEP-19 09:30 SW-BINN8545- 11092019-BS-01	L2345591-2 SW 11-SEP-19 09:30 SW-BINN8545- 11092019-BS-02	L2345591-3 SW 11-SEP-19 12:30 SW-BINN8545- 11092019-BS-03		
Grouping	Analyte						
WATER							
Dissolved Metals	Cesium (Cs)-Dissolved (mg/L)	0.000033	0.000036	0.000010			
	Chromium (Cr)-Dissolved (mg/L)	0.00033	0.00038	0.00065			
	Cobalt (Co)-Dissolved (mg/L)	0.00092	0.00091	0.00018			
	Copper (Cu)-Dissolved (mg/L)	0.00178	0.00108	0.00111			
	Iron (Fe)-Dissolved (mg/L)	0.321	0.292	1.31			
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	0.000152			
	Lithium (Li)-Dissolved (mg/L)	0.0032	0.0032	0.0012			
	Magnesium (Mg)-Dissolved (mg/L)	11.0	11.1	5.93			
	Manganese (Mn)-Dissolved (mg/L)	2.42	2.48	0.170			
	Mercury (Hg)-Dissolved (mg/L)	<0.000025 ^{DLM}	<0.0000050	<0.0000050			
	Molybdenum (Mo)-Dissolved (mg/L)	0.00145	0.00141	0.000690			
	Nickel (Ni)-Dissolved (mg/L)	0.00200	0.00197	0.00112			
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050			
	Potassium (K)-Dissolved (mg/L)	3.18	3.17	1.26			
	Rubidium (Rb)-Dissolved (mg/L)	0.00320	0.00330	0.00130			
	Selenium (Se)-Dissolved (mg/L)	0.000062	0.000073	0.000091			
	Silicon (Si)-Dissolved (mg/L)	7.86	7.79	4.26			
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010			
	Sodium (Na)-Dissolved (mg/L)	92.7	94.6	10.3			
	Strontium (Sr)-Dissolved (mg/L)	0.205	0.210	0.123			
	Sulfur (S)-Dissolved (mg/L)	1.05	1.24	2.84			
	Tellurium (Te)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020			
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010			
	Thorium (Th)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010			
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010			
	Titanium (Ti)-Dissolved (mg/L)	0.00033	0.00037	0.00307			
	Tungsten (W)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010			
	Uranium (U)-Dissolved (mg/L)	0.000218	0.000215	0.000143			
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	0.00067			
	Zinc (Zn)-Dissolved (mg/L)	0.0027	0.0027	0.0014			
	Zirconium (Zr)-Dissolved (mg/L)	<0.00020	<0.00020	0.00022			
Aggregate Organics	BOD (mg/L)	3.0	2.7	<2.0			
	COD (mg/L)	39	47	37			
	Oil and Grease (mg/L)	<5.0	<5.0	<5.0			
	Tannin & Lignin (mg/L)	1.42	1.54	2.86			
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/L)	<0.000010	<0.000010	0.000021			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2345591-1 SW 11-SEP-19 09:30 SW-BINN8545- 11092019-BS-01	L2345591-2 SW 11-SEP-19 09:30 SW-BINN8545- 11092019-BS-02	L2345591-3 SW 11-SEP-19 12:30 SW-BINN8545- 11092019-BS-03		
Grouping	Analyte					
WATER						
Polycyclic Aromatic Hydrocarbons	Acenaphthylene (mg/L)	<0.000010	<0.000010	<0.000010		
	Acridine (mg/L)	<0.000010	<0.000010	<0.000010		
	Anthracene (mg/L)	<0.000010	<0.000010	<0.000010		
	Benz(a)anthracene (mg/L)	<0.000010	<0.000010	<0.000010		
	Benzo(a)pyrene (mg/L)	<0.0000050	<0.0000050	<0.0000050		
	Benzo(b&j)fluoranthene (mg/L)	<0.000010	<0.000010	<0.000010		
	Benzo(b+j+k)fluoranthene (mg/L)	<0.000015	<0.000015	<0.000015		
	Benzo(g,h,i)perylene (mg/L)	<0.000010	<0.000010	<0.000010		
	Benzo(k)fluoranthene (mg/L)	<0.000010	<0.000010	<0.000010		
	Chrysene (mg/L)	<0.000010	<0.000010	<0.000010		
	Dibenz(a,h)anthracene (mg/L)	<0.0000050	<0.0000050	<0.0000050		
	Fluoranthene (mg/L)	<0.000010	<0.000010	0.000014		
	Fluorene (mg/L)	<0.000010	<0.000010	0.000012		
	Indeno(1,2,3-c,d)pyrene (mg/L)	<0.000010	<0.000010	<0.000010		
	1-Methylnaphthalene (mg/L)	<0.000050	<0.000050	<0.000050		
	2-Methylnaphthalene (mg/L)	<0.000050	<0.000050	<0.000050		
	Naphthalene (mg/L)	<0.000050	<0.000050	<0.000050		
	Phenanthrene (mg/L)	<0.000020	<0.000020	0.000021		
	Pyrene (mg/L)	<0.000010	<0.000010	0.000011		
	Quinoline (mg/L)	<0.000050	<0.000050	<0.000050		
	Surrogate: Acridine d9 (%)	121.8	129.9	100.3		
	Surrogate: Chrysene d12 (%)	112.7	118.1	99.3		
	Surrogate: Naphthalene d8 (%)	103.1	107.9	93.4		
	Surrogate: Phenanthrene d10 (%)	118.3	126.5	106.6		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2345591-1, -2, -3
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2345591-1, -2, -3
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2345591-1, -2, -3
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L2345591-1, -2, -3
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2345591-1, -2, -3
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2345591-1, -2, -3
Matrix Spike	Barium (Ba)-Total	MS-B	L2345591-1, -2, -3
Matrix Spike	Calcium (Ca)-Total	MS-B	L2345591-1, -2, -3
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2345591-1, -2, -3
Matrix Spike	Sodium (Na)-Total	MS-B	L2345591-1, -2, -3
Matrix Spike	Strontium (Sr)-Total	MS-B	L2345591-1, -2, -3
Matrix Spike	Sulfur (S)-Total	MS-B	L2345591-1, -2, -3

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
MBER	Estimated Result (Microbiological test). Colony count outside ideal range. Result calculated from most nearly acceptable value.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
BOD5-VA	Water	Biochemical Oxygen Demand- 5 day	APHA 5210 B- BIOCHEMICAL OXYGEN DEMAND
This analysis is carried out using procedures adapted from APHA Method 5210 B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COD-COL-VA	Water	Chemical Oxygen Demand by Colorimetric	APHA 5220 D. CHEMICAL OXYGEN DEMAND
This analysis is carried out using procedures adapted from APHA Method 5220 "Chemical Oxygen Demand (COD)". Chemical oxygen demand is determined using the closed reflux colourimetric method.			
COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength
This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method.			
Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510

Reference Information

Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.

F-IC-N-VA Water Fluoride in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

FCOLI-MF-ENV-VA Water Fecal coliform by membrane filtration APHA METHOD 9222

This analysis is carried out using procedures adapted from APHA Method 9222 "Membrane Filter Technique for Members of the Coliform Group". Coliform bacteria is enumerated by culturing and colony counting. A known sample volume is filtered through a 0.45 micron membrane filter. The test involves an initial 24 hour incubation of the filter with the appropriate growth medium, positive results require further testing (up to an additional 48 hours) to confirm and quantify the total coliform. This method is used for non-turbid water with a low background bacteria level.

HARDNESS-CALC-VA Water Hardness APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO₃ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-VA Water Diss. Mercury in Water by CVAAS or CVAFS APHA 3030B/EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-CVAA-VA Water Total Mercury in Water by CVAAS or CVAFS EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

NO2-L-IC-N-VA Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

OGG-SF-VA Water Oil & Grease by Gravimetric BCMOE (2010), EPA1664A

The procedure involves an extraction of the entire water sample with hexane. This extract is then evaporated to dryness, and the residue weighed to determine Oil and Grease.

PAH-ME-MS-VA Water PAHs in Water EPA 3511/8270D (mod)

PAHs are extracted from water using a hexane micro-extraction technique, with analysis by GC/MS. Because the two isomers cannot be readily separated chromatographically, benzo(j)fluoranthene is reported as part of the benzo(b)fluoranthene parameter.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

SALINITY-CALC-VA Water Salinity by conductivity meter APHA 2520B

Salinity is determined by the APHA 2520B Electrical Conductivity Method. Salinity is a unitless parameter that is roughly equivalent to grams per Litre. ALS applies the unit of psu (practical salinity unit) to indicate that salinity values are derived from the Practical Salinity Scale.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TAN,LIG-WT Water Tannins & Lignins APHA 5550 B-Colorimetry

This analysis is carried out using procedures adapted from APHA Method 5550 B. "Tannin & Lignin ". Both lignin and tannin contain aromatic hydroxyl groups that react with Folin phenol reagent (tungstophosphoric and molybdophosphoric acids) to form a blue color suitable for the estimation of tannin and lignin concentrations. However, the reaction is not specific for lignin or tannin, nor for compounds containing aromatic hydroxyl groups, in as much as many other reducing materials, both organic and inorganic, respond similarly.

Interferences: Any substance able to reduce Folin phenol reagent will produce a false positive response. Organic chemicals known to interfere include hydroxylated aromatics, proteins, humic substances, nucleic acid bases, fructose, and amines. Inorganic substances known to interfere include iron

Reference Information

(II), manganese (II), nitrite, cyanide, bisulfite, sulfite, sulfide, hydrazine, and hydroxylamine hydrochloride. Both 2 mg ferrous iron/L and 125 mg sodium sulfite/L individually produce a color equivalent to 1 mg tannic acid/L.

TCOLI-MF-ENV-VA Water Total coliform by membrane filtration APHA METHOD 9222

This analysis is carried out using procedures adapted from APHA Method 9222 "Membrane Filter Technique for Members of the Coliform Group". Coliform bacteria is enumerated by culturing and colony counting. A known sample volume is filtered through a 0.45 micron membrane filter. The test involves an initial 24 hour incubation of the filter with the appropriate growth medium, positive results require further testing (up to an additional 48 hours) to confirm and quantify the total coliform. This method is used for non-turbid water with a low background bacteria level.

TDS-VA Water Total Dissolved Solids by Gravimetric APHA 2540 C - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TSS-VA Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

17-763289

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

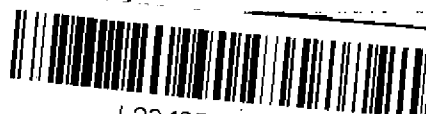
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com



L2345591-COFC

COC Number: 17 - 763289

Page 1 of 1

Report To		Report Format / Distribution		Contact your AM to confirm all E&P TATs (surcharges may apply)	
Company:	Hatfield Consultants	Select Report Format:	<input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)	Regular [R]	<input checked="" type="checkbox"/> If received by 3 pm - business days - no surcharges apply
Contact:	Paul Kohler	Quality Control (QC) Report with Report	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	PROPERTY (Business Days)	1 Business day [E - 100%]
Phone:	604-926-3261	<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked		4 day [P4-20%]	<input type="checkbox"/>
Company address below will appear on the final report:		Select Distribution:	<input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	3 day [P3-25%]	<input type="checkbox"/>
Street:	200-850 Harbourside Dr.	Email 1 or Fax:	PKohler@hatfieldgroup.com	2 day [P2-50%]	<input type="checkbox"/>
City/Province:	North Vancouver / BC	Email 2:	b.stevens@hatfieldgroup.com	Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)]	
Postal Code:	V7P 0A3	Email 3:		Date and Time Required for all E&P TATs: dd-mm-yy hh:mm	
Invoice To:	Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Invoice Distribution		For tests that can not be performed according to the service level selected, you will be contacted.	
	Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Select Invoice Distribution:	<input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	Analysis Request	
Company:		Email 1 or Fax:	SAME AS ABOVE	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below	
Contact:		Email 2:		NUMBER OF CONTAINERS	
Project Information		Oil and Gas Required Fields (client use)		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below	
ALS Account # / Quote #:	Q69520	AFE/Cost Center:	PO#	ALkalinity, anions, EC, pH, calcium	
Job #:	3WN8545	Major/Minor Code:	Routing Code:	TDS, TSS, Salinity, BOD	
PO / AFE:		Requisitioner:		TDC, DOC, COD	
LSD:		Location:		Total metals	
ALS Lab Work Order # (lab use only):		ALS Contact:	Sampler:	Dissolved metals	
Sample Identification and/or Coordinates (This description will appear on the report)		Date (dd-mm-yy)		Total coliform, fecal coliform	
SW-BINN8545-11092019-BS-01		11-Sep-19		Oil and grease	
SW-BINN8545-11092019-BS-02		11-Sep-19		PAHs	
SW-BINN8545-11092019-BS-03		11-Sep-19		Tannins, Lignins	
Drinking Water (DW) Samples ¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)		SAMPLE CONDITION AS RECEIVED (lab use only)	
Are samples taken from a Regulated DW System?		Filtered and preserved dissolved nutrients.		Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>	
<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		Preserved total nutrients.		Ice Packs <input checked="" type="checkbox"/> Ice Cubes <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>	
Are samples for human consumption/ use?		Filtered dissolved metals and mercury.		Cooling Initiated <input checked="" type="checkbox"/>	
<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO				INITIAL COOLER TEMPERATURES °C	
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL COOLER TEMPERATURES °C	
Released by:	Date:	Received by:	Date:	15	
Ben Stevenson	11-Sep-19				

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JUNE 2016 FRONT

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

CERTIFICATE OF ANALYSIS

Work Order : **VA20A4628**
Client : **Hatfield Consultants LLP**
Contact : Paul Kobler
Address : 200 - 850 Harbourside Drive
 North Vancouver BC Canada V7P 0A3
Telephone : 604 926 3261
Project : BINN8545
PO : ----
C-O-C number : 17-843602
Sampler : ----
Site : ----
Quote number : Q69520
No. of samples received : 3
No. of samples analysed : 3

Page : 1 of 8
Laboratory : Vancouver - Environmental
Account Manager : Brent Mack
Address : 8081 Lougheed Highway
 Burnaby BC Canada V5A 1W9
Telephone : +1 604 253 4188
Date Samples Received : 09-Apr-2020 12:57
Date Analysis Commenced : 09-Apr-2020
Issue Date : 17-Apr-2020 09:52

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Laboratory Department</i>
Aaron Yu	Laboratory Analyst	Metals, Burnaby, British Columbia
Angela Ren	Team Leader - Metals	Metals, Burnaby, British Columbia
Angelo Salandanan	Lab Assistant	Metals, Burnaby, British Columbia
Brieanna Allen	Department Manager - Organics	Organics, Burnaby, British Columbia
Bruna Botti	Analyst	Inorganics - Water Quality, Burnaby, British Columbia
Caitlin Macey	Team Leader - Inorganics	Inorganics - Water Quality, Burnaby, British Columbia
Caitlin Macey	Team Leader - Inorganics	Microbiology, Burnaby, British Columbia
Evan Ben-Oliel	Metal Analyst	Metals, Burnaby, British Columbia
Jon Fisher	Department Manager - Inorganics	Inorganics, Waterloo, Ontario
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Inorganics - Water Quality, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Inorganics - Water Quality, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia
Tracy Harley	Supervisor - Water Quality Instrumentation	Inorganics - Water Quality, Burnaby, British Columbia



General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	Description
-	No Unit
µg/L	micrograms per litre
µS/cm	Microsiemens per centimetre
CFU/100mL	colony forming units per 100 mL
CU	colour units
mg/L	milligrams per litre
NTU	nephelometric turbidity units
pH units	pH units
psu	practical salinity units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in reports identified as "Preliminary Report" are considered authorized for use.

Qualifiers

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
DTC	Dissolved concentration exceeds total. Results were confirmed by re-analysis.
RRV	Reported result verified by repeat analysis.



Analytical Results

Sub-Matrix: Surface Water

Client sample ID

(Matrix: Water)

					SW-BINN8545-0 9042020-BS-01	SW-BINN8545-0 9042020-BS-02	SW-BINN8545-0 9042020-BS-03	----	----
Client sampling date / time					09-Apr-2020 08:45	09-Apr-2020 10:45	09-Apr-2020 10:45	----	----
Analyte	CAS Number	Method	LOR	Unit	VA20A4628-001	VA20A4628-002	VA20A4628-003	-----	-----
					Result	Result	Result	----	----
Physical Tests									
alkalinity, bicarbonate (as CaCO ₃)	----	E290	1.0	mg/L	69.9	12.3	12.3	----	----
alkalinity, carbonate (as CaCO ₃)	----	E290	1.0	mg/L	<1.0	<1.0	<1.0	----	----
alkalinity, hydroxide (as CaCO ₃)	----	E290	1.0	mg/L	<1.0	<1.0	<1.0	----	----
alkalinity, phenolphthalein (as CaCO ₃)	----	E290	1.0	mg/L	<1.0	<1.0	<1.0	----	----
alkalinity, total (as CaCO ₃)	----	E290	1.0	mg/L	69.9	12.3	12.3	----	----
colour, true	----	E329	5.0	CU	16.0	581	589	----	----
conductivity	----	E100	2.0	µS/cm	162	61.0 ^{RRV}	60.3 ^{RRV}	----	----
hardness (as CaCO ₃), from total Ca/Mg	----	EC100A	0.60	mg/L	69.2	23.6	23.2	----	----
pH	----	E108	0.10	pH units	7.83	6.77	6.83	----	----
salinity	----	EC100S	1.0	psu	<1.0	<1.0	<1.0	----	----
solids, total dissolved [TDS]	----	E162	10	mg/L	104	107	108	----	----
solids, total suspended [TSS]	----	E160-H	3.0	mg/L	16.3	<3.0	<3.0	----	----
turbidity	----	E121	0.10	NTU	15.0	1.23	1.39	----	----
hardness (as CaCO ₃), dissolved	----	EC100	0.60	mg/L	64.3	23.0	23.1	----	----
Anions and Nutrients									
bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.050	<0.050	<0.050	----	----
chloride	16887-00-6	E235.Cl	0.50	mg/L	7.04	7.78	7.81	----	----
fluoride	16984-48-8	E235.F	0.020	mg/L	0.046	0.030	0.030	----	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	0.122	0.0108	0.0087	----	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	0.0023	<0.0010	<0.0010	----	----
sulfate (as SO ₄)	14808-79-8	E235.SO4	0.30	mg/L	10.6	0.75	0.77	----	----
Organic / Inorganic Carbon									
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	3.38	35.7	39.1	----	----
carbon, total organic [TOC]	----	E355-L	0.50	mg/L	3.36	40.1	41.8	----	----
Bacteriological Tests									
coliforms, thermotolerant [fecal]	----	E012.FC	1	CFU/100mL	29	<1	5	----	----
coliforms, total	----	E012.TC	1	CFU/100mL	500	800	500	----	----
Total Metals									
aluminum, total	7429-90-5	E420	0.0030	mg/L	0.587	0.326	0.314	----	----
antimony, total	7440-36-0	E420	0.00010	mg/L	<0.00010	0.00014	0.00018	----	----



Analytical Results

Sub-Matrix: Surface Water

Client sample ID

(Matrix: Water)

					SW-BINN8545-0 9042020-BS-01	SW-BINN8545-0 9042020-BS-02	SW-BINN8545-0 9042020-BS-03	----	----
Client sampling date / time					09-Apr-2020 08:45	09-Apr-2020 10:45	09-Apr-2020 10:45	----	----
Analyte	CAS Number	Method	LOR	Unit	VA20A4628-001	VA20A4628-002	VA20A4628-003	-----	-----
					Result	Result	Result	----	----
Total Metals									
arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00068	0.00167	0.00170	----	----
barium, total	7440-39-3	E420	0.00010	mg/L	0.0232	0.00851	0.00806	----	----
beryllium, total	7440-41-7	E420	0.000100	mg/L	<0.000100	<0.000100	<0.000100	----	----
bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	<0.000050	----	----
boron, total	7440-42-8	E420	0.010	mg/L	<0.010	0.011	0.011	----	----
cadmium, total	7440-43-9	E420	0.0000050	mg/L	0.0000257	0.0000171	0.0000138	----	----
calcium, total	7440-70-2	E420	0.050	mg/L	18.8	6.39	6.28	----	----
cesium, total	7440-46-2	E420	0.000010	mg/L	0.000044	0.000012	0.000013	----	----
chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00131	0.00091	0.00085	----	----
cobalt, total	7440-48-4	E420	0.00010	mg/L	0.00052	0.00040	0.00039	----	----
copper, total	7440-50-8	E420	0.00050	mg/L	0.00208	0.00219	0.00214	----	----
iron, total	7439-89-6	E420	0.010	mg/L	1.11	1.25	1.23	----	----
lead, total	7439-92-1	E420	0.000050	mg/L	0.000277	0.00151	0.00150	----	----
lithium, total	7439-93-2	E420	0.0010	mg/L	0.0013	<0.0010	<0.0010	----	----
magnesium, total	7439-95-4	E420	0.0050	mg/L	5.39	1.85	1.84	----	----
manganese, total	7439-96-5	E420	0.00010	mg/L	0.133	0.164	0.163	----	----
mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	0.0000061	0.0000058	----	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.000858	0.000058	0.000055	----	----
nickel, total	7440-02-0	E420	0.00050	mg/L	0.00210	0.00111	0.00117	----	----
phosphorus, total	7723-14-0	E420	0.050	mg/L	0.059	<0.050	<0.050	----	----
potassium, total	7440-09-7	E420	0.050	mg/L	1.17	0.455	0.452	----	----
rubidium, total	7440-17-7	E420	0.00020	mg/L	0.00138	0.00044	0.00037	----	----
selenium, total	7782-49-2	E420	0.000050	mg/L	0.000105	0.000106	0.000128	----	----
silicon, total	7440-21-3	E420	0.10	mg/L	4.67	0.83	0.78	----	----
silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	<0.000010	----	----
sodium, total	7440-23-5	E420	0.050	mg/L	7.26	5.48	5.45	----	----
strontium, total	7440-24-6	E420	0.00020	mg/L	0.0979	0.0364	0.0354	----	----
sulfur, total	7704-34-9	E420	0.50	mg/L	3.85	0.57	0.62	----	----
tellurium, total	13494-80-9	E420	0.00020	mg/L	<0.00020	<0.00020	<0.00020	----	----
thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	<0.000010	----	----
thorium, total	7440-29-1	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	----	----



Analytical Results

Sub-Matrix: Surface Water

Client sample ID

(Matrix: Water)

					SW-BINN8545-0 9042020-BS-01	SW-BINN8545-0 9042020-BS-02	SW-BINN8545-0 9042020-BS-03	----	----
Client sampling date / time					09-Apr-2020 08:45	09-Apr-2020 10:45	09-Apr-2020 10:45	----	----
Analyte	CAS Number	Method	LOR	Unit	VA20A4628-001	VA20A4628-002	VA20A4628-003	-----	-----
					Result	Result	Result	----	----
Total Metals									
tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	----	----
titanium, total	7440-32-6	E420	0.00030	mg/L	0.0262	0.00908	0.00848	----	----
tungsten, total	7440-33-7	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	----	----
uranium, total	7440-61-1	E420	0.000010	mg/L	0.000287	0.000027	0.000026	----	----
vanadium, total	7440-62-2	E420	0.00050	mg/L	0.00172	0.00108	0.00106	----	----
zinc, total	7440-66-6	E420	0.0030	mg/L	0.0048	0.0075	0.0062	----	----
zirconium, total	7440-67-7	E420	0.00020	mg/L	0.00050	0.00030	0.00028	----	----
Dissolved Metals									
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0120	0.274	0.272	----	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	<0.00010	0.00013	0.00013	----	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00039	0.00177	0.00182	----	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0173	0.00840	0.00910	----	----
beryllium, dissolved	7440-41-7	E421	0.000100	mg/L	<0.000100	<0.000100	<0.000100	----	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	<0.000050	----	----
boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.010	0.012	0.013	----	----
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.0000162	0.0000154	0.0000166	----	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L	17.4	6.22	6.29	----	----
cesium, dissolved	7440-46-2	E421	0.000010	mg/L	<0.000010	0.000010	<0.000010	----	----
chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	0.00012	0.00076	0.00076	----	----
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	0.00012	0.00037	0.00036	----	----
copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00159	0.00234	0.00308 ^{DTC}	----	----
iron, dissolved	7439-89-6	E421	0.010	mg/L	0.094	1.06	1.06	----	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	0.00132	0.00130	----	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	<0.0010	<0.0010	<0.0010	----	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	5.09	1.82	1.80	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.100	0.153	0.153	----	----
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	0.0000067	0.0000069	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.000920	0.000055	0.000082	----	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00069	0.00102	0.00104	----	----
phosphorus, dissolved	7723-14-0	E421	0.050	mg/L	<0.050	<0.050	<0.050	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L	1.06	0.453	0.457	----	----



Analytical Results

Sub-Matrix: Surface Water

Client sample ID

(Matrix: Water)

					SW-BINN8545-0 9042020-BS-01	SW-BINN8545-0 9042020-BS-02	SW-BINN8545-0 9042020-BS-03	----	----
Client sampling date / time					09-Apr-2020 08:45	09-Apr-2020 10:45	09-Apr-2020 10:45	----	----
Analyte	CAS Number	Method	LOR	Unit	VA20A4628-001	VA20A4628-002	VA20A4628-003	-----	-----
					Result	Result	Result	----	----
Dissolved Metals									
rubidium, dissolved	7440-17-7	E421	0.00020	mg/L	0.00084	0.00041	0.00041	----	----
selenium, dissolved	7782-49-2	E421	0.000050	mg/L	0.000131	0.000059	0.000073	----	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L	3.26	0.721	0.719	----	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	<0.000010	----	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L	6.65	5.05	5.28	----	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.0988	0.0377	0.0385	----	----
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	3.43	0.51	0.59	----	----
tellurium, dissolved	13494-80-9	E421	0.00020	mg/L	<0.00020	<0.00020	<0.00020	----	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	<0.000010	----	----
thorium, dissolved	7440-29-1	E421	0.00010	mg/L	<0.00010	<0.00010	<0.00010	----	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	<0.00010	----	----
titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	0.00665	0.00660	----	----
tungsten, dissolved	7440-33-7	E421	0.00010	mg/L	<0.00010	<0.00010	<0.00010	----	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.000257	0.000021	0.000021	----	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	0.00090	0.00091	----	----
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	0.0031	0.0100	0.0092	----	----
zirconium, dissolved	7440-67-7	E421	0.00020	mg/L	<0.00020	0.00027	0.00029	----	----
dissolved mercury filtration location	----	EP509	-	-	Field	Field	Field	----	----
dissolved metals filtration location	----	EP421	-	-	Field	Field	Field	----	----
Aggregate Organics									
biochemical oxygen demand [BOD]	----	E550	2.0	mg/L	<2.0	<2.0	<2.0	----	----
chemical oxygen demand [COD]	----	E559	20	mg/L	<20	106	105	----	----
oil & grease (gravimetric)	----	E567	5.0	mg/L	<5.0	<5.0	<5.0	----	----
oil & grease, mineral (gravimetric)	----	E567SG	5.0	mg/L	<5.0	<5.0	<5.0	----	----
tannin + lignin (as tannic acid)	----	E563	0.10	mg/L	0.37	11.6 ^{DLHC}	12.3 ^{DLHC}	----	----
Polycyclic Aromatic Hydrocarbons									
acenaphthene	83-32-9	E641A	0.010	µg/L	<0.010	<0.010	<0.010	----	----
acenaphthylene	208-96-8	E641A	0.010	µg/L	<0.010	<0.010	<0.010	----	----
acridine	260-94-6	E641A	0.010	µg/L	<0.010	<0.010	<0.010	----	----
anthracene	120-12-7	E641A	0.010	µg/L	<0.010	<0.010	<0.010	----	----
benz(a)anthracene	56-55-3	E641A	0.010	µg/L	<0.010	<0.010	<0.010	----	----



Analytical Results

Sub-Matrix: Surface Water

Client sample ID

(Matrix: Water)

					SW-BINN8545-0 9042020-BS-01	SW-BINN8545-0 9042020-BS-02	SW-BINN8545-0 9042020-BS-03	----	----
Client sampling date / time					09-Apr-2020 08:45	09-Apr-2020 10:45	09-Apr-2020 10:45	----	----
Analyte	CAS Number	Method	LOR	Unit	VA20A4628-001	VA20A4628-002	VA20A4628-003	-----	-----
					Result	Result	Result	----	----
Polycyclic Aromatic Hydrocarbons									
benzo(a)pyrene	50-32-8	E641A	0.0050	µg/L	<0.0050	<0.0050	<0.0050	----	----
benzo(b+j)fluoranthene	----	E641A	0.010	µg/L	<0.010	<0.010	<0.010	----	----
benzo(b+j+k)fluoranthene	----	E641A	0.015	µg/L	<0.015	<0.015	<0.015	----	----
benzo(g,h,i)perylene	191-24-2	E641A	0.010	µg/L	<0.010	<0.010	<0.010	----	----
benzo(k)fluoranthene	207-08-9	E641A	0.010	µg/L	<0.010	<0.010	<0.010	----	----
chrysene	218-01-9	E641A	0.010	µg/L	<0.010	<0.010	<0.010	----	----
dibenz(a,h)anthracene	53-70-3	E641A	0.0050	µg/L	<0.0050	<0.0050	<0.0050	----	----
fluoranthene	206-44-0	E641A	0.010	µg/L	<0.010	<0.010	<0.010	----	----
fluorene	86-73-7	E641A	0.010	µg/L	<0.010	<0.010	<0.010	----	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.010	µg/L	<0.010	<0.010	<0.010	----	----
methylnaphthalene, 1-	90-12-0	E641A	0.010	µg/L	<0.010	<0.010	<0.010	----	----
methylnaphthalene, 2-	91-57-6	E641A	0.010	µg/L	<0.010	<0.010	<0.010	----	----
methylnaphthalenes, 1+2-	----	E641A	0.015	µg/L	<0.015	<0.015	<0.015	----	----
naphthalene	91-20-3	E641A	0.050	µg/L	<0.050	<0.050	<0.050	----	----
phenanthrene	85-01-8	E641A	0.020	µg/L	<0.020	<0.020	<0.020	----	----
pyrene	129-00-0	E641A	0.010	µg/L	<0.010	<0.010	<0.010	----	----
quinoline	6027-02-7	E641A	0.050	µg/L	<0.050	<0.050	<0.050	----	----
B(a)P total potency equivalents [B(a)P TPE]	----	E641A	0.010	µg/L	<0.007	<0.007	<0.007	----	----
Polycyclic Aromatic Hydrocarbons Surrogates									
acridine-d9	34749-75-2	E641A	0.010	%	91.9	95.1	90.6	----	----
chrysene-d12	1719-03-5	E641A	0.010	%	121	125	122	----	----
naphthalene-d8	1146-65-2	E641A	0.010	%	79.1	86.9	81.1	----	----
phenanthrene-d10	1517-22-2	E641A	0.010	%	106	119	111	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.



Your Project #: 105052-01
Your C.O.C. #: c#620737-01-01

Attention: Evelyn Playle

HEMMERA ENVIROCHEM INC.
18th Floor, 4730 Kingsway
Burnaby, BC
Canada V5H 0C6

Report Date: 2020/09/28
Report #: R2934379
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C068671

Received: 2020/09/23, 08:00

Sample Matrix: Water
Samples Received: 7

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
Conductivity @25C	7	N/A	2020/09/24	BBY6SOP-00026	SM 23 2510 B m
Elements by CRC ICPMS (total)	7	2020/09/25	2020/09/26	BBY7SOP-00003 / BBY7SOP-00002	EPA 6020b R2 m
pH @25°C (1)	7	N/A	2020/09/24	BBY6SOP-00026	SM 23 4500-H+ B m

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.

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Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) The CCME method requires pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME holding time. Bureau Veritas Laboratories endeavours to analyze samples as soon as possible after receipt.



Your Project #: 105052-01
Your C.O.C. #: c#620737-01-01

Attention: Evelyn Playle

HEMMERA ENVIROCHEM INC.
18th Floor, 4730 Kingsway
Burnaby, BC
Canada V5H 0C6

Report Date: 2020/09/28

Report #: R2934379

Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C068671

Received: 2020/09/23, 08:00

Encryption Key



**AUTHORIZED REPORT
RAPPORT AUTORISÉ**

Bureau Veritas Laboratories

28 Sep 2020 12:22:42

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Gail Pedersen, Key Account Specialist

Email: Gail.Pedersen@bvlabs.com

Phone# (604) 734 7276

=====

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BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		YM5441	YM5442	YM5443	YM5444	YM5445	YM5446	YM5447		
Sampling Date		2020/09/21 14:46	2020/09/21 16:03	2020/09/21 16:37	2020/09/21 17:01	2020/09/21 17:01	2020/09/22 09:38	2020/09/22 15:05		
	UNITS	WQ01	MW08-Q4(1)	MW08-Q4(2)	MW08-Q4(3)	MW20-100	GW18-03	GW18-04	RDL	QC Batch
Misc. Inorganics										
Conductivity	uS/cm	48	95	47	170	180	110	110	2.0	A013419
pH	pH	5.27	3.92	5.20	6.98	7.15	6.18	5.72	N/A	A013418
RDL = Reportable Detection Limit N/A = Not Applicable										



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BV Labs Job #: C068671
Report Date: 2020/09/28

HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		YM5441	YM5442	YM5443		YM5444	YM5445		YM5446		
Sampling Date		2020/09/21 14:46	2020/09/21 16:03	2020/09/21 16:37		2020/09/21 17:01	2020/09/21 17:01		2020/09/22 09:38		
	UNITS	WQ01	MW08-Q4(1)	MW08-Q4(2)	RDL	MW08-Q4(3)	MW20-100	RDL	GW18-03	RDL	QC Batch
Total Metals by ICPMS											
Total Calcium (Ca)	ug/L	3910	1510	1520	50	15900	15500	100	4450	50	A016119
RDL = Reportable Detection Limit											

BV Labs ID		YM5447		
Sampling Date		2020/09/22 15:05		
	UNITS	GW18-04	RDL	QC Batch
Total Metals by ICPMS				
Total Calcium (Ca)	ug/L	3510	50	A016119
RDL = Reportable Detection Limit				



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VERITAS

BV Labs Job #: C068671
Report Date: 2020/09/28

HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01

GENERAL COMMENTS

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER) Comments

Sample YM5444 [MW08-Q4(3)] Elements by CRC ICPMS (total): RDL raised due to concentration over linear range, sample dilution required.
Sample YM5445 [MW20-100] Elements by CRC ICPMS (total): RDL raised due to concentration over linear range, sample dilution required.

Results relate only to the items tested.



BUREAU
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BV Labs Job #: C068671

Report Date: 2020/09/28

QUALITY ASSURANCE REPORT

HEMMERA ENVIROCHEM INC.

Client Project #: 105052-01

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
A013418	pH	2020/09/24			101	97 - 103			1.3	N/A
A013419	Conductivity	2020/09/24			101	80 - 120	<2.0	uS/cm	0	10
A016119	Total Calcium (Ca)	2020/09/26	NC	80 - 120	104	80 - 120	<50	ug/L		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)



BUREAU
VERITAS

BV Labs Job #: C068671
Report Date: 2020/09/28

HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

David Huang, M.Sc., P.Chem., QP, Scientific Services Manager

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Bureau Veritas Laboratories
4600 Canada Way, Burnaby, British Columbia Canada V5G 1K5 Tel: (604) 734 7276 Toll-free: 800-563-6266 Fax: (604) 731 2386 www.bvlab.com

Page of

11

INVOICE TO:		Report Information		Project Information	
Company Name	#1480 HEMMERA ENVIROCHEM INC.	Company Name	hemmera	Quotation #	B91471
Contact Name	Emma Zapf-Gilje / Evelyn Playle	Contact Name	eplayle	P.O. #	
Address	18th Floor, 4730 Kingsway Burnaby BC V5H 0C6	Address	skingbury emma-zapf-gilje@hemmera.com	Project #	105052-01
Phone	(604) 669-0424	Phone	(604) 669-0430	Project Name	
Email	emma.zapf-gilje@hemmera.com	Email	eplayle@hemmera.com	Site #	
Regulatory Criteria:		Special Instructions		ANALYSIS REQUESTED (PLEASE BE SPECIFIC)	
<input checked="" type="checkbox"/> CSR <input checked="" type="checkbox"/> CCME <input type="checkbox"/> BC Water Quality <input type="checkbox"/> Other				Metals Field Filtered * (Y/N)	
				Total Metals (P) Conductivity Total Calcium (P) pH	
SAMPLER MUST BE KEPT COOL (< 10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS					
Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	
1	WQ01	2010/09/21	14:46	water	
2	MW08-Q4(1)		16:03		
3	MW08-Q4(2)		16:37		
4	MW08-Q4(3)		17:01		
5	MW20-100		17:01		
6	GW18-03	2010/09/22	09:38		
7	GW18-04		15:05		
8					
9					
10					
RELINQUISHED BY: (Signature/Print)		Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	
[Signature]		2010/09/22	18:50	[Signature]	
		Date: (YY/MM/DD)	Time		
		2010/09/23	08:00		
# Items used and not submitted		Lab Use Only			
<input type="checkbox"/>		Temperature (°C) on Receipt		Custody Seal Intact on Cooler?	
		4,4,3		NA <input type="checkbox"/> Yes <input type="checkbox"/> No	
				White: BV Lab Yellow: Client	

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.



C068671_COC

Order #:
620737
Project Manager
Gail Pedersen



Your Project #: 105052-01
Your C.O.C. #: 620737-03-01

Attention: Evelyn Playle

HEMMERA ENVIROCHEM INC.
18th Floor, 4730 Kingsway
Burnaby, BC
Canada V5H 0C6

Report Date: 2020/10/01
Report #: R2936272
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C069504

Received: 2020/09/24, 17:30

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
Conductivity @25C	3	N/A	2020/09/26	BBY6SOP-00026	SM 23 2510 B m
Elements by CRC ICPMS (total)	3	2020/09/30	2020/10/01	BBY7SOP-00003 / BBY7SOP-00002	EPA 6020b R2 m
pH @25°C (1)	3	N/A	2020/09/26	BBY6SOP-00026	SM 23 4500-H+ B m

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

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Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.

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Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) The CCME method requires pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME holding time. Bureau Veritas Laboratories endeavours to analyze samples as soon as possible after receipt.



Your Project #: 105052-01
Your C.O.C. #: 620737-03-01

Attention: Evelyn Playle

HEMMERA ENVIROCHEM INC.
18th Floor, 4730 Kingsway
Burnaby, BC
Canada V5H 0C6

Report Date: 2020/10/01
Report #: R2936272
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C069504

Received: 2020/09/24, 17:30

Encryption Key



**AUTHORIZED REPORT
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Bureau Veritas Laboratories

01 Oct 2020 15:20:03

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Gail Pedersen, Key Account Specialist

Email: Gail.Pedersen@bvlabs.com

Phone# (604) 734 7276

=====

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BUREAU
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BV Labs Job #: C069504
Report Date: 2020/10/01

HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01

RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		YN0306	YN0307	YN0308		
Sampling Date		2020/09/24 12:24	2020/09/24 14:26	2020/09/24 14:43		
COC Number		620737-03-01	620737-03-01	620737-03-01		
	UNITS	WS05-E	WS04	DNR02	RDL	QC Batch
Misc. Inorganics						
Conductivity	uS/cm	210	160	44	2.0	A018107
pH	pH	6.76	6.86	6.40	N/A	A018106
RDL = Reportable Detection Limit N/A = Not Applicable						



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BV Labs Job #: C069504

Report Date: 2020/10/01

HEMMERA ENVIROCHEM INC.

Client Project #: 105052-01

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		YN0306	YN0307	YN0308		
Sampling Date		2020/09/24 12:24	2020/09/24 14:26	2020/09/24 14:43		
COC Number		620737-03-01	620737-03-01	620737-03-01		
	UNITS	WS05-E	WS04	DNR02	RDL	QC Batch
Total Metals by ICPMS						
Total Calcium (Ca)	ug/L	10500	6380	2210	50	A023860
RDL = Reportable Detection Limit						



BV Labs Job #: C069504
Report Date: 2020/10/01

HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01

GENERAL COMMENTS

Results relate only to the items tested.



BUREAU
VERITAS

BV Labs Job #: C069504

Report Date: 2020/10/01

QUALITY ASSURANCE REPORT

HEMMERA ENVIROCHEM INC.

Client Project #: 105052-01

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
A018106	pH	2020/09/26			101	97 - 103			0.15	N/A
A018107	Conductivity	2020/09/26			103	80 - 120	<2.0	uS/cm		
A023860	Total Calcium (Ca)	2020/10/01	98	80 - 120	99	80 - 120	<50	ug/L		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.



BUREAU
VERITAS

BV Labs Job #: C069504
Report Date: 2020/10/01

HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01

VALIDATION SIGNATURE PAGE

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David Huang, M.Sc., P.Chem., QP, Scientific Services Manager

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C069504_COC

Only

Bottle Order #:



620737

Project Manager

Gail Pedersen

INVOICE TO:
Name: #1480 HEMMERA ENVIROCHEM INC.
Name: Emma Zapf-Gilje
Address: 18th Floor, 4730 Kingsway
Burnaby BC V5H 0C6
(604) 669-0424 Fax: (604) 669-0430
emma.zapf-gilje@hemmera.com

Report Information
Company Name: eplaye
Contact Name: skingsbury
Address: emma.zapf-gilje@hemmera.com
Phone: eplaye@hemmera.com
Email: eplaye@hemmera.com

Project Information
Quotation #: B91471
P.O. #:
Project #: 105052-01
Project Name:
Site #:
Sampled By:

Regulatory Criteria:
☒ CSR
☒ CCME
☐ BC Water Quality
☐ Other

Special Instructions

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

Turnaround Time (TAT) Required:

Please provide advance notice for rush projects

Regular (Standard) TAT:

(will be applied if Rush TAT is not specified)

Standard TAT = 5-7 Working days for most tests.

Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)

1 DAY ☐ 2 Day ☐ 3 Day ☐ Date Required: ☐

Rush Confirmation Number: (call lab for #)

of Bottles

Comments

SAMPLES MUST BE KEPT COOL (< 10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Metals Field Filtered (Y/N)	Total Calcium (P)	Conductivity	pH
1	WS05-E	2020/09/24	12:24	water	N	X	X	X
2	WS04	↓	14:26	↓	N	X	X	X
3	DNRO2	↓	14:43	↓	N	X	X	X
4								
5								
6								
7								
8								
9								
10								

Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Metals Field Filtered (Y/N)	Total Calcium (P)	Conductivity	pH
1	WS05-E	2020/09/24	12:24	water	N	X	X	X
2	WS04	↓	14:26	↓	N	X	X	X
3	DNRO2	↓	14:43	↓	N	X	X	X
4								
5								
6								
7								
8								
9								
10								

* RELINQUISHED BY: (Signature/Print) Emma Zapf-Gilje Date: (YY/MM/DD) 2020/09/24 Time 17:25 RECEIVED BY: (Signature/Print) Carey Yan Date: (YY/MM/DD) 2020/09/24 Time 17:30 # jars used and not submitted

Lab Use Only
Time Sensitive ☐ Temperature (°C) on Receipt 15, 13, 14 Custody Seal Intact on Cooler? ☐ Yes ☒ No

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

ICE PACKS (4)



Your Project #: 105052-01
Your C.O.C. #: C#620737-02-01

Attention: Evelyn Playle

HEMMERA ENVIROCHEM INC.
18th Floor, 4730 Kingsway
Burnaby, BC
Canada V5H 0C6

Report Date: 2020/10/08
Report #: R2939719
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C071799

Received: 2020/10/01, 17:50

Sample Matrix: Water
Samples Received: 5

Analyses	Date		Date Analyzed	Laboratory Method	Analytical Method
	Quantity	Extracted			
Conductivity @25C	5	N/A	2020/10/05	BBY6SOP-00026	SM 23 2510 B m
Elements by CRC ICPMS (total)	5	2020/10/06	2020/10/08	BBY7SOP-00003 / BBY7SOP-00002	EPA 6020b R2 m
pH @25°C (1)	5	N/A	2020/10/05	BBY6SOP-00026	SM 23 4500-H+ B m

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.

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Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) The CCME method requires pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME holding time. Bureau Veritas Laboratories endeavours to analyze samples as soon as possible after receipt.



Your Project #: 105052-01
Your C.O.C. #: C#620737-02-01

Attention: Evelyn Playle

HEMMERA ENVIROCHEM INC.
18th Floor, 4730 Kingsway
Burnaby, BC
Canada V5H 0C6

Report Date: 2020/10/08
Report #: R2939719
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C071799

Received: 2020/10/01, 17:50

Encryption Key



**AUTHORIZED REPORT
RAPPORT AUTORISÉ**

Bureau Veritas Laboratories

08 Oct 2020 12:04:06

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Gail Pedersen, Key Account Specialist

Email: Gail.Pedersen@bvlabs.com

Phone# (604) 734 7276

=====

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BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



BV Labs Job #: C071799
Report Date: 2020/10/08

HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01

RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		YO4065	YO4066	YO4067	YO4068	YO4069		
Sampling Date		2020/10/01	2020/10/01	2020/10/01	2020/10/01	2020/10/01		
	UNITS	GW18-01	GW18-02	WQ03	GW18-03	W503	RDL	QC Batch
Misc. Inorganics								
Conductivity	uS/cm	79	51	72	35	91	2.0	A032843
pH	pH	6.53	5.82	4.88	5.22	4.19	N/A	A032842
RDL = Reportable Detection Limit N/A = Not Applicable								



BUREAU
VERITAS

BV Labs Job #: C071799
Report Date: 2020/10/08

HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		YO4065		YO4066	YO4067	YO4068	YO4069		
Sampling Date		2020/10/01		2020/10/01	2020/10/01	2020/10/01	2020/10/01		
	UNITS	GW18-01	RDL	GW18-02	WQ03	GW18-03	W503	RDL	QC Batch
Total Metals by ICPMS									
Total Calcium (Ca)	ug/L	7720	100	2460	3190	2140	3610	50	A034249
RDL = Reportable Detection Limit									



BUREAU
VERITAS

BV Labs Job #: C071799

Report Date: 2020/10/08

HEMMERA ENVIROCHEM INC.

Client Project #: 105052-01

GENERAL COMMENTS

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER) Comments

Sample YO4065 [GW18-01] Elements by CRC ICPMS (total): RDL raised due to concentration over linear range, sample dilution required.

Results relate only to the items tested.



BUREAU
VERITAS

BV Labs Job #: C071799

Report Date: 2020/10/08

QUALITY ASSURANCE REPORT

HEMMERA ENVIROCHEM INC.

Client Project #: 105052-01

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
A032842	pH	2020/10/05			101	97 - 103			0.39	N/A
A032843	Conductivity	2020/10/05			102	80 - 120	<2.0	uS/cm	0	10
A034249	Total Calcium (Ca)	2020/10/08	100	80 - 120	100	80 - 120	<50	ug/L		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.



BUREAU
VERITAS

BV Labs Job #: C071799
Report Date: 2020/10/08

HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

David Huang, M.Sc., P.Chem., QP, Scientific Services Manager

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Page of
1

Bureau Veritas Laboratories
4606 Canada Way, Burnaby, British Columbia Canada V5G 1K5 Tel: (604) 734 7276 Toll-free 800-563-6266 Fax: (604) 731 2386 www.bvlabs.com

INVOICE TO:

Company Name: #1480 HEMMERA ENVIROCHEM INC.
Contact Name: Emma Zapf-Gilje
Address: 18th Floor, 4730 Kingsway
Burnaby BC V5H 0C6
Phone: (604) 669-0424 Fax: (604) 669-0430
Email: emma.zapf-gilje@hemmera.com

Report Information

Company Name: eplalye
Contact Name: Skingibury
Address: emma.zapf-gilje@hemmera.com
Phone: eplalye@hemmera.com
Fax: eplalye@hemmera.com

Project Information

Quotation #: B91471
P.O. #: 105052-01
Project Name: 105052-01
Site #: 105052-01
Sampled By: 105052-01

Barcode

C071799_COC

Regulatory Criteria:

☒ CSR
☐ CCME
☒ BC Water Quality
☐ Other

Special Instructions

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

Media Field Filtered? (Y/N)

Conductivity
Total Calcium
pH

Turnaround Time (TAT) Required:

Please provide advance notice for rush projects

Regular (Standard) TAT:

(will be applied if Rush TAT is not specified)
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)

1 DAY ☐ 2 Day ☐ 3 Day ☐ Date Required: ☐

Rush Confirmation Number: (call lab for #)

SAMPLES MUST BE KEPT COOL (< 10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Media Field Filtered? (Y/N)	Conductivity	Total Calcium	pH
1 G-w18-01		20/10/01		water	N	X	X	X
2 G-w18-02						X	X	X
3 W-03						X	X	X
4 G-w18-03						X	X	X
5 W-03						X	X	X
6								
7								
8								
9								
10								

RELINQUISHED BY: (Signature/Print)

Steve Brown, Brown

Date: (YY/MM/DD)

20/10/01

Time

17:50

RECEIVED BY: (Signature/Print)

KEVIN CHOW

Date: (YY/MM/DD)

20/10/01

Time

17:50

jars used and not submitted

1/1

Time Sensitive

☒

Temperature (°C) on Receipt

19.18/19

Lab Use Only

Custody Seal Intact on Cooler?

☐ Yes ☒ No

White BV Labs

Yellow Client

IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.



Your Project #: 105052-01
Site Location: BURNS BOG
Your C.O.C. #: G149385

Attention: Evelyn Playle

HEMMERA ENVIROCHEM INC.
18th Floor, 4730 Kingsway
Burnaby, BC
Canada V5H 0C6

Report Date: 2020/10/08
Report #: R2939726
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C072283

Received: 2020/10/03, 13:45

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
Conductivity @25C	4	N/A	2020/10/06	BBY6SOP-00026	SM 23 2510 B m
Elements by CRC ICPMS (total)	4	2020/10/06	2020/10/08	BBY7SOP-00003 / BBY7SOP-00002	EPA 6020b R2 m
pH @25°C (1)	4	N/A	2020/10/06	BBY6SOP-00026	SM 23 4500-H+ B m

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

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Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) The CCME method requires pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME holding time. Bureau Veritas Laboratories endeavours to analyze samples as soon as possible after receipt.



Your Project #: 105052-01
Site Location: BURNS BOG
Your C.O.C. #: G149385

Attention: Evelyn Playle

HEMMERA ENVIROCHEM INC.
18th Floor, 4730 Kingsway
Burnaby, BC
Canada V5H 0C6

Report Date: 2020/10/08

Report #: R2939726

Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C072283

Received: 2020/10/03, 13:45

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Bureau Veritas Laboratories

08 Oct 2020 12:05:11

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Gail Pedersen, Key Account Specialist

Email: Gail.Pedersen@bvlabs.com

Phone# (604) 734 7276

=====

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BUREAU
VERITAS

BV Labs Job #: C072283
Report Date: 2020/10/08

HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01
Site Location: BURNS BOG
Sampler Initials: SB

RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		YO7029	YO7030	YO7031	YO7032		
Sampling Date		2020/10/02 16:00	2020/10/02 11:00	2020/10/02 09:30	2020/10/02 13:00		
COC Number		G149385	G149385	G149385	G149385		
	UNITS	MW03	MN06Q2	WQ02	MW06Q3	RDL	QC Batch
Misc. Inorganics							
Conductivity	uS/cm	330	33	70	29	2.0	A032999
pH	pH	6.95	5.87	4.25	5.02	N/A	A032978
RDL = Reportable Detection Limit N/A = Not Applicable							



BUREAU
VERITAS

BV Labs Job #: C072283
Report Date: 2020/10/08

HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01
Site Location: BURNS BOG
Sampler Initials: SB

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		YO7029	YO7030	YO7031	YO7032		
Sampling Date		2020/10/02 16:00	2020/10/02 11:00	2020/10/02 09:30	2020/10/02 13:00		
COC Number		G149385	G149385	G149385	G149385		
	UNITS	MW03	MN06Q2	WQ02	MW06Q3	RDL	QC Batch
Total Metals by ICPMS							
Total Calcium (Ca)	ug/L	15900	1010	1760	515	50	A035322
RDL = Reportable Detection Limit							



BUREAU
VERITAS

BV Labs Job #: C072283

Report Date: 2020/10/08

HEMMERA ENVIROCHEM INC.

Client Project #: 105052-01

Site Location: BURNS BOG

Sampler Initials: SB

GENERAL COMMENTS

Results relate only to the items tested.



BUREAU
VERITAS

BV Labs Job #: C072283

Report Date: 2020/10/08

QUALITY ASSURANCE REPORT

HEMMERA ENVIROCHEM INC.

Client Project #: 105052-01

Site Location: BURNS BOG

Sampler Initials: SB

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
A032978	pH	2020/10/06			101	97 - 103			2.8	N/A
A032999	Conductivity	2020/10/06			100	80 - 120	<2.0	uS/cm	0	10
A035322	Total Calcium (Ca)	2020/10/08	102	80 - 120	99	80 - 120	<50	ug/L		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

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Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.



BUREAU
VERITAS

BV Labs Job #: C072283
Report Date: 2020/10/08

HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01
Site Location: BURNS BOG
Sampler Initials: SB

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

David Huang, M.Sc., P.Chem., QP, Scientific Services Manager

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Your C.O.C. #: G149440

Attention: Evelyn Playle

HEMMERA ENVIROCHEM INC.
18th Floor, 4730 Kingsway
Burnaby, BC
Canada V5H 0C6

Report Date: 2020/10/22

Report #: R2945861

Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C075580

Received: 2020/10/15, 10:35

Sample Matrix: Water
Samples Received: 7

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
Conductivity @25C	7	N/A	2020/10/17	BBY6SOP-00026	SM 23 2510 B m
Elements by CRC ICPMS (total)	7	2020/10/20	2020/10/21	BBY7SOP-00003 / BBY7SOP-00002	EPA 6020b R2 m
pH @25°C (1)	7	N/A	2020/10/17	BBY6SOP-00026	SM 23 4500-H+ B m

Remarks:

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Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

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(1) The CCME method requires pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME holding time. Bureau Veritas Laboratories endeavours to analyze samples as soon as possible after receipt.



Your C.O.C. #: G149440

Attention: Evelyn Playle

HEMMERA ENVIROCHEM INC.
18th Floor, 4730 Kingsway
Burnaby, BC
Canada V5H 0C6

Report Date: 2020/10/22

Report #: R2945861

Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C075580

Received: 2020/10/15, 10:35

Encryption Key



**AUTHORIZED REPORT
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Bureau Veritas Laboratories

22 Oct 2020 11:35:08

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Gail Pedersen, Key Account Specialist

Email: Gail.Pedersen@bvlabs.com

Phone# (604) 734 7276

=====

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RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		YQ6768	YQ6769	YQ6770	YQ6771	YQ6772	YQ6773	YQ6774		
Sampling Date		2020/10/14 10:10	2020/10/14 14:02	2020/10/14 13:50	2020/10/14 12:15	2020/10/14 15:18	2020/10/14 11:45	2020/10/14 11:02		
COC Number		G149440	G149440	G149440	G149440	G149440	G149440	G149440		
	UNITS	MW01	DNR-01	GW1807	WS05-W	GW1806	MW05	WQ04	RDL	QC Batch

Misc. Inorganics

Conductivity	uS/cm	190	92	120	44	66	310	93	2.0	A052025
pH	pH	6.82	6.37	7.48	5.86	4.77	7.02	5.86	N/A	A052024

RDL = Reportable Detection Limit

N/A = Not Applicable



BUREAU
VERITAS

BV Labs Job #: C075580
Report Date: 2020/10/22

HEMMERA ENVIROCHEM INC.

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		YQ6768	YQ6769	YQ6770	YQ6771	YQ6772	YQ6773	YQ6774		
Sampling Date		2020/10/14 10:10	2020/10/14 14:02	2020/10/14 13:50	2020/10/14 12:15	2020/10/14 15:18	2020/10/14 11:45	2020/10/14 11:02		
COC Number		G149440	G149440	G149440	G149440	G149440	G149440	G149440		
	UNITS	MW01	DNR-01	GW1807	WS05-W	GW1806	MW05	WQ04	RDL	QC Batch

Total Metals by ICPMS

Total Calcium (Ca)	ug/L	5330	8400	12800	1110	2900	17400	8640	50	A056224
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RDL = Reportable Detection Limit



BUREAU
VERITAS

BV Labs Job #: C075580

Report Date: 2020/10/22

HEMMERA ENVIROCHEM INC.

GENERAL COMMENTS

Results relate only to the items tested.



BUREAU
VERITAS

BV Labs Job #: C075580

Report Date: 2020/10/22

QUALITY ASSURANCE REPORT

HEMMERA ENVIROCHEM INC.

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
A052024	pH	2020/10/17			101	97 - 103			1.0	N/A
A052025	Conductivity	2020/10/17			100	80 - 120	<2.0	uS/cm		
A056224	Total Calcium (Ca)	2020/10/21	NC	80 - 120	99	80 - 120	<50	ug/L		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)



BUREAU
VERITAS

BV Labs Job #: C075580
Report Date: 2020/10/22

HEMMERA ENVIROCHEM INC.

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

David Huang, M.Sc., P.Chem., QP, Scientific Services Manager

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



Your Project #: 105052-01
 Site Location: BURNS BOG
 Your C.O.C. #: g155958

Attention: Evelyn Playle

HEMMERA ENVIROCHEM INC.
 18th Floor, 4730 Kingsway
 Burnaby, BC
 Canada V5H 0C6

Report Date: 2020/12/11
 Report #: R2966122
 Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BV LABS JOB #: C089057

Received: 2020/12/02, 15:25

Sample Matrix: Water
 # Samples Received: 7

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Conductivity @25C	7	N/A	2020/12/03	BBY6SOP-00026	SM 23 2510 B m
Hardness Total (calculated as CaCO ₃) (1)	7	N/A	2020/12/09	BBY WI-00033	Auto Calc
Elements by CRC ICPMS (total)	7	2020/12/07	2020/12/09	BBY7SOP-00003 / BBY7SOP-00002	EPA 6020b R2 m
pH @25°C (2)	7	N/A	2020/12/03	BBY6SOP-00026	SM 23 4500-H+ B m

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

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Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.

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Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) "Total Hardness" was calculated from Total Ca and Mg concentrations and may be biased high (Hardness, or Dissolved Hardness, calculated from Dissolved Ca and Mg, should be used for compliance if available).

(2) The CCME method requires pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME holding time. Bureau Veritas Laboratories endeavours to analyze samples as soon as possible after receipt.



Your Project #: 105052-01
Site Location: BURNS BOG
Your C.O.C. #: g155958

Attention: Evelyn Playle

HEMMERA ENVIROCHEM INC.
18th Floor, 4730 Kingsway
Burnaby, BC
Canada V5H 0C6

Report Date: 2020/12/11
Report #: R2966122
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BV LABS JOB #: C089057

Received: 2020/12/02, 15:25

Encryption Key

Carmen McKay
Key Account Specialist
11 Dec 2020 10:30:15

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Gail Pedersen, Key Account Specialist

Email: Gail.Pedersen@bvlabs.com

Phone# (604) 734 7276

=====

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BUREAU
VERITAS

BV Labs Job #: C089057
Report Date: 2020/12/11

HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01
Site Location: BURNS BOG
Sampler Initials: SB

RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		YY8986	YY8987	YY8988	YY8989	YY8990	YY8991	YY8992		
Sampling Date		2020/12/02 08:20	2020/12/02 10:00	2020/12/02 12:02	2020/12/02 12:20	2020/12/02 13:30	2020/12/02 14:10	2020/12/02 11:05		
COC Number		g155958	g155958	g155958	g155958	g155958	g155958	g155958		
	UNITS	WS01	WS02	GW18 07	DNR01	WS05-W	MW05	GW18 06	RDL	QC Batch
Calculated Parameters										
Total Hardness (CaCO ₃)	mg/L	10.6	77.3	34.5	86.8	113	10.0	21.6	0.50	A101377
Misc. Inorganics										
Conductivity	uS/cm	46	220	120	180	530	34	58	2.0	A103451
pH	pH	4.96	7.43	6.49	7.14	6.93	5.59	5.49	N/A	A103429
RDL = Reportable Detection Limit N/A = Not Applicable										



BUREAU
VERITAS

BV Labs Job #: C089057
Report Date: 2020/12/11

HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01
Site Location: BURNS BOG
Sampler Initials: SB

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		YY8986	YY8987	YY8988	YY8989	YY8990	YY8991	YY8992		
Sampling Date		2020/12/02 08:20	2020/12/02 10:00	2020/12/02 12:02	2020/12/02 12:20	2020/12/02 13:30	2020/12/02 14:10	2020/12/02 11:05		
COC Number		g155958	g155958	g155958	g155958	g155958	g155958	g155958		
	UNITS	WS01	WS02	GW18 07	DNR01	WS05-W	MW05	GW18 06	RDL	QC Batch

Total Metals by ICPMS

Total Calcium (Ca)	ug/L	2530	21600	7920	26300	30500	1310	3860	50	A106386
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RDL = Reportable Detection Limit



BUREAU
VERITAS

BV Labs Job #: C089057

Report Date: 2020/12/11

HEMMERA ENVIROCHEM INC.

Client Project #: 105052-01

Site Location: BURNS BOG

Sampler Initials: SB

GENERAL COMMENTS

As per client request, the client ID for sample YY8989 was changed from DWR01 to DNR01. The client request was received 2020/12/11.

Results relate only to the items tested.



BUREAU
VERITAS

BV Labs Job #: C089057

Report Date: 2020/12/11

QUALITY ASSURANCE REPORT

HEMMERA ENVIROCHEM INC.

Client Project #: 105052-01

Site Location: BURNS BOG

Sampler Initials: SB

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
A103429	pH	2020/12/03			102	97 - 103			0.28	N/A
A103451	Conductivity	2020/12/03			100	80 - 120	<2.0	uS/cm	0.60	10
A106386	Total Calcium (Ca)	2020/12/09	104	80 - 120	101	80 - 120	<50	ug/L		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.



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VERITAS

BV Labs Job #: C089057
Report Date: 2020/12/11

HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01
Site Location: BURNS BOG
Sampler Initials: SB

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

David Huang, M.Sc., P.Chem., QP, Scientific Services Manager

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



Your Project #: 105052-01
Site Location: BURNS BOG
Your C.O.C. #: G155959

Attention: Evelyn Playle

HEMMERA ENVIROCHEM INC.
18th Floor, 4730 Kingsway
Burnaby, BC
Canada V5H 0C6

Report Date: 2020/12/10
Report #: R2965925
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C089469

Received: 2020/12/03, 16:45

Sample Matrix: Water
Samples Received: 6

Analyses	Date		Date Analyzed	Laboratory Method	Analytical Method
	Quantity	Extracted			
Conductivity @25C	6	N/A	2020/12/04	BBY6SOP-00026	SM 23 2510 B m
Hardness Total (calculated as CaCO ₃) (1)	6	N/A	2020/12/10	BBY WI-00033	Auto Calc
Elements by CRC ICPMS (total)	6	2020/12/07	2020/12/09	BBY7SOP-00003 / BBY7SOP-00002	EPA 6020b R2 m
pH @25°C (2)	6	N/A	2020/12/04	BBY6SOP-00026	SM 23 4500-H+ B m

Remarks:

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Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.

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Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) "Total Hardness" was calculated from Total Ca and Mg concentrations and may be biased high (Hardness, or Dissolved Hardness, calculated from Dissolved Ca and Mg, should be used for compliance if available).

(2) The CCME method requires pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME holding time. Bureau Veritas Laboratories endeavours to analyze samples as soon as possible after receipt.



Your Project #: 105052-01
Site Location: BURNS BOG
Your C.O.C. #: G155959

Attention: Evelyn Playle

HEMMERA ENVIROCHEM INC.
18th Floor, 4730 Kingsway
Burnaby, BC
Canada V5H 0C6

Report Date: 2020/12/10
Report #: R2965925
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C089469

Received: 2020/12/03, 16:45

Encryption Key



**AUTHORIZED REPORT
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Bureau Veritas Laboratories

10 Dec 2020 16:36:58

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Gail Pedersen, Key Account Specialist

Email: Gail.Pedersen@bvlabs.com

Phone# (604) 734 7276

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BUREAU
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BV Labs Job #: C089469

Report Date: 2020/12/10

HEMMERA ENVIROCHEM INC.

Client Project #: 105052-01

Site Location: BURNS BOG

Sampler Initials: SB

RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		YZ1057	YZ1058	YZ1059	YZ1060	YZ1061	YZ1062		
Sampling Date		2020/12/03 10:30	2020/12/03 09:50	2020/12/03 11:45	2020/12/03 12:30	2020/12/03 13:40	2020/12/03 15:15		
COC Number		G155959	G155959	G155959	G155959	G155959	G155959		
	UNITS	MW06-Q2	MW06-Q3S	GW04	GW1802	GW1801	WQ 02	RDL	QC Batch
Calculated Parameters									
Total Hardness (CaCO ₃)	mg/L	3.46	6.64	11.2	19.2	116	6.63	0.50	A102474
Misc. Inorganics									
Conductivity	uS/cm	37	37	42	77	110	51	2.0	A104935
pH	pH	4.71	4.96	5.14	6.06	6.24	4.23	N/A	A104934
RDL = Reportable Detection Limit									
N/A = Not Applicable									



BUREAU
VERITAS

BV Labs Job #: C089469

Report Date: 2020/12/10

HEMMERA ENVIROCHEM INC.

Client Project #: 105052-01

Site Location: BURNS BOG

Sampler Initials: SB

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		YZ1057	YZ1058	YZ1059	YZ1060		YZ1061		YZ1062		
Sampling Date		2020/12/03 10:30	2020/12/03 09:50	2020/12/03 11:45	2020/12/03 12:30		2020/12/03 13:40		2020/12/03 15:15		
COC Number		G155959	G155959	G155959	G155959		G155959		G155959		
	UNITS	MW06-Q2	MW06-Q3S	GW04	GW1802	RDL	GW1801	RDL	WQ 02	RDL	QC Batch

Total Metals by ICPMS

Total Calcium (Ca)	ug/L	577	1240	2390	3960	50	15900	250	1220	50	A107069
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RDL = Reportable Detection Limit



BUREAU
VERITAS

BV Labs Job #: C089469
Report Date: 2020/12/10

HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01
Site Location: BURNS BOG
Sampler Initials: SB

GENERAL COMMENTS

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER) Comments

Sample YZ1061 [GW1801] Elements by CRC ICPMS (total): RDL raised due to concentration over linear range, sample dilution required.

Results relate only to the items tested.



BUREAU
VERITAS

BV Labs Job #: C089469

Report Date: 2020/12/10

QUALITY ASSURANCE REPORT

HEMMERA ENVIROCHEM INC.

Client Project #: 105052-01

Site Location: BURNS BOG

Sampler Initials: SB

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS
A104934	pH	2020/12/04			102	97 - 103		
A104935	Conductivity	2020/12/04			101	80 - 120	<2.0	uS/cm
A107069	Total Calcium (Ca)	2020/12/09	NC	80 - 120	102	80 - 120	<50	ug/L

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)



BUREAU
VERITAS

BV Labs Job #: C089469
Report Date: 2020/12/10

HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01
Site Location: BURNS BOG
Sampler Initials: SB

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

David Huang, M.Sc., P.Chem., QP, Scientific Services Manager

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Your Project #: 105052-01
Site Location: BURNS BAG
Your C.O.C. #: G155956

Attention: Evelyn Playle

HEMMERA ENVIROCHEM INC.
18th Floor, 4730 Kingsway
Burnaby, BC
Canada V5H 0C6

Report Date: 2020/12/10
Report #: R2965968
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C089853

Received: 2020/12/04, 17:05

Sample Matrix: Water
Samples Received: 7

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
Conductivity @25C	7	N/A	2020/12/07	BBY6SOP-00026	SM 23 2510 B m
Elements by CRC ICPMS (total)	7	2020/12/08	2020/12/09	BBY7SOP-00003 / BBY7SOP-00002	EPA 6020b R2 m
pH @25°C (1)	7	N/A	2020/12/07	BBY6SOP-00026	SM 23 4500-H+ B m

Remarks:

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Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.

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Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) The CCME method requires pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME holding time. Bureau Veritas Laboratories endeavours to analyze samples as soon as possible after receipt.



Your Project #: 105052-01
Site Location: BURNS BAG
Your C.O.C. #: G155956

Attention: Evelyn Playle

HEMMERA ENVIROCHEM INC.
18th Floor, 4730 Kingsway
Burnaby, BC
Canada V5H 0C6

Report Date: 2020/12/10
Report #: R2965968
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C089853

Received: 2020/12/04, 17:05

Encryption Key



**AUTHORIZED REPORT
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Bureau Veritas Laboratories

10 Dec 2020 17:27:38

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Gail Pedersen, Key Account Specialist

Email: Gail.Pedersen@bvlabs.com

Phone# (604) 734 7276

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BUREAU
VERITASBV Labs Job #: C089853
Report Date: 2020/12/10HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01
Site Location: BURNS BAG
Sampler Initials: SB

RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		YZ3246	YZ3246	YZ3247	YZ3248	YZ3249	YZ3250	YZ3251		
Sampling Date		2020/12/04 13:49	2020/12/04 13:49	2020/12/04 09:30	2020/12/04 11:20	2020/12/04 12:00	2020/12/04 11:00	2020/12/04 15:20		
COC Number		G155956	G155956	G155956	G155956	G155956	G155956	G155956		
	UNITS	W503	W503 Lab-Dup	WQ01	MW08-Q4(1)	MW08-Q4(2)	MW08-Q4(3)	WQ03	RDL	QC Batch

Misc. Inorganics

Conductivity	uS/cm	71	72	46	100	58	170	94	2.0	A107213
pH	pH	4.14	4.13	4.30	3.74	4.58	7.52	6.61	N/A	A107211

RDL = Reportable Detection Limit

Lab-Dup = Laboratory Initiated Duplicate

N/A = Not Applicable

BV Labs ID		YZ3252		
Sampling Date		2020/12/04 14:38		
COC Number		G155956		
	UNITS	GW 18 05	RDL	QC Batch
Misc. Inorganics				
Conductivity	uS/cm	70	2.0	A107213
pH	pH	5.79	N/A	A107211
RDL = Reportable Detection Limit				
N/A = Not Applicable				



BUREAU
VERITAS

BV Labs Job #: C089853
Report Date: 2020/12/10

HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01
Site Location: BURNS BAG
Sampler Initials: SB

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		YZ3246	YZ3247	YZ3248	YZ3249		YZ3250		YZ3251		
Sampling Date		2020/12/04 13:49	2020/12/04 09:30	2020/12/04 11:20	2020/12/04 12:00		2020/12/04 11:00		2020/12/04 15:20		
COC Number		G155956	G155956	G155956	G155956		G155956		G155956		
	UNITS	W503	WQ01	MW08-Q4(1)	MW08-Q4(2)	RDL	MW08-Q4(3)	RDL	WQ03	RDL	QC Batch

Total Metals by ICPMS

Total Calcium (Ca)	ug/L	2310	1700	1100	1700	50	15200	100	6050	50	A108444
--------------------	------	------	------	------	------	----	-------	-----	------	----	---------

RDL = Reportable Detection Limit

BV Labs ID		YZ3252		
Sampling Date		2020/12/04 14:38		
COC Number		G155956		
	UNITS	GW 18 05	RDL	QC Batch

Total Metals by ICPMS

Total Calcium (Ca)	ug/L	3270	50	A108444
--------------------	------	------	----	---------

RDL = Reportable Detection Limit



BUREAU
VERITAS

BV Labs Job #: C089853
Report Date: 2020/12/10

HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01
Site Location: BURNS BAG
Sampler Initials: SB

GENERAL COMMENTS

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER) Comments

Sample YZ3250 [MW08-Q4(3)] Elements by CRC ICPMS (total): RDL raised due to concentration over linear range, sample dilution required.

Results relate only to the items tested.



BUREAU
VERITAS

BV Labs Job #: C089853

Report Date: 2020/12/10

QUALITY ASSURANCE REPORT

HEMMERA ENVIROCHEM INC.

Client Project #: 105052-01

Site Location: BURNS BAG

Sampler Initials: SB

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
A107211	pH	2020/12/07			102	97 - 103			0.24	N/A
A107213	Conductivity	2020/12/07			97	80 - 120	<2.0	uS/cm	0.28	10
A108444	Total Calcium (Ca)	2020/12/09	99	80 - 120	98	80 - 120	<50	ug/L		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.



BUREAU
VERITAS

BV Labs Job #: C089853
Report Date: 2020/12/10

HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01
Site Location: BURNS BAG
Sampler Initials: SB

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

David Huang, M.Sc., P.Chem., QP, Scientific Services Manager

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



CHAIN OF CUSTODY RECORD

Page **G 155956** of

Invoice Information		Report Information (if differs from invoice)		Project Information		Turnaround Time (TAT) Required																																																																																																																																																																																																																																																																										
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COC-1020

Bureau Veritas - Shaping a World of Trust





Your Project #: 105052-01
Site Location: BURNS BAG
Your C.O.C. #: G156063

Attention: Evelyn Playle

HEMMERA ENVIROCHEM INC.
18th Floor, 4730 Kingsway
Burnaby, BC
Canada V5H 0C6

Report Date: 2020/12/15
Report #: R2967422
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C090649

Received: 2020/12/08, 15:55

Sample Matrix: Water
Samples Received: 9

Analyses	Date		Date Analyzed	Laboratory Method	Analytical Method
	Quantity	Extracted			
Conductivity @25C	9	N/A	2020/12/10	BBY6SOP-00026	SM 23 2510 B m
Elements by CRC ICPMS (total)	9	2020/12/11	2020/12/11	BBY7SOP-00003 / BBY7SOP-00002	EPA 6020b R2 m
pH @25°C (1)	9	N/A	2020/12/10	BBY6SOP-00026	SM 23 4500-H+ B m

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) The CCME method requires pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME holding time. Bureau Veritas Laboratories endeavours to analyze samples as soon as possible after receipt.



Your Project #: 105052-01
Site Location: BURNS BAG
Your C.O.C. #: G156063

Attention: Evelyn Playle

HEMMERA ENVIROCHEM INC.
18th Floor, 4730 Kingsway
Burnaby, BC
Canada V5H 0C6

Report Date: 2020/12/15
Report #: R2967422
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C090649

Received: 2020/12/08, 15:55

Encryption Key



**AUTHORIZED REPORT
RAPPORT AUTORISÉ**

Bureau Veritas Laboratories

15 Dec 2020 10:14:00

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Gail Pedersen, Key Account Specialist

Email: Gail.Pedersen@bvlabs.com

Phone# (604) 734 7276

=====

This report has been generated and distributed using a secure automated process.

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

BUREAU
VERITASBV Labs Job #: C090649
Report Date: 2020/12/15HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01
Site Location: BURNS BAG
Sampler Initials: DL**RESULTS OF CHEMICAL ANALYSES OF WATER**

BV Labs ID		YZ9944	YZ9945	YZ9946	YZ9947		YZ9948	YZ9949		
Sampling Date		2020/12/08 10:00	2020/12/08 11:04	2020/12/08 11:04	2020/12/08 14:30		2020/12/08 14:10	2020/12/08 11:45		
COC Number		G156063	G156063	G156063	G156063		G156063	G156063		
	UNITS	GW18-03	WS05-E	SW20-100	SW20-101	QC Batch	WS04	MW20-200	RDL	QC Batch
Misc. Inorganics										
Conductivity	uS/cm	110	150	150	74	A112536	82	230	2.0	A112529
pH	pH	6.11	7.06	7.02	6.27	A112535	6.65	6.75	N/A	A112527
RDL = Reportable Detection Limit N/A = Not Applicable										

BV Labs ID		YZ9950	YZ9951	YZ9951	YZ9952		
Sampling Date		2020/12/08 11:45	2020/12/08 12:45	2020/12/08 12:45	2020/12/08 14:30		
COC Number		G156063	G156063	G156063	G156063		
	UNITS	MW03	MW01	MW01 Lab-Dup	DNR02	RDL	QC Batch
Misc. Inorganics							
Conductivity	uS/cm	230	180	180	73	2.0	A112529
pH	pH	6.85	6.71	6.77	6.27	N/A	A112527
RDL = Reportable Detection Limit Lab-Dup = Laboratory Initiated Duplicate N/A = Not Applicable							



BUREAU
VERITAS

BV Labs Job #: C090649
Report Date: 2020/12/15

HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01
Site Location: BURNS BAG
Sampler Initials: DL

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		YZ9944	YZ9945	YZ9946	YZ9947	YZ9948	YZ9949	YZ9950		
Sampling Date		2020/12/08 10:00	2020/12/08 11:04	2020/12/08 11:04	2020/12/08 14:30	2020/12/08 14:10	2020/12/08 11:45	2020/12/08 11:45		
COC Number		G156063	G156063	G156063	G156063	G156063	G156063	G156063		
	UNITS	GW18-03	WS05-E	SW20-100	SW20-101	WS04	MW20-200	MW03	RDL	QC Batch

Total Metals by ICPMS

Total Calcium (Ca)	ug/L	5220	10800	11400	6030	5730	11700	12300	50	A111615
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RDL = Reportable Detection Limit

BV Labs ID		YZ9951	YZ9952		
Sampling Date		2020/12/08 12:45	2020/12/08 14:30		
COC Number		G156063	G156063		
	UNITS	MW01	DNR02	RDL	QC Batch

Total Metals by ICPMS

Total Calcium (Ca)	ug/L	5670	3540	50	A111615
--------------------	------	------	------	----	---------

RDL = Reportable Detection Limit



BUREAU
VERITAS

BV Labs Job #: C090649

Report Date: 2020/12/15

HEMMERA ENVIROCHEM INC.

Client Project #: 105052-01

Site Location: BURNS BAG

Sampler Initials: DL

GENERAL COMMENTS

Results relate only to the items tested.



BUREAU
VERITAS

BV Labs Job #: C090649

Report Date: 2020/12/15

QUALITY ASSURANCE REPORT

HEMMERA ENVIROCHEM INC.

Client Project #: 105052-01

Site Location: BURNS BAG

Sampler Initials: DL

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
A111615	Total Calcium (Ca)	2020/12/11	NC	80 - 120	97	80 - 120	<50	ug/L		
A112527	pH	2020/12/10			101	97 - 103			0.89	N/A
A112529	Conductivity	2020/12/10			99	80 - 120	<2.0	uS/cm	1.1	10
A112535	pH	2020/12/10			101	97 - 103				
A112536	Conductivity	2020/12/10			98	80 - 120	<2.0	uS/cm		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)



BUREAU
VERITAS

BV Labs Job #: C090649
Report Date: 2020/12/15

HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01
Site Location: BURNS BAG
Sampler Initials: DL

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

David Huang, M.Sc., P.Chem., QP, Scientific Services Manager

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CHAIN OF CUSTODY RECORD

Page 1 of 1 **G 156063**

Invoice Information		Report Information (if differs from invoice)		Project Information		Turnaround Time (TAT) Required																																																								
Company: Hemmerg	Company:	Quotation:	<input checked="" type="checkbox"/> 5 - 7 Days Regular (Most analyses)																																																											
Contact Name: E. Playle	Contact Name:	P.O. #/AFR:	PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS																																																											
Address: 4732 Kingsway	Address:	Project #: 105052-61	Rush TAT (Surcharges will be applied)																																																											
V5H0C6 PC:	PC:	Site Location: Burns Bog	<input type="checkbox"/> Same Day <input type="checkbox"/> 2 Days																																																											
Phone/Fax: 519-588-2328	Phone/Fax:	Site #: Danny Lusina	<input type="checkbox"/> 1 Day <input type="checkbox"/> 3-4 Days																																																											
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Sample Identification		Date Sampled (yyyy/mm/dd)	Time Sampled (hh:mm)	Matrix	# of Containers	Regulatory Criteria																																																								
1. GW18-03		2020/12/08	10:00		2	<input type="checkbox"/> BC CSR <input type="checkbox"/> YK CSR <input type="checkbox"/> CCME <input type="checkbox"/> Drinking Water <input type="checkbox"/> BC Water Quality <input type="checkbox"/> Other																																																								
2. WS05-E		2020/12/08	11:04		2	HOLD - DO NOT ANALYZE Special Instructions																																																								
3. SW20-100		2020/12/08	11:04		2																																																									
4. SW20-101		2020/12/08	14:30		2																																																									
5. WS04		2020/12/08	14:10		2																																																									
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Unless otherwise agreed to in writing, work submitted on this Chain of Custody is subject to Bureau Veritas' standard Terms and Conditions. Signing of this Chain of Custody document is acknowledgement and acceptance of																																																														
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Danny Lusina	2020/12/08	15:45	ALFRED NGAI	2020/12/08	15:55																																																									



C090649_COC



Your Project #: 105052-01
Site Location: BURNS BAG
Your C.O.C. #: g156046

Attention: Evelyn Playle

HEMMERA ENVIROCHEM INC.
18th Floor, 4730 Kingsway
Burnaby, BC
Canada V5H 0C6

Report Date: 2020/12/16
Report #: R2968218
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C091049

Received: 2020/12/09, 17:05

Sample Matrix: Water
Samples Received: 2

Analyses	Date		Date Analyzed	Laboratory Method	Analytical Method
	Quantity	Extracted			
Conductivity @25C	2	N/A	2020/12/15	BBY6SOP-00026	SM 23 2510 B m
Elements by CRC ICPMS (total)	2	2020/12/14	2020/12/16	BBY7SOP-00003 / BBY7SOP-00002	EPA 6020b R2 m
pH @25°C (1)	2	N/A	2020/12/15	BBY6SOP-00026	SM 23 4500-H+ B m

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) The CCME method requires pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME holding time. Bureau Veritas Laboratories endeavours to analyze samples as soon as possible after receipt.



Your Project #: 105052-01
Site Location: BURNS BAG
Your C.O.C. #: g156046

Attention: Evelyn Playle

HEMMERA ENVIROCHEM INC.
18th Floor, 4730 Kingsway
Burnaby, BC
Canada V5H 0C6

Report Date: 2020/12/16
Report #: R2968218
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C091049

Received: 2020/12/09, 17:05

Encryption Key



**AUTHORIZED REPORT
RAPPORT AUTORISÉ**

Bureau Veritas Laboratories

16 Dec 2020 14:07:30

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Gail Pedersen, Key Account Specialist

Email: Gail.Pedersen@bvlabs.com

Phone# (604) 734 7276

=====

This report has been generated and distributed using a secure automated process.

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BUREAU
VERITAS

BV Labs Job #: C091049
Report Date: 2020/12/16

HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01
Site Location: BURNS BAG
Sampler Initials: SB

RESULTS OF CHEMICAL ANALYSES OF WATER

BV Labs ID		ZA2056	ZA2057		
Sampling Date		2020/12/09 14:30	2020/12/09 09:10		
COC Number		g156046	g156046		
	UNITS	GW1804	WQ04	RDL	QC Batch
Misc. Inorganics					
Conductivity	uS/cm	61	57	2.0	A115167
pH	pH	5.54	5.97	N/A	A115165
RDL = Reportable Detection Limit N/A = Not Applicable					



BUREAU
VERITAS

BV Labs Job #: C091049
Report Date: 2020/12/16

HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01
Site Location: BURNS BAG
Sampler Initials: SB

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

BV Labs ID		ZA2056	ZA2057		
Sampling Date		2020/12/09 14:30	2020/12/09 09:10		
COC Number		g156046	g156046		
	UNITS	GW1804	WQ04	RDL	QC Batch
Total Metals by ICPMS					
Total Calcium (Ca)	ug/L	3330	3640	50	A113963
RDL = Reportable Detection Limit					



BUREAU
VERITAS

BV Labs Job #: C091049

Report Date: 2020/12/16

HEMMERA ENVIROCHEM INC.

Client Project #: 105052-01

Site Location: BURNS BAG

Sampler Initials: SB

GENERAL COMMENTS

Results relate only to the items tested.



BUREAU
VERITAS

BV Labs Job #: C091049

Report Date: 2020/12/16

QUALITY ASSURANCE REPORT

HEMMERA ENVIROCHEM INC.

Client Project #: 105052-01

Site Location: BURNS BAG

Sampler Initials: SB

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS
A113963	Total Calcium (Ca)	2020/12/16	NC	80 - 120	101	80 - 120	<50	ug/L
A115165	pH	2020/12/15			102	97 - 103		
A115167	Conductivity	2020/12/15			101	80 - 120	<2.0	uS/cm

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)



BUREAU
VERITAS

BV Labs Job #: C091049
Report Date: 2020/12/16

HEMMERA ENVIROCHEM INC.
Client Project #: 105052-01
Site Location: BURNS BAG
Sampler Initials: SB

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

David Huang, M.Sc., P.Chem., QP, Scientific Services Manager

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



CHAIN OF CUSTODY RECORD

Page 1 of 1
G 156046

Invoice Information		Report Information (if differs from invoice)		Project Information		Turnaround Time (TAT) Required																																																																												
Company: <u>Hemmera</u>	Company:	Quotation:	<input checked="" type="checkbox"/> 5 - 7 Days Regular (Most analyses)		PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS																																																																													
Contact Name: <u>EVGLYN</u>	Contact Name:	P.O. #/REF:																																																																																
Address: <u>4730 Kingsway</u>	Address:	Project #:	<u>105052-01</u>		Rush TAT (Surcharges will be applied)																																																																													
<u>V5H 0C6 BC</u>	PC:	Site Location:	<u>Burns Bog</u>		<input type="checkbox"/> Same Day	<input type="checkbox"/> 2 Days																																																																												
Phone/Fax: <u>519 588 2378</u>	Phone/Fax:	Site #:			<input type="checkbox"/> 1 Day	<input type="checkbox"/> 3-4 Days																																																																												
Email: <u>ep1c@hemmera.com</u>	Email:	Sampled By:	<u>STEVEN BROWN</u>		Date Required: _____																																																																													
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Unless otherwise agreed to in writing, work submitted on this Chain of Custody is subject to Bureau Veritas' standard Terms and Conditions. Signing of this Chain of Custody document is acknowledgement and acceptance of our terms.

Relinquished by: (Signature/ Print)	Date (yyyy/mm/dd):	Time (hh:mm):	Received by: (Signature/ Print)	Date (yyyy/mm/dd):	Time (hh:mm):
<u>STEVEN BROWN</u>	<u>2020/11/09</u>	<u>16:20</u>	<u>ANITA ANANDA</u>	<u>2020/12/09</u>	<u>17:05</u>

