

# **Old Cranbrook Landfill 2021 Groundwater Monitoring Annual Report**



**PREPARED FOR: REGIONAL DISTRICT OF EAST KOOTENAY**

**PREPARED BY: SPERLING HANSEN ASSOCIATES**

**January, 2022**

**PRJ21063**



**SPERLING  
HANSEN  
ASSOCIATES**

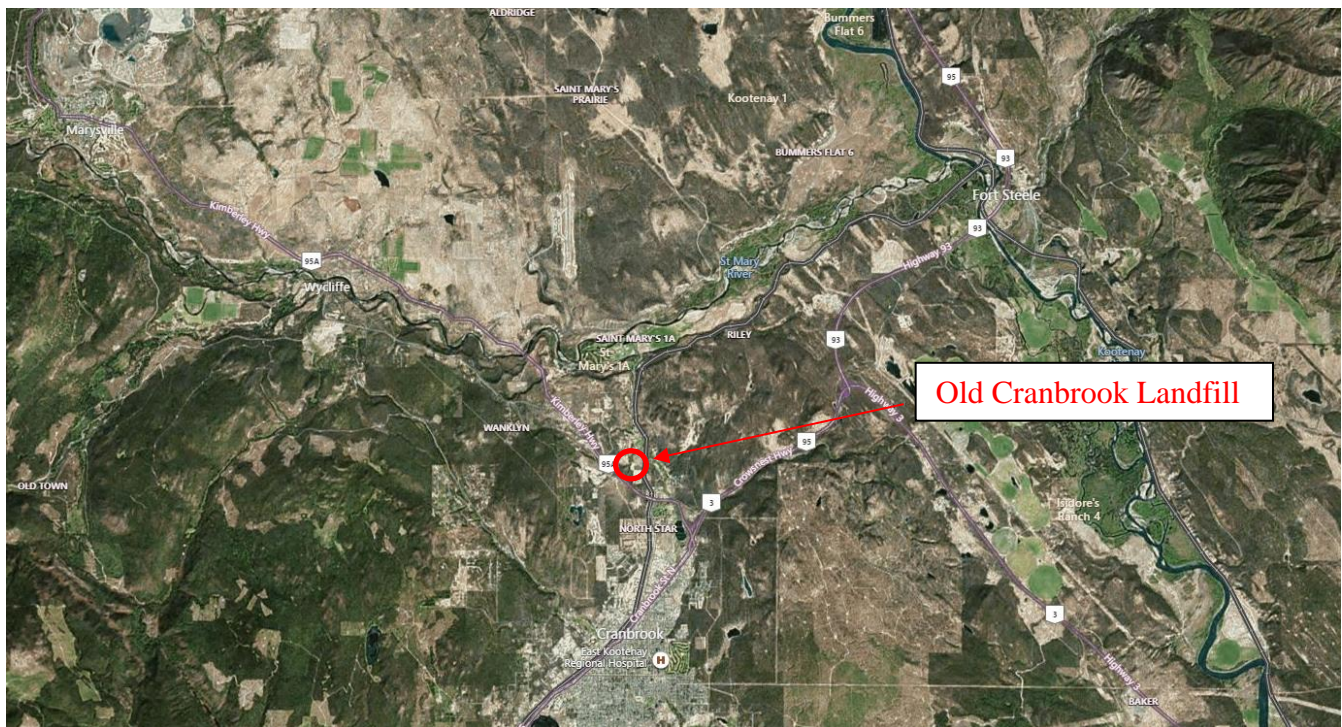


- Landfill Engineering
- Solid Waste Planning
- Environmental Monitoring
- Landfill Fire Control

## 1. INTRODUCTION

Sperling Hansen Associates (SHA) was retained by the Regional District of East Kootenay (RDEK) in 2020 to develop an updated Groundwater Monitoring Program (GMP) for seven (7) Solid Waste Management facilities located within the RDEK. As part of this GMP update SHA, along with Subconsultant Bear Environmental Limited (BEAR), will conduct four (4) groundwater sampling events per year, and provide one interim report per event for each site. The goal of this program is to provide the RDEK with valuable information regarding the groundwater quality at disposal sites and to assist in developing appropriate monitoring and management measures for the next five years.

In 2021, sampling events occurred in January, April, July, and November over a week period. Typically, the fall event is completed in October, however this year BEAR and SHA encountered delays in equipment availability due to supply shortages. As a result, the fall event in 2021 was completed in early November. Samples taken from each site are recorded below, and water quality analysis discussed in Section 3. This report details the sampling notes, lab analysis results, and trends observed at the wells throughout 2021. Section 5 presents recommendations for the next year of monitoring.



**Photo 1-1. Old Cranbrook Landfill Site Location.**

### 1.1 Location and Setting

The Cranbrook Landfill is located just north of the city of Cranbrook within the Central Subregion of East Kootenay. The site is situated off of Highway 95A at Corbett Rd. The latitude and longitude are 49.55358 N and -115.75853 W respectively.



The site is approximately 7 hectares in size and closure construction was completed in 2007.



**Photo 1-2. Old Cranbrook Landfill Site Layout.**

## **1.2 Site Operations**

The landfill originally functioned as a natural attenuation landfill for 20 years, until the year 2000. The site was finally closed in 2007 and 2008 and revegetated. A passive gas collection system was installed during closure construction and has since been plumbed to a candlestick flare where the RDEK receive carbon offset credits for the methane destruction. The Old Cranbrook Landfill permit, PR-6767, is attached as Appendix A.

## **2. MONITORING PROGRAM**

As per Permit 6767, the RDEK is to undertake groundwater monitoring to assess the impact of approved works on groundwater quality and the renovative capacity of the sub surface environment in the area. The routine groundwater program consists of sampling 6 groundwater monitoring wells. The well locations are identified in Figure 1.

### **2.1 Methodology**

Due to the nature of waste when it comes into contact with water, it is required to monitor the groundwater on and surrounding the site to observe impacts from the landfill to groundwater and surface water. In compliance with Landfill Criteria for Municipal Solid Waste, Sperling Hansen Associates (SHA) was retained to conduct the groundwater monitoring for the wells.

BEAR conducts the field sampling at the seven sites. Each well sampled is tested for a set of parameters that are intended to determine landfill impact. Some parameters are tested quarterly while others are only tested annually. Sampling was conducted in accordance with the BC Field Sampling Manual. Table 2-1 shows which parameters were sampled in 2021.

**Table 2-1. Groundwater Monitoring Parameters.**

Site	Quarterly Parameters	Yearly Parameters
<b>Cranbrook Landfill</b>	Temperature	Temperature
	Conductivity	Conductivity
	pH	pH
	Nitrite (N)	Nitrite (N)
	Nitrate (N)	Nitrate (N)
	Ammonia Nitrogen (NH3)	Ammonia Nitrogen (NH3)
	Fluoride (F)	Fluoride (F)
	Sulphate (SO4)	Sulphate (SO4)
	Chloride (Cl)	Chloride (Cl)
	Hardness	Hardness
	Total Alkalinity	Total Alkalinity
	Total Suspended Solids	Total Suspended Solids
	Turbidity	Turbidity
	Dissolved Metals	Dissolved Metals
	* LANDFILL GAS	* LANDFILL GAS
		BTEX
		EPH/VPH

Analysis of the water samples was conducted by ALS Environmental, a CALA accredited laboratory. Samples were sent to ALS in Calgary via courier by BEAR. Certificate of Analysis (COA) are included in Appendix C. SHA reviewed available Laboratory COAs, based on internal laboratory QA/QC, the results are considered reliable.

## 2.2 Regulatory Criteria

In the absence of an OC, Permit or DOCP, SHA determined regulatory criteria based on site and surrounding area water use.

The CSR Protocol 21 indicates that Drinking Water (DW) Standards generally apply where drinking water sources are within 500m of a site, or if a property is situated on an aquifer that could be used in the future for Drinking Water. Information from the BC Water Atlas indicates that mapped Aquifer 524 underlies the Site. The *Aquifer Classification Worksheet* suggests that in areas, a deeper Aquifer 525 underlies Aquifer 524 where a water system exists. A search for water wells revealed approximately 5

water wells within 500m of the Site. Without further investigation, current and future DW standards are assumed to apply.

The BC Contaminated Sites Regulation (CSR) Protocol 21 indicates that Aquatic Life Standards (AW) generally apply to all groundwater located within 500 m of a surface water body containing aquatic life. The Site is located approximately 400m west of Joseph Creek, therefore the Aquatic Life for Freshwater (AW) standards will apply.

BC CSR Schedule 3.2 standards have been applied by SHA to include:

- The Schedule 3.2 of the BC CSR with consideration to Aquatic Life (AW) and Drinking Water (DW);

These standards are the most recent published by BC ENV used to assess groundwater at contaminated sites and the quality of drinking water.

## 2.3 Groundwater Flow

The Old Cranbrook site is located approximately 3 km south east of the St. Mary River and approximately 400m west of Joseph Creek. A pond/small lake is located 1.5 km south west of the Site.

Based on the regional topography, groundwater is inferred to flow west. Locally, groundwater flow can be affected by building foundations, recharge areas, drainage and subsurface utilities. Depending on their depth, underground structures may significantly influence shallow groundwater flow in the vicinity of the Site. Local groundwater appears to flow towards the north east. Well details are shown in Table 2-2 below.

**Table 2-2. Well Details and Water Level**

Well ID	Well Construction	Q1 Water Level (m)	Q2 Water Level (m)	Q3 Water Level (m)	Q4 Water Level (m)
E265127	2" PVC	18.620	14.120	17.260	19.090
E265122	2" PVC	63.475	63.285	63.630	63.750
E265123	2" PVC	62.465	62.315	62.520	62.675
E265124	2" PVC	67.055	54.180	54.625	54.665
E265125	2" PVC	57.305	57.130	57.345	57.540
E265129	2" PVC	56.175	55.975	56.300	56.440

Due to equipment unavailability in October and November 2021, bailers were used for sampling rather than a pump. As a result, purging at the 6 wells was insufficient because of the bailer technique and substantial well depth.

## 2.4 Nomenclature

The reporting of monitoring wells at the East Kootenay sites has previously been a combination of Environmental Monitoring System Numbers (EMSN) and site number names that are the more common naming convention (MW-1). The majority of sites have both, but some wells only have the E number. To avoid confusion and the potential of double counting the wells, SHA has decided to use the E numbers when referring to them. This way reports and analyses can be consistent, and can be traced to the OC or Permit for the site. The site maps attached to these Annual Reports as Figure 1 have been updated to reflect this change and now have the EMSN numbers labelled.

## 3. RESULTS

Water quality results are presented in Appendix B, Table B-1. Parameters tested in this event included:

- Quarterly sampling parameters – pH, conductivity, alkalinity, hardness, total suspended solids, turbidity, anions and nutrients, and dissolved metals;
- Annual parameters - benzene, toluene, ethylbenzene, and xylene (BTEX), volatile petroleum hydrocarbons, (VPH), and extractable petroleum hydrocarbons (EPH).

All parameters tested were below applicable standards and guidelines with the exception of two parameters:

- Lithium (dissolved)
- Fluoride

Table 3-1 presents a summary of exceedances by analyte.

**Table 3-1. Exceedances Summary by Analyte**

	E265123	E265125
<b>Lab Results</b>		
<b>Dissolved Metals</b>		
Lithium (dissolved)	X	X
<b>General and Inorganic Parameters</b>		
Fluoride		X

Details are provided in the Sections below.

### 3.1 Exceedances

Table 3-2 below shows which wells sampled exhibited exceedances in select parameters. E265123 and E265125 exceeded the CSR DW limit for dissolved lithium for all quarterly sampling events. Historically, the 2020 and 2019 results for these wells also showed consistent lithium exceedances, when compared to the applicable standards (CSR DW limit = 8 µg/L). The maximum concentration of lithium was detected at E265123 in April 2021 with a concentration of 108 µg/L. This is approximately 13.5 times above the DW standard.

Fluoride concentrations at E265125 also exceeded the CSR DW limit in all quarters. Historically, the 2019 and 2020 fluoride results for E265125 also showed concentrations above the applicable DW standard. The maximum concentration of fluoride at E265125 was 2,120 µg/L in July 2020 versus the BC CSR DW standard of 1,500 µg/L.

All other parameters tested were below applicable BC CSR AW and DW standards.

**Table 3-2. Maximum Parameter Concentrations Above BC CSR DW Standards**

Parameter	BC CSR DW Standard	Maximum Concentration (mg/L)	Well Name
Lithium (Li)	8 µg/L	108	E265123
Fluoride (F)	1,500 µg/L	2,120	E265125

### 3.2 Notes on Regional Background Concentrations

As per the British Columbia Contaminated Sites Regulation (CSR) Schedule 3.2, 2019, the drinking water limit for Lithium (Li) is 8 µg/L or 0.008 mg/L. Many regions in B.C. have background concentrations of lithium that exceed this limit, which poses a complication for monitored sites that are required under Operation Certificates or Permits to avoid exceedances of harmful parameters. In response, the B.C. Ministry of Environment and Climate Change (BC ENV) published a document in 2018 qualifying the limit and providing background concentrations for three regions in the province for five metals, including lithium. The limits published in the *Technical Bulletin 3: Regional Background Concentrations for Select Inorganic Substances in Groundwater* account for naturally occurring levels of the five metals, and are therefore higher than the limit within the CSR currently.

However, these three regions only comprise the Lower Mainland, South Vancouver Island, and Thompson-Okanagan. SHA believes the exceedances in lithium observed at the RDEK sites may be attributable to natural background concentrations that are not accounted for in the CSR Schedule 3.2 or *Technical Bulletin 3*. It should be noted that Eco/Logic did not have a limit for lithium, which explains the discrepancy in exceedances despite there being little difference between 2019 and 2020 results.

Note that Thompson-Okanagan, the nearest region to the RDEK with a back ground concentration qualifier for lithium, has a qualified concentration in the Bulletin of 96 µg/L, or 0.096 mg/L. SHA does not believe the RD needs to look into remediation measures at this point, but recommends the RD flag

this exceedance history in the case that the Ministry publishes a background concentration for the Kootenay region. SHA recommends that future sampling at the Site be conducted utilizing low flow sampling methods to minimize the re-suspension of colloidal materials that can be caused during sampling with bailers and/or Waterra inertia pumps.

### 3.3 Landfill Gas

The landfill criteria stipulate that soil gas concentrations at the landfill site boundary must not exceed the lower explosive limit of methane (5% by volume) at any time. The landfill gas probes monitored in July and October showed to have well below the percent LEL limit. This is particularly important for the Cranbrook site as it is a closed natural attenuation site that is still producing landfill gas. In order to ensure that this requirement is met, these wells are monitored quarterly. As part of the quarterly monitoring program, Bear Environmental completed one round of landfill gas monitoring on July 24<sup>th</sup>, 2020 as the initial round in SHA's contract, and a second in October 2020. A Landtec GEM 2000 Plus landfill gas analyzer was used for the monitoring. Each measurement consisted of reading relative pressure in the probe, and purging the probe until stable readings has been established.

The results from the 2021 monitoring event are presented in Appendix B, Table B-2. As mentioned in the Columbia Valley annual report, due to delayed shipping of the tool used for LFG sampling (Landtec GEM), did not make it to the RDEK in time to be used for the January sampling event. Therefore, data for January 2021 is omitted.

As can be seen in the table, all readings were well below the landfill criteria. It is recommended landfill gas monitoring continue in its current format. In the event that elevated levels of landfill gas are detected in any of the probes, the RDEK representative must be notified right away as further actions may be required.

## 4. DISCUSSION

All parameters tested were below applicable standards with the exception of the following parameters:

- Lithium and Fluoride

Historically, these parameters show elevated concentrations at wells E265123/E265125 and E265125 respectively. In 2021, the maximum concentration of lithium was found at E265123 at 108 µg/L versus the BC CSR DW standard of 8 µg/L. The maximum concentration of fluoride was found at E265125 at 2,120 µg/L versus the BC CSR DW standard 1,500 µg/L. These maximums are calculated as 13.5- and 1.4-times respective standards.

Trends will continue to be monitored. As these parameters occur elevated but without the accompaniment of elevated typical landfill contaminants of concern, SHA considers the impacts to groundwater from the Old Cranbrook Landfill to be low.

Note that there is a history of fluoride loading in the upstream surrounding area as documented in the *BC Water Quality Ambient Water Quality Criteria for Fluoride*.



SHA recommends that as metals parameters, specifically lithium, appear elevated on-site, low flow monitoring methods should be implemented during sampling to minimize the re-suspension of colloidal materials that can be caused during sampling with bailers and/or Waterra inertia pumps.

## 4.1 Trend Analysis

To illustrate the trends observed in key parameters at the wells sampled, SHA has prepared figures that combine the 2020-2021 analytical results with the applicable criteria limits. These figures are attached to this report in Appendix D.

- Figure 2 – Lithium concentrations
- Figure 3 – Sulfate concentrations
- Figure 4 – Sodium concentrations
- Figure 5 – Chloride concentrations
- Figure 6 – Nitrate concentrations
- Figure 7 – Specific conductance (Conductivity)
- Figure 8 – Fluoride concentrations

The red line on each figure represents the limit for that parameter according to the criteria, to show if wells are under or exceeding the maximum allowable concentration at the time of each quarterly sampling event.

Lithium is the parameter with an observable consistent trend above the CSR DW limit. Sulfate, sodium, chloride, nitrate, and conductivity are graphed because they are typical landfill indicators. As shown in the graphs, these parameters are below allowable limits and show the landfill is not impacting groundwater chemistry beyond regulatory standards. There is no limit for conductivity, but the consistently high trend shows that the presence of the landfill does impact groundwater relative to background or upgradient concentrations.

*Please note that the graphs provided are for observing trends, and data less than or equal to the detection limit for a parameter appears on graphs as trace concentrations. If a well shows to have no data on the graph, please refer to the master data table for the exact parameter concentration.*

## 5. CONCLUSIONS AND RECOMMENDATIONS

Of the six wells sampled, two include concentrations above BC CSR DW limits. Concentrations of lithium and fluoride were above BC CSR DW standards at wells E265123 and E265125. As these elevated parameters, lithium and fluoride, were detected without the accompaniment of elevated typical landfill contaminants of concern, SHA considers the impacts to groundwater from the Old Cranbrook Landfill to be low.

SHA recommends the following:

Parameter concentrations of dissolved metals slightly above applicable standards were detected in the Site groundwater monitoring wells. Based on surrounding land use, and relatively low impact to the immediate environment, SHA does not envision a change to the sampling method is warranted at this time. However, if exceeding parameters begin to form a consistently increasing trend, the RDEK may consider groundwater sampling methods using a low flow technique, where possible, to minimize the re-suspension of colloidal materials that can be caused during sampling with bailers and/or Waterra inertia pumps. If this sampling method is effective in providing a more accurate interpretation of groundwater data and able to show the groundwater exceedances are a result of suspended materials from bailer sampling, then SHA could make a recommendation to the Regional District to implement this sampling method for the monitoring going forward.

The next sampling event is scheduled for January, 2022.

## 6. STATEMENT OF LIMITATIONS

This report has been prepared by Sperling Hansen Associates. (SHA) on behalf of the Regional District of East Kootenay (RDEK) in accordance with generally accepted engineering practices to a level of care and skill normally exercised by other members of the engineering and science professions currently practicing under similar conditions in British Columbia.

The report is based on site visits, project experience, and analysis by SHA staff of data compiled during the preparation of this report from a number of sources. Except where specifically stated to the contrary, the information on which this study is based has been obtained from external sources. This external information has not been independently verified or otherwise examined by SHA to determine its accuracy and completeness. SHA has relied in good faith on this information and does not accept responsibility of any deficiency, misstatements or inaccuracies contained in the reports as a result of omissions, misinterpretation and/or fraudulent acts of the persons interviewed or contacted, or errors or omissions in the reviewed documentation.

The report is intended solely for the use of the RDEK. Any use which other parties makes of this report, or any reliance on, or decisions to be made based on it, are the responsibilities of such other parties. SHA does not accept any responsibility for other uses of the material contained herein nor for damages, if any, suffered by any third party because of decisions made or actions based on this report. Copying of this intellectual property for other purposes is not permitted.

The findings and conclusions of this report are valid only as of the date of this report. The interpretations presented in this report and the conclusions and recommendations that are drawn are based on information that was made available to SHA during the course of this project. Should additional new data become available in the future, SHA should be requested to re-evaluate the findings of this report and modify the conclusions and recommendations drawn, as required.

Should you have any questions on this report or require further assistance or information, please feel free to contact the undersigned at 778-471-7088 or 604-986-7723.

**Report prepared by:**



**Chloe Hetherington**  
Environmental Analyst Assistant

**Report reviewed by:**



**Scott Garthwaite, ASCT**  
Sr. Civil Technologist

## 7. REFERENCES

Eco/Logic Environmental, Cranbrook Post-Closure Groundwater Monitoring 2019, prepared for the Regional District of East Kootenay.

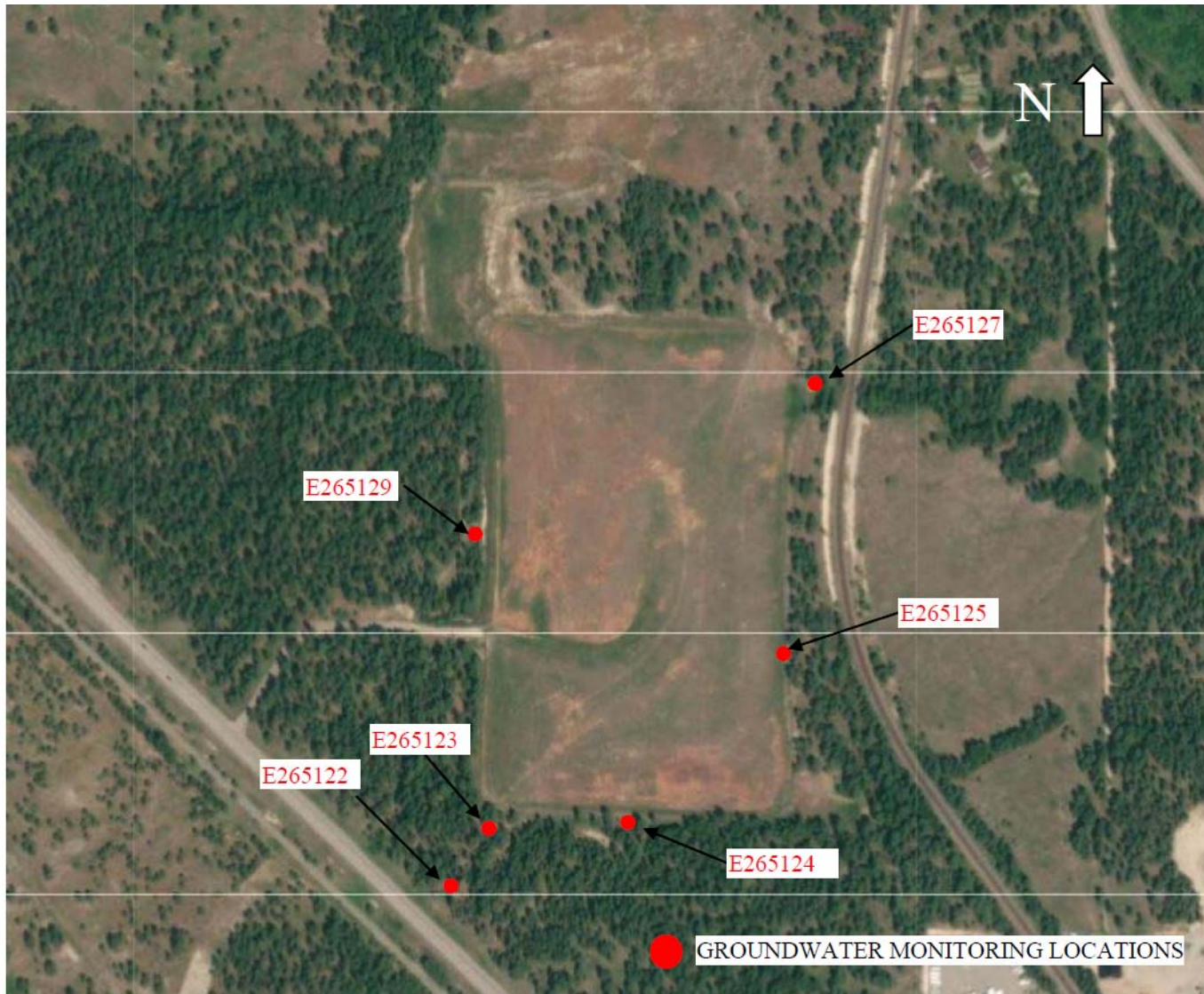
Environmental Management Act, BC Contaminated Sites Regulation Schedule 3.2, 2019 Freshwater Aquatic Life.

Environmental Management Act, BC Contaminated Sites Regulation Schedule 3.2, 2019 Drinking Water.

Bing Maps <https://www.bing.com/maps>

RDEK Public Web Map 2020, retrieved from <https://www.rdek.bc.ca/departments/mapping>





SPERLING  
HANSEN  
ASSOCIATES



PROJECT:

**SOLID WASTE FACILITY  
MONITORING  
PROGRAM 2020-2025**

TITLE:

**OLD CRANBROOK  
LANDFILL  
MONITORING LOCATIONS**

SCALE:  
N/A

DATE:  
2022/01/10  
yyyy/mm/dd

PROJECT NO:  
**21063**

DESIGNED

DRAWING NO:

DRAWN

CH

CHECKED

**Figure 1**

---

---

## APPENDICES

---

---

---

---

**APPENDIX A**  
**Permit**

---

---



Province of  
British Columbia  
MINISTRY OF ENVIRONMENT LANDS AND PARKS  
AND MINISTER RESPONSIBLE FOR  
MULTICULTURALISM AND HUMAN RIGHTS

BC  
ENVIRONMENT

#401 -333 Victoria Street  
Nelson, British Columbia  
V1L 4K3  
Telephone: (604)354-6333  
Main Fax: (604)354-6332  
BP Fax: (604)354-6367

REGISTERED MAIL

File: PR-6767

May 21, 1996

Regional District of East Kootenay  
19-24th Avenue South  
Cranbrook bc V1C 3H8

Attention: Wayne McNamar  
Administrator

Dear Sir:

Re: Cancellation of Permit under the Waste Management Act S.B.C. 1982, c41

As requested in your letter of April 4, 1996 Waste Management Permit PR-6767 in the name of Regional District of East Kootenay is hereby cancelled pursuant to Section 23,(4),(b),(iv) of the Waste Management Act.

Yours truly,

Rick Crozier, R.P.Bio.  
Regional Waste Manager  
Kootenay Region

RJC/rp

cc: Environmental Protection, Victoria  
Gary Lawrence, EP-Cranbrook





Province of  
British Columbia

Ministry of  
Environment

Waste Management Branch  
Kootenay Region  
310 Ward Street  
Nelson, B.C.  
V1L 5S4  
Phone: 352-2211  
Local 273, 305, or 339

YOUR FILE  
OUR FILE **PR-6767**

**APR 13 1984**

REGISTERED MAIL:

Regional District of East Kootenay,  
19 - 24th Avenue, South,  
Cranbrook, British Columbia  
V1C 3H8

Gentlemen:

LETTER OF TRANSMITTAL

Enclosed is a copy of Permit No. PR-6767 issued under the provisions of the Waste Management Act in the name of Regional District of East Kootenay. Your attention is respectfully directed to the terms and conditions outlined in the Permit.

The administration of this Permit will be carried out by staff from our Regional Office located at 310 Ward Street, Nelson, British Columbia, V1L 5S4 (telephone 352-2211). Plans, data and reports pertinent to the Permit are to be submitted to the Regional Waste Manager at this address.

You will note that values have been expressed in the International Systems of Units (SI). These units are to be used in submitting monitoring results and any other information in connection with this Permit.

This Permit does not authorize entry upon, crossing over, or use for any purpose of private or Crown lands or works, unless and except as authorized by the owner of such lands or works. The responsibility for obtaining such authority shall rest with the Permittee.

Yours very truly,

M.K. Baillargeon, P.Eng.  
Regional Waste Manager

Enclosure



MINISTRY OF ENVIRONMENT

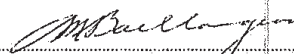
PERMIT

*Under the Provisions of the Waste Management Act*

..... Regional District of East Kootenay .....  
..... 19 - 24th Avenue, South, Cranbrook, British Columbia V1C 3H8 .....  
is hereby authorized to discharge ..... refuse .....  
from ..... municipal sources .....  
located ..... within the Regional District of East Kootenay .....  
to ..... the ground, approximately 11.3 km northeast of Cranbrook, British .....  
..... Columbia .....

This permit has been issued under the terms and conditions prescribed in the attached appendices

..... 01, A-1, B-1, C-1 and C-2 .....  
.....  
.....

.....  .....  
Regional Waste Manager

Date issued ..... APR 13 1984, 19 .....  
Amendments dated ..... , 19 .....  
..... , 19 .....  
..... , 19 .....

Permit No. PR-6767



MINISTRY OF ENVIRONMENT  
WASTE MANAGEMENT BRANCH

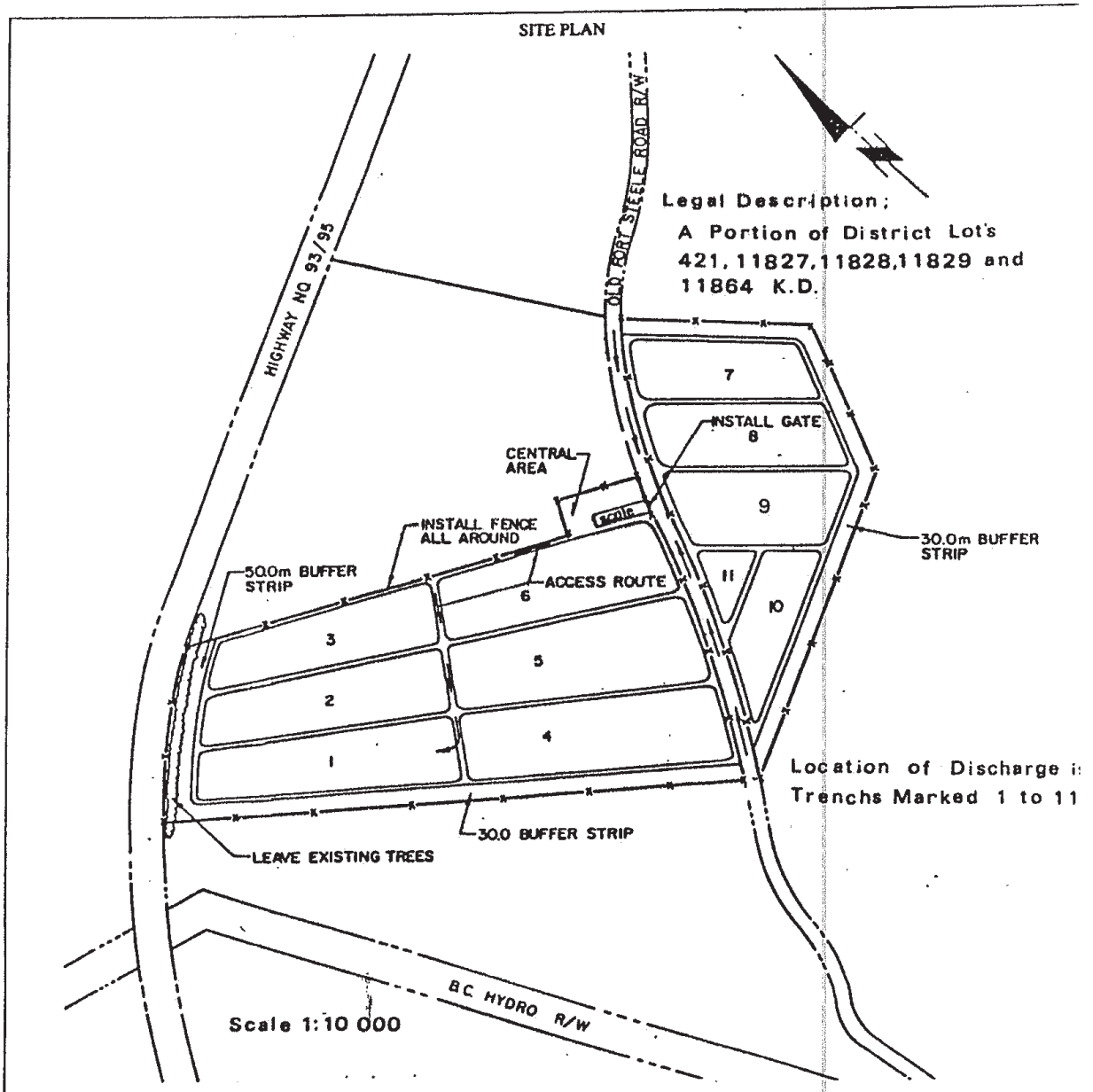
APPENDIX No. 01

to Permit No. P.R.-6.7.6.7

- (a) The discharge of refuse to which this appendix is applicable is to a site located on a portion of District Lots 421, 11827, 11828, 11829 and 11864, Kootenay District as shown on the attached Appendix A-1
- (b) The quantity of refuse which may be discharged is an average of 140 tonnes/day based on the operating period
- (c) The type of refuse which may be discharged is municipal  
(Municipal, industrial, etc.)
- (d) The nature or characteristics of the refuse which may be discharged are typical municipal refuse, excluding special wastes
- (e) The works authorized are a landfill operation with daily compaction and covering approximately located as shown on the attached Appendix A-1
- (f) The land from which the refuse originates and to which this appendix is appurtenant is the Regional District of East Kootenay and municipalities within its boundaries
- (g) Those works authorized and proposed must be completed and in operation when discharge commences

Date APR 13 1984, 19  
Amended, 19

  
Regional Waste Manager



LOCATION MAP	
	<p>Regional District of East Kootenay</p> <p>(Name of applicant(s))</p> <p>Nov. 3, 83</p> <p>(Date)</p> <p>(Signature of applicant(s) or agent)</p> <p>W.C. McNamar, Administrator</p> <p>(FOR OFFICE USE ONLY)</p> <p>APR 13 1984</p> <p>Date Issued</p> <p>Date Amended</p> <p>Regional Waste Manager</p> <p>Appendix A-1 to Permit No. PR-6767</p> <p>Approval No.</p>





MINISTRY OF ENVIRONMENT  
WASTE MANAGEMENT BRANCH

APPENDIX No. B-1

to Permit No. PR-6767

A. Landfill Operation

The permittee shall maintain the landfill authorized in Appendix 01 as a Level 'A' operation in accordance with the Pollution Control Objectives for Municipal Type Waste Discharges in British Columbia, dated September, 1975, which, in normal conditions, requires that cover material be applied once per day of operation. The Regional Waste Manager may vary the frequency of covering when freezing conditions adversely affect normal operation.

B. Site Preparation and Restoration

Provision of fencing, site access, vehicle safety barriers, surface water diversionary works, firebreaks and site restoration as required, shall be carried out to the satisfaction of the Regional Waste Manager.

C. Operational Plan

An operational plan of the works authorized in Appendix 01 shall be submitted to the Regional Waste Manager in duplicate and his approval obtained before operation commences. The works shall be operated in accordance with the plan.

D. Leachate

Should leachate emanating from the refuse site become detrimental to the groundwater, a means of mitigating the impact of the leachate will be implemented by the permittee.

E. Dust Control

If dust created within the landfill area becomes a problem then the permittee shall provide control measures acceptable to the Regional Waste Manager.

Date issued **APR 13 1984**, 19 .....

Date amended ....., 19 .....

....., 19 .....

*M. B. Langdon*  
Regional Waste Manager



MINISTRY OF ENVIRONMENT  
WASTE MANAGEMENT BRANCH

APPENDIX No. C-1

to Permit No. PR-6767

The following monitoring program shall be performed by the permittee. Variation may be made as recommended by the Regional Waste Manager.

A. Discharge Monitoring

The permittee shall install a suitable weigh scale and weigh and record the weight of all refuse delivered to the landfill site. Records of the total weight of refuse discharged and the average daily weight of refuse discharged shall be submitted quarterly to the Regional Waste Manager. The average weight shall be based on the operating period.

B. Groundwater Monitoring

1. The permittee shall undertake a program of groundwater sampling to monitor the quality of the groundwater in the vicinity of the landfill site.
2. The permittee shall submit details of the proposed monitoring program to the Regional Waste Manager for approval prior to discharge of refuse to the landfill site.
3. The groundwater monitoring program shall include but is not limited to the following:
  - 3.1 All sampling well locations, well construction, sampling techniques and equipment are to be approved by the Regional Waste Manager prior to installation or use.
  - 3.2 The permittee shall obtain a grab sample from each well once each quarter. Proper care should be taken in sampling, storing and transporting the samples to adequately control temperature and avoid contamination, breakage, etc.

  
Regional Waste Manager

Date issued APR 13 1984, 19

Date amended , 19

, 19



MINISTRY OF ENVIRONMENT  
WASTE MANAGEMENT BRANCH

APPENDIX No. C-2

to Permit No. PR-6767


- 3.3 The permittee shall obtain analyses of the samples for the following:

pH, specific conductance, chloride, fluoride, nitrogen and nitrate nitrogen, sulfate, dissolved oxygen, alkalinity, total organic carbon, dissolved organic carbon, orthophosphate, sulphide and phenol, and the following dissolved metals: arsenic, barium, beryllium, boron, cadmium, calcium, chromium, copper, iron, lead, magnesium, mercury, nickel, potassium, selenium, sodium, zinc.

Analyses are to be carried out in accordance with procedures described in the second edition (February, 1976) of "A Laboratory Manual for the Chemical Analysis of Waters, Wastewaters, Sediments and Biological Materials", or by suitable alternative procedures as approved by the Regional Waste Manager.

Copies of the above mentioned manual are available from the Waste Management Branch, 810 Blanshard Street, Victoria, British Columbia, V8V 1X5, at a cost of \$5.00, and are also available for inspection at all Waste Management Branch offices.

- 3.4 Maintain data of analyses for inspection and submit the data suitably tabulated to the Regional Waste Manager, quarterly.
4. The permittee shall have the approved groundwater monitoring program in place prior to discharge of refuse to the landfill site.

  
Regional Waste Manager

Date issued APR 13 1984, 19

Date amended , 19

, 19

---

---

**APPENDIX B**  
**Water Quality Results**

---

---

### Table B-2 Water Quality Analysis

[illegible]

Table B-2

	January, 2021	April, 2021										July, 2021										November, 2021									
Well ID	GEM not available. No data	CH <sub>4</sub> %	CO <sub>2</sub> %	O <sub>2</sub> %	BAL %	H <sub>2</sub> ppm	CO ppm	H <sub>2</sub> S ppm	LEL %	Relative Pressure	Barometric Pressure	CH <sub>4</sub> %	CO <sub>2</sub> %	O <sub>2</sub> %	BAL %	H <sub>2</sub> ppm	CO ppm	H <sub>2</sub> S ppm	LEL %	Relative Pressure	Barometric Pressure	CH <sub>4</sub> %	CO <sub>2</sub> %	O <sub>2</sub> %	BAL %	H <sub>2</sub> ppm	CO ppm	H <sub>2</sub> S ppm	LEL %	Relative Pressure	Barometric Pressure
E265122-S		0.5	1.1	15.8	82.6	low	0	0	12	0.36	26.70	0.8	0	17.2	82.0	low	0	0	16	-0.01	26.76	0.2	0.9	15.7	83.2	low	0	0	5	0.00	27.07
E265122-D		0.6	1.1	15.8	82.6	low	0	0	12	0.36	26.70	1.1	0.7	15.1	83.0	low	0	0	23	-0.01	26.76	0.0	0.1	17.6	82.3	low	0	0	0	0.00	27.07
E265123		1.7	3.3	14.0	81.1	low	0	0	34	1.79	26.71	2.0	1.6	14.4	81.9	low	0	0	41	-0.01	26.76	0.0	0.0	17.7	82.3	low	0	0	0	0.00	27.06
E265124-S		0.3	0	18.9	80.8	low	0	0	6	0.00	26.70	0.7	0	17.3	82.1	low	0	0	15	-0.01	26.76	0.0	0.1	17.7	82.2	low	0	0	0	0.00	27.10
E265124-D		0.5	0.5	17.9	81.1	low	0	0	10	0.00	26.70	0.7	0.2	16.4	28.8	low	0	0	13	-0.01	26.76	0.0	0.2	17.6	82.2	low	0	0	0	0.00	27.10
TH-4		0.5	0.7	17.1	81.7	low	0	0	10	-0.60	26.74	1.1	0.4	16.0	82.5	low	0	0	23	-0.01	26.76	0.0	0.1	17.4	82.5	low	0	0	0	0.00	27.08
TH4-A		0.3	3.7	12.0	84.1	low	0	0	6	-0.60	26.74	0.9	3	11.5	84.6	low	0	0	18	-0.01	26.76	0.0	0.1	17.4	82.5	low	0	0	0	0.00	27.08
E265127(TH-6)		0.3	1.4	16.0	82.3	low	0	0	6	0.00	26.74	0.6	2.7	16.0	80.8	low	0	0	12	-0.01	26.80	0.0	1.8	16.4	81.8	low	0	0	0	0.00	27.10
TH-1-S		1.1	4.3	11.3	83.3	low	0	0	22	0.01	26.70	1.1	3.9	11.8	83.3	low	0	0	22	-0.01	26.76	0.0	0.1	17.7	82.3	low	0	0	0	0.00	27.09
TH-1-D		0.4	0.1	18.7	80.8	low	0	0	9	0.01	26.70	1.4	0.5	15.6	82.6	low	0	0	28	-0.01	26.76	0.4	5.4	14.5	79.6	low	11	0	10	0.00	27.09



---

---

**APPENDIX C**  
**Certificates of Analysis**

---

---



Sperling Hansen Associates Inc.  
ATTN: Scott Garthwaite  
#8 - 1225 East Keith Road  
North Vancouver BC V7J 1J3

Date Received: 14-JAN-21  
Report Date: 20-JAN-21 10:04 (MT)  
Version: FINAL

Client Phone: 604-986-7723

## Certificate of Analysis

Lab Work Order #: L2548154  
Project P.O. #: NOT SUBMITTED  
Job Reference: 20050 CRANBROOK  
C of C Numbers:  
Legal Site Desc:

Patryk Wojciak, B.Sc., P.Chem.  
Account Manager

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

ADDRESS: 2559 29 Street NE, Calgary, AB T1Y 7B5 Canada | Phone: +1 403 291 9897 | Fax: +1 403 291 0298  
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

## ALS ENVIRONMENTAL ANALYTICAL REPORT

20-JAN-21 10:04 (MT)

Version: FINAL

Sample ID Description Sampled Date Sampled Time Client ID		L2548154-1 GROUNDWATER 11-JAN-21 12:00 E265129	L2548154-2 GROUNDWATER 11-JAN-21 12:00 E265122	L2548154-3 GROUNDWATER 11-JAN-21 12:00 E265123	L2548154-4 GROUNDWATER 11-JAN-21 12:00 E265124	L2548154-5 GROUNDWATER 11-JAN-21 12:00 E265125
Grouping	Analyte					
<b>WATER</b>						
<b>Physical Tests</b>	Hardness (as CaCO <sub>3</sub> ) (mg/L)	303	286	284	310 <sup>DLHC</sup>	56.5
	Total Suspended Solids (mg/L)	2950	1260	66.7	16000	7.6
<b>Anions and Nutrients</b>	Alkalinity, Total (as CaCO <sub>3</sub> ) (mg/L)	319	307	283	352	321
	Ammonia as N (mg/L)	<0.0050	0.0066	0.0437	<0.0050	<0.0050
	Bicarbonate (HCO <sub>3</sub> ) (mg/L)	389	374	345	429	376
	Carbonate (CO <sub>3</sub> ) (mg/L)	<5.0	<5.0	<5.0	<5.0	7.3
	Chloride (Cl) (mg/L)	22.6	12.2	34.0	16.0	1.69
	Conductivity (EC) (uS/cm)	605	531	589	570	572
	Fluoride (F) (mg/L)	0.107	0.104	0.132	0.112	2.09
	Hydroxide (OH) (mg/L)	<5.0	<5.0	<5.0	<5.0	<5.0
	Nitrate and Nitrite (as N) (mg/L)	1.73	1.47	0.0830	1.35	0.0713
	Nitrate (as N) (mg/L)	1.73	1.47	0.0830	1.35	0.0713
	Nitrite (as N) (mg/L)	0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	pH (pH)	7.94	8.06	8.20	7.98	8.52
	Sulfate (SO <sub>4</sub> ) (mg/L)	28.5	17.6	21.3	28.0	5.98
<b>Dissolved Metals</b>	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0035	0.0233	0.0021	0.0037	0.0034
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	0.00023	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00020	0.00016	0.00027	0.00024	0.00095
	Barium (Ba)-Dissolved (mg/L)	0.165	0.142	0.134	0.169	0.208
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	0.027	<0.010	0.100
	Cadmium (Cd)-Dissolved (mg/L)	0.0000196	0.0000134	0.0000405	0.0000177	0.0000120
	Calcium (Ca)-Dissolved (mg/L)	58.9	58.3	46.5	61.7	10.4
	Chromium (Cr)-Dissolved (mg/L)	0.00123	0.00133	<0.00010	0.00061	0.00136
	Cobalt (Co)-Dissolved (mg/L)	0.00082	0.00216	0.00173	0.00189	0.00039
	Copper (Cu)-Dissolved (mg/L)	0.00051	0.00077	0.00058	0.00066	0.00048
	Iron (Fe)-Dissolved (mg/L)	0.054	0.068	0.909	0.014	0.015
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.0057	0.0048	0.0847	0.0057	0.0206
	Magnesium (Mg)-Dissolved (mg/L)	37.7	34.2	40.7	37.9	7.44
	Manganese (Mn)-Dissolved (mg/L)	0.00986	0.0223	0.219	0.0519	0.00613
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.00423	0.00550	0.00519	0.0234	0.00181
	Nickel (Ni)-Dissolved (mg/L)	0.0114	0.0170	0.0187	0.0618	0.00178

\* 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				
		L2548154-6 GROUNDWATER 11-JAN-21 12:00 E265127				
Grouping	Analyte					
<b>WATER</b>						
<b>Physical Tests</b>	Hardness (as CaCO3) (mg/L)	308				
	Total Suspended Solids (mg/L)	6.3				
<b>Anions and Nutrients</b>	Alkalinity, Total (as CaCO3) (mg/L)	311				
	Ammonia as N (mg/L)	<0.0050				
	Bicarbonate (HCO3) (mg/L)	379				
	Carbonate (CO3) (mg/L)	<5.0				
	Chloride (Cl) (mg/L)	6.19				
	Conductivity (EC) (uS/cm)	536				
	Fluoride (F) (mg/L)	0.028				
	Hydroxide (OH) (mg/L)	<5.0				
	Nitrate and Nitrite (as N) (mg/L)	0.0635				
	Nitrate (as N) (mg/L)	0.0620				
	Nitrite (as N) (mg/L)	0.0015				
	pH (pH)	8.20				
	Sulfate (SO4) (mg/L)	15.9				
<b>Dissolved Metals</b>	Dissolved Mercury Filtration Location	FIELD				
	Dissolved Metals Filtration Location	FIELD				
	Aluminum (Al)-Dissolved (mg/L)	0.0020				
	Antimony (Sb)-Dissolved (mg/L)	<0.00010				
	Arsenic (As)-Dissolved (mg/L)	0.00013				
	Barium (Ba)-Dissolved (mg/L)	0.418				
	Beryllium (Be)-Dissolved (mg/L)	<0.000020				
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050				
	Boron (B)-Dissolved (mg/L)	<0.010				
	Cadmium (Cd)-Dissolved (mg/L)	0.000133				
	Calcium (Ca)-Dissolved (mg/L)	58.6				
	Chromium (Cr)-Dissolved (mg/L)	0.00097				
	Cobalt (Co)-Dissolved (mg/L)	0.00035				
	Copper (Cu)-Dissolved (mg/L)	0.00214				
	Iron (Fe)-Dissolved (mg/L)	0.012				
	Lead (Pb)-Dissolved (mg/L)	0.000053				
	Lithium (Li)-Dissolved (mg/L)	0.0017				
	Magnesium (Mg)-Dissolved (mg/L)	39.3				
	Manganese (Mn)-Dissolved (mg/L)	0.00221				
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050				
	Molybdenum (Mo)-Dissolved (mg/L)	0.000660				
	Nickel (Ni)-Dissolved (mg/L)	0.00164				

\* 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		L2548154-1 GROUNDWATER 11-JAN-21 12:00 E265129	L2548154-2 GROUNDWATER 11-JAN-21 12:00 E265122	L2548154-3 GROUNDWATER 11-JAN-21 12:00 E265123	L2548154-4 GROUNDWATER 11-JAN-21 12:00 E265124	L2548154-5 GROUNDWATER 11-JAN-21 12:00 E265125
Grouping	Analyte					
<b>WATER</b>						
<b>Dissolved Metals</b>	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	2.34	2.19	2.38	2.41	1.42
	Selenium (Se)-Dissolved (mg/L)	0.000480	0.000278	0.000385	0.000626	<0.000050
	Silicon (Si)-Dissolved (mg/L)	6.97	7.05	5.61	6.97	4.25
	Silver (Ag)-Dissolved (mg/L)	<0.000010	0.000031	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	20.8	14.1	20.0	19.8	129
	Strontium (Sr)-Dissolved (mg/L)	0.252	0.221	0.312	0.258	0.0737
	Sulfur (S)-Dissolved (mg/L)	10.7	6.64	7.98	11.3	2.41
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	0.00033	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	0.00041	<0.00030	<0.00030	<0.00030
	Uranium (U)-Dissolved (mg/L)	0.00520	0.00407	0.00367	0.00574	0.00117
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	0.0044	0.0054	0.440	0.0024	0.0025
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

\* 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		L2548154-6 GROUNDWATER 11-JAN-21 12:00 E265127				
Grouping	Analyte					
<b>WATER</b>						
<b>Dissolved Metals</b>	Phosphorus (P)-Dissolved (mg/L)	<0.050				
	Potassium (K)-Dissolved (mg/L)	2.11				
	Selenium (Se)-Dissolved (mg/L)	0.000207				
	Silicon (Si)-Dissolved (mg/L)	5.15				
	Silver (Ag)-Dissolved (mg/L)	<0.000010				
	Sodium (Na)-Dissolved (mg/L)	5.64				
	Strontium (Sr)-Dissolved (mg/L)	0.195				
	Sulfur (S)-Dissolved (mg/L)	6.06				
	Thallium (Tl)-Dissolved (mg/L)	<0.000010				
	Tin (Sn)-Dissolved (mg/L)	<0.00010				
	Titanium (Ti)-Dissolved (mg/L)	<0.00030				
	Uranium (U)-Dissolved (mg/L)	0.00392				
	Vanadium (V)-Dissolved (mg/L)	<0.00050				
	Zinc (Zn)-Dissolved (mg/L)	0.0137				
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030				

\* 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	L2548154-1, -2, -3, -4, -5, -6
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2548154-1, -2, -3, -4, -5, -6
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2548154-1, -2, -3, -4, -5, -6

### Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
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**
<b>BE-D-L-CCMS-CL</b>	Water	Diss. Be (low) 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.			
<b>CL-L-IC-N-CL</b>	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
<b>F-L-IC-CL</b>	Water	Fluoride	APHA 4110 B-Ion Chromatography
<b>HARDNESS-CALC-CL</b>	Water	Hardness	APHA 2340 B
Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO <sub>3</sub> equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.			
<b>HG-D-CVAA-CL</b>	Water	Dissolved Mercury in Water by CVAAS	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.			
<b>MET-D-CCMS-CL</b>	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.			
<b>N2N3-CALC-CL</b>	Water	Nitrate+Nitrite	CALCULATION
<b>NH3-L-F-CL</b>	Water	Ammonia, Total (as N)	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
<b>NO2-L-IC-N-CL</b>	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.			
<b>NO3-L-IC-N-CL</b>	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.			
<b>PH/EC/ALK-CL</b>	Water	pH, Conductivity and Total Alkalinity	APHA 4500H,2510,2320
All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed) pH measurement is determined from the activity of the hydrogen ions using a hydrogen electrode and a reference electrode. Alkalinity measurement is based on the sample's capacity to neutralize acid Conductivity measurement is based on the sample's capacity to convey an electric current			
<b>SO4-L-IC-N-CL</b>	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
<b>TSS-L-CL</b>	Water	Total Suspended Solids	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, and by drying the filter at 104 deg. C.			

\*\* 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:*

## Reference Information

Laboratory Definition Code	Laboratory Location
----------------------------	---------------------

CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA
----	--

### Chain of Custody Numbers:

#### 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.*

## Quality Control Report

Workorder: L2548154

Report Date: 20-JAN-21

Page 1 of 8

Client: Sperling Hansen Associates Inc.

#8 - 1225 East Keith Road

North Vancouver BC V7J 1J3

Contact: Scott Garthwaite

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>BE-D-L-CCMS-CL</b>		<b>Water</b>						
<b>Batch</b>	<b>R5349898</b>							
<b>WG3474441-3 DUP</b>		<b>L2548154-6</b>						
Beryllium (Be)-Dissolved		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	16-JAN-21
<b>WG3474441-2 LCS</b>		<b>TMRM</b>						
Beryllium (Be)-Dissolved			99.2		%		80-120	16-JAN-21
<b>WG3474441-1 MB</b>								
Beryllium (Be)-Dissolved			<0.000020		mg/L		0.00002	16-JAN-21
<b>WG3474441-4 MS</b>		<b>L2548154-6</b>						
Beryllium (Be)-Dissolved			110.7		%		70-130	16-JAN-21
<b>CL-L-IC-N-CL</b>		<b>Water</b>						
<b>Batch</b>	<b>R5347978</b>							
<b>WG3473949-10 LCS</b>								
Chloride (Cl)			104.6		%		85-115	14-JAN-21
<b>WG3473949-9 MB</b>								
Chloride (Cl)			<0.10		mg/L		0.1	14-JAN-21
<b>F-L-IC-CL</b>		<b>Water</b>						
<b>Batch</b>	<b>R5347978</b>							
<b>WG3473949-10 LCS</b>								
Fluoride (F)			99.0		%		85-115	14-JAN-21
<b>WG3473949-9 MB</b>								
Fluoride (F)			<0.020		mg/L		0.02	14-JAN-21
<b>HG-D-CVAA-CL</b>		<b>Water</b>						
<b>Batch</b>	<b>R5353916</b>							
<b>WG3475612-7 DUP</b>		<b>L2548154-1</b>						
Mercury (Hg)-Dissolved		<0.0000050	0.0000072	RPD-NA	mg/L	N/A	20	19-JAN-21
<b>WG3475612-2 LCS</b>								
Mercury (Hg)-Dissolved			101.0		%		80-120	19-JAN-21
<b>WG3475612-6 LCS</b>								
Mercury (Hg)-Dissolved			99.1		%		80-120	19-JAN-21
<b>WG3475612-1 MB</b>								
Mercury (Hg)-Dissolved			<0.0000050		mg/L		0.000005	19-JAN-21
<b>WG3475612-8 MS</b>		<b>L2548154-1</b>						
Mercury (Hg)-Dissolved			103.0		%		70-130	19-JAN-21
<b>MET-D-CCMS-CL</b>		<b>Water</b>						
<b>Batch</b>	<b>R5349898</b>							
<b>WG3474441-3 DUP</b>		<b>L2548154-6</b>						
Aluminum (Al)-Dissolved		0.0020	0.0021		mg/L	4.0	20	16-JAN-21
Antimony (Sb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	16-JAN-21

## Quality Control Report

Workorder: L2548154

Report Date: 20-JAN-21

Page 2 of 8

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-D-CCMS-CL</b>		<b>Water</b>						
<b>Batch</b>	<b>R5349898</b>							
<b>WG3474441-3</b>	<b>DUP</b>	<b>L2548154-6</b>						
Arsenic (As)-Dissolved		0.00013	0.00014		mg/L	7.6	20	16-JAN-21
Barium (Ba)-Dissolved		0.418	0.414		mg/L	1.0	20	16-JAN-21
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	16-JAN-21
Boron (B)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	16-JAN-21
Cadmium (Cd)-Dissolved		0.000133	0.000134		mg/L	0.9	20	16-JAN-21
Calcium (Ca)-Dissolved		58.6	60.2		mg/L	2.7	20	16-JAN-21
Chromium (Cr)-Dissolved		0.00097	0.00099		mg/L	2.2	20	16-JAN-21
Cobalt (Co)-Dissolved		0.00035	0.00035		mg/L	0.9	20	16-JAN-21
Copper (Cu)-Dissolved		0.00214	0.00213		mg/L	0.3	20	16-JAN-21
Iron (Fe)-Dissolved		0.012	0.012		mg/L	2.4	20	16-JAN-21
Lead (Pb)-Dissolved		0.000053	0.000053		mg/L	0.2	20	16-JAN-21
Lithium (Li)-Dissolved		0.0017	0.0016		mg/L	6.3	20	16-JAN-21
Magnesium (Mg)-Dissolved		39.3	39.0		mg/L	0.9	20	16-JAN-21
Manganese (Mn)-Dissolved		0.00221	0.00215		mg/L	2.7	20	16-JAN-21
Molybdenum (Mo)-Dissolved		0.000660	0.000674		mg/L	2.2	20	16-JAN-21
Nickel (Ni)-Dissolved		0.00164	0.00166		mg/L	1.1	20	16-JAN-21
Phosphorus (P)-Dissolved		<0.050	<0.050	RPD-NA	mg/L	N/A	20	16-JAN-21
Potassium (K)-Dissolved		2.11	2.11		mg/L	0.3	20	16-JAN-21
Selenium (Se)-Dissolved		0.000207	0.000220		mg/L	6.3	20	16-JAN-21
Silicon (Si)-Dissolved		5.15	5.16		mg/L	0.2	20	16-JAN-21
Silver (Ag)-Dissolved		<0.000010	0.000010	RPD-NA	mg/L	N/A	20	16-JAN-21
Sodium (Na)-Dissolved		5.64	5.62		mg/L	0.4	20	16-JAN-21
Strontium (Sr)-Dissolved		0.195	0.199		mg/L	2.1	20	16-JAN-21
Sulfur (S)-Dissolved		6.06	6.16		mg/L	1.6	20	16-JAN-21
Thallium (Tl)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	16-JAN-21
Tin (Sn)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	16-JAN-21
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	16-JAN-21
Uranium (U)-Dissolved		0.00392	0.00398		mg/L	1.5	20	16-JAN-21
Vanadium (V)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	16-JAN-21
Zinc (Zn)-Dissolved		0.0137	0.0137		mg/L	0.2	20	16-JAN-21
Zirconium (Zr)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	16-JAN-21
<b>WG3474441-2</b>	<b>LCS</b>	<b>TMRM</b>						
Aluminum (Al)-Dissolved			102.3		%		80-120	16-JAN-21
Antimony (Sb)-Dissolved			98.7		%		80-120	16-JAN-21

## Quality Control Report

Workorder: L2548154

Report Date: 20-JAN-21

Page 3 of 8

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-D-CCMS-CL</b>		<b>Water</b>						
<b>Batch</b>	<b>R5349898</b>							
<b>WG3474441-2</b>	<b>LCS</b>	<b>TMRM</b>						
Arsenic (As)-Dissolved			101.2		%		80-120	16-JAN-21
Barium (Ba)-Dissolved			101.5		%		80-120	16-JAN-21
Bismuth (Bi)-Dissolved			97.1		%		80-120	16-JAN-21
Boron (B)-Dissolved			99.3		%		80-120	16-JAN-21
Cadmium (Cd)-Dissolved			101.6		%		80-120	16-JAN-21
Calcium (Ca)-Dissolved			98.6		%		80-120	16-JAN-21
Chromium (Cr)-Dissolved			102.7		%		80-120	16-JAN-21
Cobalt (Co)-Dissolved			101.3		%		80-120	16-JAN-21
Copper (Cu)-Dissolved			98.9		%		80-120	16-JAN-21
Iron (Fe)-Dissolved			96.7		%		80-120	16-JAN-21
Lead (Pb)-Dissolved			99.7		%		80-120	16-JAN-21
Lithium (Li)-Dissolved			101.1		%		80-120	16-JAN-21
Magnesium (Mg)-Dissolved			107.6		%		80-120	16-JAN-21
Manganese (Mn)-Dissolved			103.0		%		80-120	16-JAN-21
Molybdenum (Mo)-Dissolved			101.6		%		80-120	16-JAN-21
Nickel (Ni)-Dissolved			101.2		%		80-120	16-JAN-21
Phosphorus (P)-Dissolved			104.6		%		70-130	16-JAN-21
Potassium (K)-Dissolved			103.4		%		80-120	16-JAN-21
Selenium (Se)-Dissolved			100.3		%		80-120	16-JAN-21
Silicon (Si)-Dissolved			101.7		%		60-140	16-JAN-21
Silver (Ag)-Dissolved			98.0		%		80-120	16-JAN-21
Sodium (Na)-Dissolved			105.0		%		80-120	16-JAN-21
Strontium (Sr)-Dissolved			102.9		%		80-120	16-JAN-21
Sulfur (S)-Dissolved			99.0		%		80-120	16-JAN-21
Thallium (Tl)-Dissolved			98.6		%		80-120	16-JAN-21
Tin (Sn)-Dissolved			100.3		%		80-120	16-JAN-21
Titanium (Ti)-Dissolved			95.4		%		80-120	16-JAN-21
Uranium (U)-Dissolved			101.5		%		80-120	16-JAN-21
Vanadium (V)-Dissolved			102.1		%		80-120	16-JAN-21
Zinc (Zn)-Dissolved			98.5		%		80-120	16-JAN-21
Zirconium (Zr)-Dissolved			97.0		%		80-120	16-JAN-21
<b>WG3474441-1</b>	<b>MB</b>							
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	16-JAN-21
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	16-JAN-21

## Quality Control Report

Workorder: L2548154

Report Date: 20-JAN-21

Page 4 of 8

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-D-CCMS-CL</b>								
<b>Water</b>								
<b>Batch</b>	<b>R5349898</b>							
<b>WG3474441-1 MB</b>								
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	16-JAN-21
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	16-JAN-21
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	16-JAN-21
Boron (B)-Dissolved			<0.010		mg/L		0.01	16-JAN-21
Cadmium (Cd)-Dissolved			<0.0000050		mg/L		0.000005	16-JAN-21
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	16-JAN-21
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	16-JAN-21
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	16-JAN-21
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	16-JAN-21
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	16-JAN-21
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	16-JAN-21
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	16-JAN-21
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	16-JAN-21
Manganese (Mn)-Dissolved			<0.00010		mg/L		0.0001	16-JAN-21
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	16-JAN-21
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	16-JAN-21
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	16-JAN-21
Potassium (K)-Dissolved			<0.050		mg/L		0.05	16-JAN-21
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	16-JAN-21
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	16-JAN-21
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	16-JAN-21
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	16-JAN-21
Strontium (Sr)-Dissolved			<0.00020		mg/L		0.0002	16-JAN-21
Sulfur (S)-Dissolved			<0.50		mg/L		0.5	16-JAN-21
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	16-JAN-21
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	16-JAN-21
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	16-JAN-21
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	16-JAN-21
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	16-JAN-21
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	16-JAN-21
Zirconium (Zr)-Dissolved			<0.00020		mg/L		0.0002	16-JAN-21
<b>WG3474441-4 MS</b>		<b>L2548154-6</b>						
Aluminum (Al)-Dissolved			110.1		%		70-130	16-JAN-21
Antimony (Sb)-Dissolved			106.3		%		70-130	16-JAN-21



## Quality Control Report

Workorder: L2548154

Report Date: 20-JAN-21

Page 5 of 8

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-D-CCMS-CL</b>	<b>Water</b>							
<b>Batch</b>	<b>R5349898</b>							
<b>WG3474441-4 MS</b>		<b>L2548154-6</b>						
Arsenic (As)-Dissolved			107.3		%		70-130	16-JAN-21
Barium (Ba)-Dissolved			N/A	MS-B	%		-	16-JAN-21
Bismuth (Bi)-Dissolved			102.8		%		70-130	16-JAN-21
Boron (B)-Dissolved			109.4		%		70-130	16-JAN-21
Cadmium (Cd)-Dissolved			109.5		%		70-130	16-JAN-21
Calcium (Ca)-Dissolved			N/A	MS-B	%		-	16-JAN-21
Chromium (Cr)-Dissolved			108.5		%		70-130	16-JAN-21
Cobalt (Co)-Dissolved			109.8		%		70-130	16-JAN-21
Copper (Cu)-Dissolved			105.6		%		70-130	16-JAN-21
Iron (Fe)-Dissolved			108.1		%		70-130	16-JAN-21
Lead (Pb)-Dissolved			107.0		%		70-130	16-JAN-21
Lithium (Li)-Dissolved			107.1		%		70-130	16-JAN-21
Magnesium (Mg)-Dissolved			N/A	MS-B	%		-	16-JAN-21
Manganese (Mn)-Dissolved			109.5		%		70-130	16-JAN-21
Molybdenum (Mo)-Dissolved			110.2		%		70-130	16-JAN-21
Nickel (Ni)-Dissolved			107.6		%		70-130	16-JAN-21
Phosphorus (P)-Dissolved			110.3		%		70-130	16-JAN-21
Potassium (K)-Dissolved			111.1		%		70-130	16-JAN-21
Selenium (Se)-Dissolved			112.2		%		70-130	16-JAN-21
Silicon (Si)-Dissolved			109.3		%		70-130	16-JAN-21
Silver (Ag)-Dissolved			107.2		%		70-130	16-JAN-21
Sodium (Na)-Dissolved			113.7		%		70-130	16-JAN-21
Strontium (Sr)-Dissolved			108.3		%		70-130	16-JAN-21
Thallium (Tl)-Dissolved			104.9		%		70-130	16-JAN-21
Tin (Sn)-Dissolved			106.9		%		70-130	16-JAN-21
Titanium (Ti)-Dissolved			103.3		%		70-130	16-JAN-21
Uranium (U)-Dissolved			110.9		%		70-130	16-JAN-21
Vanadium (V)-Dissolved			108.0		%		70-130	16-JAN-21
Zinc (Zn)-Dissolved			106.2		%		70-130	16-JAN-21
Zirconium (Zr)-Dissolved			108.8		%		70-130	16-JAN-21
<b>NH3-L-F-CL</b>	<b>Water</b>							

## Quality Control Report

Workorder: L2548154

Report Date: 20-JAN-21

Page 6 of 8

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>NH3-L-F-CL</b>	<b>Water</b>							
Batch	R5350127							
<b>WG3474466-14 LCS</b>								
Ammonia as N			106.0		%		85-115	16-JAN-21
<b>WG3474466-13 MB</b>								
Ammonia as N			<0.0050		mg/L		0.005	16-JAN-21
<b>NO2-L-IC-N-CL</b>	<b>Water</b>							
Batch	R5347978							
<b>WG3473949-10 LCS</b>								
Nitrite (as N)			101.5		%		90-110	14-JAN-21
<b>WG3473949-9 MB</b>								
Nitrite (as N)			<0.0010		mg/L		0.001	14-JAN-21
<b>NO3-L-IC-N-CL</b>	<b>Water</b>							
Batch	R5347978							
<b>WG3473949-10 LCS</b>								
Nitrate (as N)			105.8		%		90-110	14-JAN-21
<b>WG3473949-9 MB</b>								
Nitrate (as N)			<0.0050		mg/L		0.005	14-JAN-21
<b>PH/EC/ALK-CL</b>	<b>Water</b>							
Batch	R5348677							
<b>WG3474168-8 LCS</b>								
Conductivity (EC)			99.2		%		90-110	14-JAN-21
Alkalinity, Total (as CaCO3)			102.1		%		85-115	14-JAN-21
<b>WG3474168-7 MB</b>								
Conductivity (EC)			<2.0		uS/cm		2	14-JAN-21
Bicarbonate (HCO3)			<5.0		mg/L		5	14-JAN-21
Carbonate (CO3)			<5.0		mg/L		5	14-JAN-21
Hydroxide (OH)			<5.0		mg/L		5	14-JAN-21
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	14-JAN-21
<b>SO4-L-IC-N-CL</b>	<b>Water</b>							
Batch	R5347978							
<b>WG3473949-10 LCS</b>								
Sulfate (SO4)			101.0		%		85-115	14-JAN-21
<b>WG3473949-9 MB</b>								
Sulfate (SO4)			<0.050		mg/L		0.05	14-JAN-21
<b>TSS-L-CL</b>	<b>Water</b>							

## Quality Control Report

Workorder: L2548154

Report Date: 20-JAN-21

Page 7 of 8

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>TSS-L-CL</b>	<b>Water</b>							
<b>Batch</b>	<b>R5349796</b>							
<b>WG3474326-2 LCS</b>								
Total Suspended Solids			105.4		%		85-115	16-JAN-21
<b>WG3474326-4 LCS</b>								
Total Suspended Solids			96.3		%		85-115	16-JAN-21
<b>WG3474326-1 MB</b>								
Total Suspended Solids			<1.0		mg/L		1	16-JAN-21
<b>WG3474326-3 MB</b>								
Total Suspended Solids			<1.0		mg/L		1	16-JAN-21

# Quality Control Report

Workorder: L2548154

Report Date: 20-JAN-21

Page 8 of 8

## Legend:

---

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

## Sample Parameter Qualifier Definitions:

---

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

---

## Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

---

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



www.alsglobal.com

# Chain of Custody (COC) / Analytical Request Form

COC Number: 20 -

Canada Toll Free: 1 800 668 9878

Page of

<b>Report To</b> Contact and company name below will appear on the final report		<b>Reports / Recipients</b>		<b>Turnaround Time (TAT) Requested</b>		
Company:	Sperling Hansen Associates Inc.	Select Report Format:	<input type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)	<input checked="" type="checkbox"/> Routine [R] if received by 3pm M-F - no s <input type="checkbox"/> 4 day [P4] if received by 3pm M-F - 20% <input type="checkbox"/> 3 day [P3] if received by 3pm M-F - 25% <input type="checkbox"/> 2 day [P2] if received by 3pm M-F - 50% <input type="checkbox"/> 1 day [E] if received by 3pm M-F - 100% <input type="checkbox"/> Same day [E2] if received by 10am M-S - fees may apply to rush requests on weekend routine tests		
Contact:	Scott Garthwaite	Merge QC/QCI Reports with COA	<input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> N/A			
Phone:	778-471-7088	<input checked="" type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked				
Company address below will appear on the final report		Select Distribution:	<input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			
Street:	1225 East Keith Road	Email 1 or Fax	sgarthwaite@sperlinghansen.com	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm am/pm For all tests with rush TATs requested, please contact your AM to confirm availability.		
City/Province:	North Vancouver, B.C.	Email 2	chetherington@sperlinghansen.com			
Postal Code:	V7J 1J3	Email 3				
<b>Invoice To</b>		<b>Invoice Recipients</b>		<b>Analysis Request</b>		
Same as Report To <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		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below		
Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		Email 1 or Fax rhajjafari@sperlinghansen.com				
Company:		Email 2				
Contact:						
<b>Project Information</b>		<b>Oil and Gas Required Fields (client use)</b>		<b>NUMBER OF CONTAINERS</b> ammonia Anions Total Alkalinity TSS Dissolved Metals (F/P) Total Metals (P)		
ALS Account # / Quote #:		AFE/Cost Center: PO#				
Job #: 20050 Cranbrook		Major/Minor Code: Routing Code:				
PO / AFE:		Requisitioner:				
LSD:		Location:		<b>SAMPLES ON HOLD</b> <b>EXTENDED STORAGE REQUIRED</b> <b>SUSPECTED HAZARD (see notes)</b>		
ALS Lab Work Order # (ALS use only):		ALS Contact: Dean Watt				
		Sampler: <i>Tyler McBride</i>				
ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type		
	<del>TH4A</del> E265129	11-01-21	11	Groundwater	X X X	
	E265122	11-01-21		Groundwater	X X X	
	E265123	11-01-21		Groundwater	X X X	
	E265124	11-01-21		Groundwater	X X X	
	E265125	11-01-21		Groundwater	X X X	
	E265127	11-01-21		Groundwater	X X X	
<b>Drinking Water (DW) Samples<sup>1</sup> (client use)</b>		<b>Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)</b>		<b>SAMPLE RECEIPT DETAILS (ALS use only)</b>		
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		British Columbia Contaminated Sites Regulation Stage 10 Amendment (NOV. 2017)		Cooling Method: <input type="checkbox"/> NONE <input type="checkbox"/> ICE <input type="checkbox"/> ICE PACKS <input type="checkbox"/> FROZEN <input type="checkbox"/> COOLING INITIATED		
Are samples for human consumption/ use? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		British Columbia Approved and Working Water Quality Guidelines (MAY, 2015)		Submission Comments identified on Sample Receipt Notification: <input type="checkbox"/> YES <input type="checkbox"/> NO		
				Cooler Custody Seals Intact: <input type="checkbox"/> YES <input type="checkbox"/> N/A Sample Custody Seals Intact: <input type="checkbox"/> YES <input type="checkbox"/> N/A		
				INITIAL COOLER TEMPERATURES °C		
				FINAL COOLER TEMPERATURES °C		
<b>SHIPMENT RELEASE (client use)</b>		<b>INITIAL SHIPMENT RECEPTION (ALS use only)</b>		<b>FINAL SHIPMENT RECEPTION (ALS use only)</b>		
Released by: <i>Tyler McBride</i>	Date: 13-01-21	Time:	Received by: <i>[Signature]</i>	Date: 1/14	Time: 14:50	

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY

YELLOW - CLIENT COPY

AUG 2020 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

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



Sperling Hansen Associates Inc.  
ATTN: Scott Garthwaite  
#8 - 1225 East Keith Road  
North Vancouver BC V7J 1J3

Date Received: 29-APR-21  
Report Date: 10-MAY-21 10:07 (MT)  
Version: FINAL

Client Phone: 604-986-7723

## Certificate of Analysis

Lab Work Order #: L2581860  
Project P.O. #: NOT SUBMITTED  
Job Reference: 20050 CRANBROOK  
C of C Numbers:  
Legal Site Desc:

Patryk Wojciak, B.Sc., P.Chem.  
Account Manager

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

ADDRESS: 2559 29 Street NE, Calgary, AB T1Y 7B5 Canada | Phone: +1 403 291 9897 | Fax: +1 403 291 0298  
ALS CANADA LTD Part of the ALS Group An ALS Limited Company



## ALS ENVIRONMENTAL ANALYTICAL REPORT

10-MAY-21 10:07 (MT)

Version: FINAL

Sample ID Description Sampled Date Sampled Time Client ID		L2581860-1 WATER 26-APR-21 08:00 TH4-A / E265129	L2581860-2 WATER 26-APR-21 08:00 E265122	L2581860-3 WATER 26-APR-21 08:00 E265123	L2581860-4 WATER 26-APR-21 08:00 E265124	L2581860-5 WATER 26-APR-21 08:00 E265125
Grouping	Analyte					
<b>WATER</b>						
<b>Physical Tests</b>	Hardness (as CaCO <sub>3</sub> ) (mg/L)	325	289	298	322	56.3
	Temperature (Degree C)	19.8	20.3	20.6	20.4	20.7
	Total Suspended Solids (mg/L)	57.6	462	63.5	4790	5.9
	Turbidity (NTU)	18.0	288	33.8	>4000	3.59
<b>Anions and Nutrients</b>	Alkalinity, Total (as CaCO <sub>3</sub> ) (mg/L)	284	269	269	304	316
	Ammonia as N (mg/L)	<0.0050	0.0337	0.0233	0.0117	0.0053
	Bicarbonate (HCO <sub>3</sub> ) (mg/L)	346	328	328	370	358
	Carbonate (CO <sub>3</sub> ) (mg/L)	<5.0	<5.0	<5.0	<5.0	13.8
	Chloride (Cl) (mg/L)	22.9 <sup>HTD</sup>	12.0 <sup>HTD</sup>	34.2	17.7	1.45
	Conductivity (EC) (uS/cm)	611	535	598	595	581
	Fluoride (F) (mg/L)	0.077 <sup>HTD</sup>	0.074 <sup>HTD</sup>	0.100	0.076	2.07
	Hydroxide (OH) (mg/L)	<5.0	<5.0	<5.0	<5.0	<5.0
	Nitrate (as N) (mg/L)	1.74 <sup>HTD</sup>	1.47 <sup>HTD</sup>	0.0684	1.40	0.0609
	Nitrite (as N) (mg/L)	<0.0010 <sup>HTD</sup>	<0.0010 <sup>HTD</sup>	<0.0010	0.0010	<0.0010
	pH (pH)	7.94 <sup>HTD</sup>	8.02 <sup>HTD</sup>	8.22	7.91	8.60
	Sulfate (SO <sub>4</sub> ) (mg/L)	29.4 <sup>HTD</sup>	18.4 <sup>HTD</sup>	21.8	32.5	5.96
<b>Dissolved Metals</b>	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	<0.0010	0.0018	<0.0010	0.0017	0.0027
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00016	0.00019	0.00048	0.00028	0.00087
	Barium (Ba)-Dissolved (mg/L)	0.176	0.134	0.112	0.167	0.190
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	0.034	<0.010	0.108
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	0.0000244	0.0000232	<0.0000050	0.0000081
	Calcium (Ca)-Dissolved (mg/L)	64.6	58.2	48.3	62.4	10.4
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	0.00014	0.00010	0.00018
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	0.00029	0.00039	0.00066	0.00031
	Copper (Cu)-Dissolved (mg/L)	0.00089	0.00118	0.00118	0.00030	0.00031
	Iron (Fe)-Dissolved (mg/L)	0.022	0.027	0.347	<0.010	0.083
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.0065	0.0054	0.108	0.0065	0.0237
	Magnesium (Mg)-Dissolved (mg/L)	39.7	34.8	43.2	40.4	7.38
	Manganese (Mn)-Dissolved (mg/L)	0.00078	0.00747	0.134	0.0156	0.0129
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.00113	0.00376	0.00251	0.00784	0.00237

\* 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		L2581860-6 WATER 26-APR-21 08:00 E265127				
Grouping	Analyte					
<b>WATER</b>						
<b>Physical Tests</b>	Hardness (as CaCO <sub>3</sub> ) (mg/L)	292				
	Temperature (Degree C)	20.6				
	Total Suspended Solids (mg/L)	4.1				
	Turbidity (NTU)	3.83				
<b>Anions and Nutrients</b>	Alkalinity, Total (as CaCO <sub>3</sub> ) (mg/L)	268				
	Ammonia as N (mg/L)	0.0181				
	Bicarbonate (HCO <sub>3</sub> ) (mg/L)	327				
	Carbonate (CO <sub>3</sub> ) (mg/L)	<5.0				
	Chloride (Cl) (mg/L)	5.33				
	Conductivity (EC) (uS/cm)	505				
	Fluoride (F) (mg/L)	<0.020				
	Hydroxide (OH) (mg/L)	<5.0				
	Nitrate (as N) (mg/L)	0.0659				
	Nitrite (as N) (mg/L)	<0.0010				
	pH (pH)	8.15				
	Sulfate (SO <sub>4</sub> ) (mg/L)	14.5				
<b>Dissolved Metals</b>	Dissolved Mercury Filtration Location	FIELD				
	Dissolved Metals Filtration Location	FIELD				
	Aluminum (Al)-Dissolved (mg/L)	0.0016				
	Antimony (Sb)-Dissolved (mg/L)	<0.00010				
	Arsenic (As)-Dissolved (mg/L)	0.00011				
	Barium (Ba)-Dissolved (mg/L)	0.391				
	Beryllium (Be)-Dissolved (mg/L)	<0.000020				
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050				
	Boron (B)-Dissolved (mg/L)	<0.010				
	Cadmium (Cd)-Dissolved (mg/L)	0.0000750				
	Calcium (Ca)-Dissolved (mg/L)	51.7				
	Chromium (Cr)-Dissolved (mg/L)	<0.00010				
	Cobalt (Co)-Dissolved (mg/L)	0.00012				
	Copper (Cu)-Dissolved (mg/L)	0.00179				
	Iron (Fe)-Dissolved (mg/L)	0.025				
	Lead (Pb)-Dissolved (mg/L)	<0.000050				
	Lithium (Li)-Dissolved (mg/L)	0.0016				
	Magnesium (Mg)-Dissolved (mg/L)	39.5				
	Manganese (Mn)-Dissolved (mg/L)	0.00197				
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050				
	Molybdenum (Mo)-Dissolved (mg/L)	0.000593				

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

## ALS ENVIRONMENTAL ANALYTICAL REPORT

10-MAY-21 10:07 (MT)

Version: FINAL

Sample ID Description Sampled Date Sampled Time Client ID		L2581860-1 WATER 26-APR-21 08:00 TH4-A / E265129	L2581860-2 WATER 26-APR-21 08:00 E265122	L2581860-3 WATER 26-APR-21 08:00 E265123	L2581860-4 WATER 26-APR-21 08:00 E265124	L2581860-5 WATER 26-APR-21 08:00 E265125
Grouping	Analyte					
<b>WATER</b>						
<b>Dissolved Metals</b>	Nickel (Ni)-Dissolved (mg/L)	0.00254	0.00911	0.00473	0.0113	0.00652
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	2.43	2.24	2.45	2.52	1.42
	Selenium (Se)-Dissolved (mg/L)	0.000477	0.000262	0.000430	0.000587	<0.000050
	Silicon (Si)-Dissolved (mg/L)	7.22	6.95	6.21	7.18	4.37
	Silver (Ag)-Dissolved (mg/L)	0.000013	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	21.1	14.5	19.0	20.9	127
	Strontium (Sr)-Dissolved (mg/L)	0.276	0.226	0.319	0.287	0.0765
	Sulfur (S)-Dissolved (mg/L)	11.7	7.34	8.86	12.6	2.56
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	0.000015	<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Dissolved (mg/L)	0.00557	0.00419	0.00435	0.00631	0.00117
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	0.0052	0.0156	0.0402	0.0017	0.0019
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
<b>Volatile Organic Compounds</b>	Benzene (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Ethylbenzene (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Methyl-tert-Butyl Ether (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Styrene (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Toluene (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	o-Xylene (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	m+p-Xylene (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Xylenes (mg/L)	<0.00071	<0.00071	<0.00071	<0.00071	<0.00071
	Volatile Hydrocarbons (VH6-10) (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
	Surrogate: 4-Bromofluorobenzene (%)	101.2	101.7	101.0	104.0	102.1
	Surrogate: 3,4-Dichlorotoluene (%)	83.2	87.2	86.2	73.6	83.4
	Surrogate: 1,4-Difluorobenzene (%)	95.9	97.1	97.4	97.7	94.1
<b>Hydrocarbons</b>	EPH10-19 (ug/L)	<100	<100	<100	<100	<100
	EPH19-32 (ug/L)	<100	160	<100	<100	240
	VPH (C6-C10) (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
	Surrogate: 2-Bromobenzotrifluoride (%)	82.1	81.2	81.7	82.1	81.2

\* 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		L2581860-6 WATER 26-APR-21 08:00 E265127				
Grouping	Analyte					
<b>WATER</b>						
<b>Dissolved Metals</b>	Nickel (Ni)-Dissolved (mg/L)	0.00224				
	Phosphorus (P)-Dissolved (mg/L)	<0.050				
	Potassium (K)-Dissolved (mg/L)	2.16				
	Selenium (Se)-Dissolved (mg/L)	0.000210				
	Silicon (Si)-Dissolved (mg/L)	4.95				
	Silver (Ag)-Dissolved (mg/L)	<0.000010				
	Sodium (Na)-Dissolved (mg/L)	5.23				
	Strontium (Sr)-Dissolved (mg/L)	0.182				
	Sulfur (S)-Dissolved (mg/L)	5.43				
	Thallium (Tl)-Dissolved (mg/L)	<0.000010				
	Tin (Sn)-Dissolved (mg/L)	<0.00010				
	Titanium (Ti)-Dissolved (mg/L)	<0.00030				
	Uranium (U)-Dissolved (mg/L)	0.00360				
	Vanadium (V)-Dissolved (mg/L)	<0.00050				
	Zinc (Zn)-Dissolved (mg/L)	0.0118				
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030				
<b>Volatile Organic Compounds</b>	Benzene (mg/L)	<0.00050				
	Ethylbenzene (mg/L)	<0.00050				
	Methyl-tert-Butyl Ether (mg/L)	<0.00050				
	Styrene (mg/L)	<0.00050				
	Toluene (mg/L)	<0.00050				
	o-Xylene (mg/L)	<0.00050				
	m+p-Xylene (mg/L)	<0.00050				
	Xylenes (mg/L)	<0.00071				
	Volatile Hydrocarbons (VH6-10) (mg/L)	<0.10				
	Surrogate: 4-Bromofluorobenzene (%)	103.9				
	Surrogate: 3,4-Dichlorotoluene (%)	73.6				
	Surrogate: 1,4-Difluorobenzene (%)	95.9				
<b>Hydrocarbons</b>	EPH10-19 (ug/L)	<100				
	EPH19-32 (ug/L)	<100				
	VPH (C6-C10) (mg/L)	<0.10				
	Surrogate: 2-Bromobenzotrifluoride (%)	83.1				

\* 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	Magnesium (Mg)-Dissolved	MS-B	L2581860-1, -2, -3, -4, -5, -6
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2581860-1, -2, -3, -4, -5, -6

### Qualifiers for Individual Parameters Listed:

Qualifier	Description
HTD	Hold time exceeded for re-analysis or dilution, but initial testing was conducted within hold time.
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**
<b>BE-D-L-CCMS-CL</b>	Water	Diss. Be (low) 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.			
<b>BTXSM-HS-MS-CL</b>	Water	BTEX, Styrene and MTBE	EPA 8260C/5021A
The water sample, with added reagents, is heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. BTEX Target compound concentrations are measured using mass spectrometry detection.			
<b>CL-L-IC-N-CL</b>	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
<b>EPH-L-ME-FID-CL</b>	Water	EPH (C10-C19) & EPH (C19-C32)	BC Lab manual
EPH is extracted from water using a hexane micro-extraction technique, with analysis by GC-FID, as per the BC Lab Manual. EPH results include PAHs and are therefore not equivalent to LEPH or HEPH.			
<b>F-L-IC-CL</b>	Water	Fluoride	APHA 4110 B-Ion Chromatography
<b>HARDNESS-CALC-CL</b>	Water	Hardness	APHA 2340 B
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.			
<b>HG-D-CVAA-CL</b>	Water	Dissolved Mercury in Water by CVAAS	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.			
<b>MET-D-CCMS-CL</b>	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.			
<b>NH3-L-F-CL</b>	Water	Ammonia, Total (as N)	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
<b>NO2-L-IC-N-CL</b>	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.			
<b>NO3-L-IC-N-CL</b>	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.			
<b>PH/EC/ALK-CL</b>	Water	pH, Conductivity and Total Alkalinity	APHA 4500H,2510,2320
All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)			
pH measurement is determined from the activity of the hydrogen ions using a hydrogen electrode and a reference electrode.			
Alkalinity measurement is based on the sample's capacity to neutralize acid			
Conductivity measurement is based on the sample's capacity to convey an electric current			
<b>SO4-L-IC-N-CL</b>	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
<b>TEMP-CL</b>	Water	Temperature	APHA 2550-Thermometer
<b>TSS-L-CL</b>	Water	Total Suspended Solids	APHA 2540 D-Gravimetric
This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids			

## Reference Information

(TSS) are determined by filtering a sample through a glass fibre filter, and by drying the filter at 104 deg. C.

**TURBIDITY-CL**                      Water                      Turbidity                      APHA 2130 B-Nephelometer

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

**VH-HS-FID-CL**                      Water                      VHs                      BC Env. Lab Manual (VH in Water)

The water sample, with added reagents, is heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. Compounds eluting between n-hexane and n-decane are measured and summed together using flame-ionization detection.

**VPH-CALC-CL**                      Water                      VPH Calculation                      BC MOE LABORATORY MANUAL (2005)

These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water" (Version 2.1, July 20, 1999). According to this method, the concentrations of specific Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene, Xylenes and Styrene) are subtracted from the collective concentration of Volatile Hydrocarbons (VH) that elute between n-hexane (nC6) and n-decane (nC10). Analysis of Volatile Hydrocarbons adheres to all prescribed elements of BCMELP method "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

**XYLENES-CALC-CL**                      Water                      Sum of Xylene Isomer Concentrations                      CALCULATION

Calculation of Total Xylenes

Total Xylenes is the sum of the concentrations of the ortho, meta, and para Xylene isomers. Results below detection limit (DL) are treated as zero. The DL for Total Xylenes is set to a value no less than the square root of the sum of the squares of the DLs of the individual Xylenes.

\*\* 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
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA

### Chain of Custody Numbers:

#### 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.*





## Quality Control Report

Workorder: L2581860

Report Date: 10-MAY-21

Page 2 of 8

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>EPH-L-ME-FID-CL</b>								
<b>Water</b>								
<b>Batch</b>	<b>R5453956</b>							
<b>WG3527874-2</b>	<b>LCS</b>							
EPH10-19			105.0		%		70-130	06-MAY-21
EPH19-32			102.0		%		70-130	06-MAY-21
<b>WG3527874-1</b>	<b>MB</b>							
EPH10-19			<100		ug/L		100	06-MAY-21
EPH19-32			<100		ug/L		100	06-MAY-21
Surrogate: 2-Bromobenzotrifluoride			72.7		%		60-140	06-MAY-21
<b>F-L-IC-CL</b>								
<b>Water</b>								
<b>Batch</b>	<b>R5449618</b>							
<b>WG3529286-3</b>	<b>DUP</b>	<b>L2581860-6</b>						
Fluoride (F)		<0.020	<0.020	RPD-NA	mg/L	N/A	20	01-MAY-21
<b>WG3529286-2</b>	<b>LCS</b>							
Fluoride (F)			91.6		%		85-115	01-MAY-21
<b>WG3529286-1</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	01-MAY-21
<b>WG3529286-4</b>	<b>MS</b>	<b>L2581860-6</b>						
Fluoride (F)			99.7		%		75-125	01-MAY-21
<b>HG-D-CVAA-CL</b>								
<b>Water</b>								
<b>Batch</b>	<b>R5452466</b>							
<b>WG3529545-10</b>	<b>LCS</b>							
Mercury (Hg)-Dissolved			104.0		%		80-120	05-MAY-21
<b>WG3529545-9</b>	<b>MB</b>							
Mercury (Hg)-Dissolved			<0.000005C		mg/L		0.000005	05-MAY-21
<b>MET-D-CCMS-CL</b>								
<b>Water</b>								
<b>Batch</b>	<b>R5450760</b>							
<b>WG3529562-6</b>	<b>LCS</b>	<b>TMRM</b>						
Aluminum (Al)-Dissolved			98.0		%		80-120	05-MAY-21
Antimony (Sb)-Dissolved			99.8		%		80-120	05-MAY-21
Arsenic (As)-Dissolved			93.8		%		80-120	05-MAY-21
Barium (Ba)-Dissolved			95.4		%		80-120	05-MAY-21
Bismuth (Bi)-Dissolved			96.3		%		80-120	05-MAY-21
Boron (B)-Dissolved			97.6		%		80-120	05-MAY-21
Cadmium (Cd)-Dissolved			93.5		%		80-120	05-MAY-21
Calcium (Ca)-Dissolved			92.5		%		80-120	05-MAY-21
Chromium (Cr)-Dissolved			93.9		%		80-120	05-MAY-21
Cobalt (Co)-Dissolved			95.0		%		80-120	05-MAY-21

## Quality Control Report

Workorder: L2581860

Report Date: 10-MAY-21

Page 3 of 8

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-D-CCMS-CL</b>		<b>Water</b>						
<b>Batch</b>	<b>R5450760</b>							
<b>WG3529562-6</b>	<b>LCS</b>	<b>TMRM</b>						
Copper (Cu)-Dissolved			95.0		%		80-120	05-MAY-21
Iron (Fe)-Dissolved			102.6		%		80-120	05-MAY-21
Lead (Pb)-Dissolved			93.5		%		80-120	05-MAY-21
Lithium (Li)-Dissolved			108.7		%		80-120	05-MAY-21
Magnesium (Mg)-Dissolved			99.7		%		80-120	05-MAY-21
Manganese (Mn)-Dissolved			96.2		%		80-120	05-MAY-21
Molybdenum (Mo)-Dissolved			94.9		%		80-120	05-MAY-21
Nickel (Ni)-Dissolved			87.0		%		80-120	05-MAY-21
Phosphorus (P)-Dissolved			98.2		%		70-130	05-MAY-21
Potassium (K)-Dissolved			93.7		%		80-120	05-MAY-21
Selenium (Se)-Dissolved			87.7		%		80-120	05-MAY-21
Silicon (Si)-Dissolved			97.4		%		60-140	05-MAY-21
Silver (Ag)-Dissolved			96.3		%		80-120	05-MAY-21
Sodium (Na)-Dissolved			97.1		%		80-120	05-MAY-21
Strontium (Sr)-Dissolved			98.3		%		80-120	05-MAY-21
Sulfur (S)-Dissolved			97.4		%		80-120	05-MAY-21
Thallium (Tl)-Dissolved			96.2		%		80-120	05-MAY-21
Tin (Sn)-Dissolved			92.1		%		80-120	05-MAY-21
Titanium (Ti)-Dissolved			92.7		%		80-120	05-MAY-21
Uranium (U)-Dissolved			96.9		%		80-120	05-MAY-21
Vanadium (V)-Dissolved			95.4		%		80-120	05-MAY-21
Zinc (Zn)-Dissolved			94.7		%		80-120	05-MAY-21
Zirconium (Zr)-Dissolved			94.7		%		80-120	05-MAY-21
<b>WG3529562-5</b>	<b>MB</b>							
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	05-MAY-21
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	05-MAY-21
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	05-MAY-21
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	05-MAY-21
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	05-MAY-21
Boron (B)-Dissolved			<0.010		mg/L		0.01	05-MAY-21
Cadmium (Cd)-Dissolved			<0.0000050		mg/L		0.000005	05-MAY-21
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	05-MAY-21
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	05-MAY-21
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	05-MAY-21

## Quality Control Report

Workorder: L2581860

Report Date: 10-MAY-21

Page 4 of 8

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-CL		Water						
Batch	R5450760							
WG3529562-5 MB								
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	05-MAY-21
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	05-MAY-21
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	05-MAY-21
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	05-MAY-21
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	05-MAY-21
Manganese (Mn)-Dissolved			<0.00010		mg/L		0.0001	05-MAY-21
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	05-MAY-21
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	05-MAY-21
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	05-MAY-21
Potassium (K)-Dissolved			<0.050		mg/L		0.05	05-MAY-21
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	05-MAY-21
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	05-MAY-21
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	05-MAY-21
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	05-MAY-21
Strontium (Sr)-Dissolved			<0.00020		mg/L		0.0002	05-MAY-21
Sulfur (S)-Dissolved			<0.50		mg/L		0.5	05-MAY-21
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	05-MAY-21
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	05-MAY-21
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	05-MAY-21
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	05-MAY-21
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	05-MAY-21
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	05-MAY-21
Zirconium (Zr)-Dissolved			<0.00020		mg/L		0.0002	05-MAY-21
NH3-L-F-CL		Water						
Batch	R5450818							
WG3529618-2 LCS								
Ammonia as N			103.8		%		85-115	05-MAY-21
WG3529618-1 MB								
Ammonia as N			<0.0050		mg/L		0.005	05-MAY-21
NO2-L-IC-N-CL		Water						
Batch	R5449618							
WG3529286-3 DUP		L2581860-6						
Nitrite (as N)			<0.0010	<0.0010	RPD-NA	mg/L	N/A	20
WG3529286-2 LCS								
Nitrite (as N)			103.0		%		90-110	01-MAY-21



## Quality Control Report

Workorder: L2581860

Report Date: 10-MAY-21

Page 6 of 8

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>SO4-L-IC-N-CL</b>		<b>Water</b>						
<b>Batch</b>	<b>R5449618</b>							
<b>WG3529286-3</b>	<b>DUP</b>	<b>L2581860-6</b>						
Sulfate (SO4)		14.5	14.5		mg/L	0.0	20	01-MAY-21
<b>WG3529286-2</b>	<b>LCS</b>							
Sulfate (SO4)			99.7		%		85-115	01-MAY-21
<b>WG3529286-1</b>	<b>MB</b>							
Sulfate (SO4)			<0.050		mg/L		0.05	01-MAY-21
<b>WG3529286-4</b>	<b>MS</b>	<b>L2581860-6</b>						
Sulfate (SO4)			94.4		%		75-125	01-MAY-21
<b>TEMP-CL</b>		<b>Water</b>						
<b>Batch</b>	<b>R5454752</b>							
<b>WG3531386-3</b>	<b>DUP</b>	<b>L2581860-6</b>						
Temperature		20.6	20.6		Degree C	0.0	25	07-MAY-21
<b>TSS-L-CL</b>		<b>Water</b>						
<b>Batch</b>	<b>R5447581</b>							
<b>WG3528101-2</b>	<b>LCS</b>							
Total Suspended Solids			89.0		%		85-115	03-MAY-21
<b>WG3528101-1</b>	<b>MB</b>							
Total Suspended Solids			<1.0		mg/L		1	03-MAY-21
<b>TURBIDITY-CL</b>		<b>Water</b>						
<b>Batch</b>	<b>R5444060</b>							
<b>WG3527067-6</b>	<b>DUP</b>	<b>L2581860-6</b>						
Turbidity		3.83	3.51		NTU	8.7	15	30-APR-21
<b>WG3527067-5</b>	<b>LCS</b>							
Turbidity			99.0		%		85-115	30-APR-21
<b>WG3527067-4</b>	<b>MB</b>							
Turbidity			<0.10		NTU		0.1	30-APR-21
<b>VH-HS-FID-CL</b>		<b>Water</b>						
<b>Batch</b>	<b>R5452338</b>							
<b>WG3530035-2</b>	<b>LCS</b>							
Volatile Hydrocarbons (VH6-10)			110.7		%		70-130	04-MAY-21
<b>WG3530035-1</b>	<b>MB</b>							
Volatile Hydrocarbons (VH6-10)			<0.10		mg/L		0.1	04-MAY-21
Surrogate: 3,4-Dichlorotoluene			86.3		%		70-130	04-MAY-21

# Quality Control Report

Workorder: L2581860

Report Date: 10-MAY-21

Page 7 of 8

## Legend:

---

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

## Sample Parameter Qualifier Definitions:

---

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

---

# Quality Control Report

Workorder: L2581860

Report Date: 10-MAY-21

Page 8 of 8

## Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
<b>Physical Tests</b>							
Turbidity							
	1	26-APR-21 08:00	30-APR-21 09:20	3	4	days	EHTR
	2	26-APR-21 08:00	30-APR-21 09:20	3	4	days	EHTR
	3	26-APR-21 08:00	30-APR-21 09:20	3	4	days	EHTR
	4	26-APR-21 08:00	30-APR-21 09:20	3	4	days	EHTR
	5	26-APR-21 08:00	30-APR-21 09:20	3	4	days	EHTR
	6	26-APR-21 08:00	30-APR-21 09:20	3	4	days	EHTR

## Anions and Nutrients

### Nitrate in Water by IC (Low Level)

1	26-APR-21 08:00	04-MAY-21 11:19	3	8	days	EHTR
2	26-APR-21 08:00	04-MAY-21 11:19	3	8	days	EHTR
3	26-APR-21 08:00	01-MAY-21 09:12	3	5	days	EHTR
4	26-APR-21 08:00	01-MAY-21 09:12	3	5	days	EHTR
5	26-APR-21 08:00	01-MAY-21 09:12	3	5	days	EHTR
6	26-APR-21 08:00	01-MAY-21 09:12	3	5	days	EHTR

### Nitrite in Water by IC (Low Level)

1	26-APR-21 08:00	04-MAY-21 11:19	3	8	days	EHTR
2	26-APR-21 08:00	04-MAY-21 11:19	3	8	days	EHTR
3	26-APR-21 08:00	01-MAY-21 09:12	3	5	days	EHTR
4	26-APR-21 08:00	01-MAY-21 09:12	3	5	days	EHTR
5	26-APR-21 08:00	01-MAY-21 09:12	3	5	days	EHTR
6	26-APR-21 08:00	01-MAY-21 09:12	3	5	days	EHTR

## Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

## Notes\*:

Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.  
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2581860 were received on 29-APR-21 08:55.

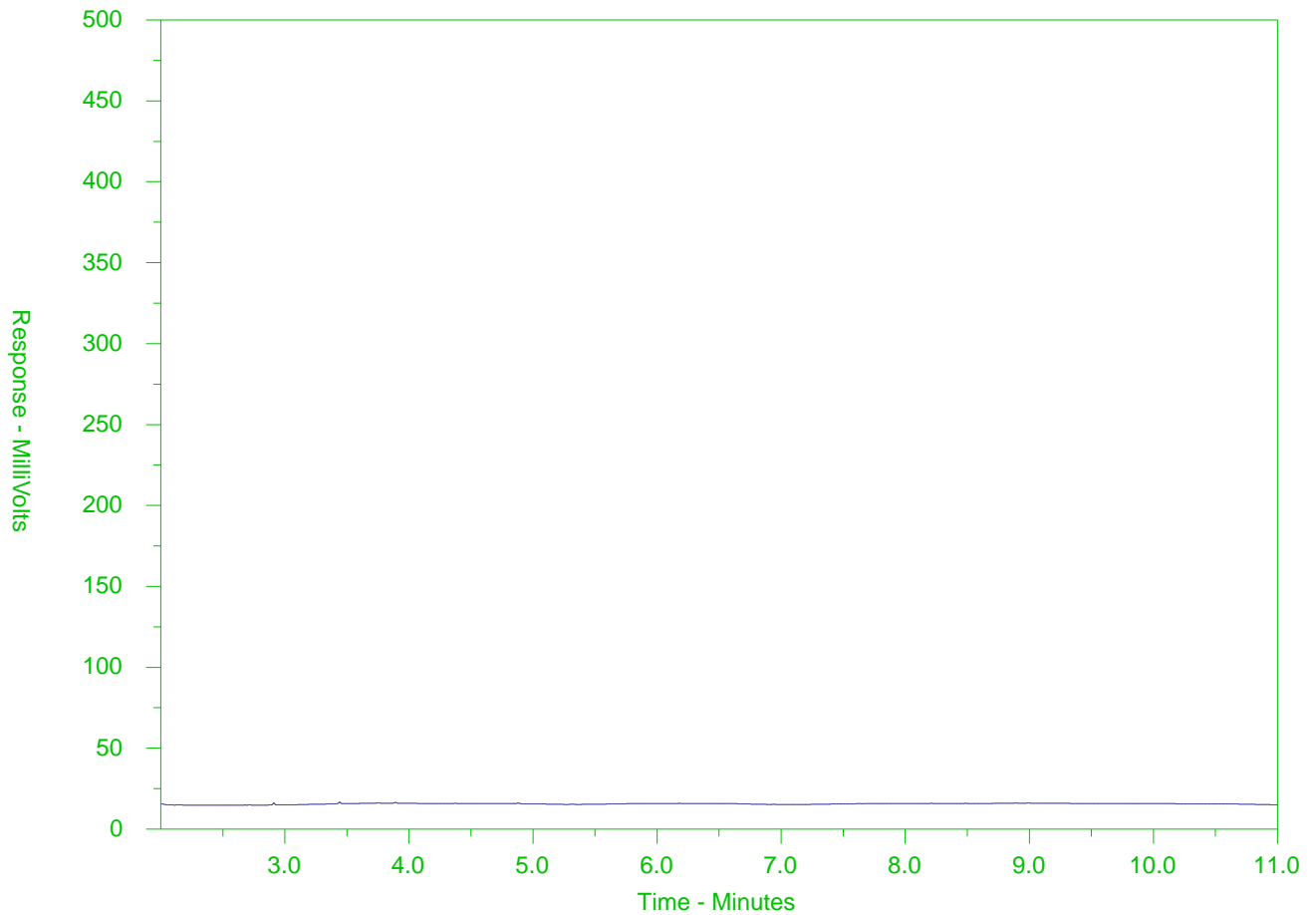
ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2581860-1  
Client Sample ID: TH4-A / E265129



← EPH10-19 →		← EPH19-32 →	
nC10	nC19	nC32	
174°C	330°C	467°C	
346°F	626°F	873°F	
← Gasoline →	← Motor Oils/ Lube Oils/ Grease →		
← Diesel/ Jet Fuels →			

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

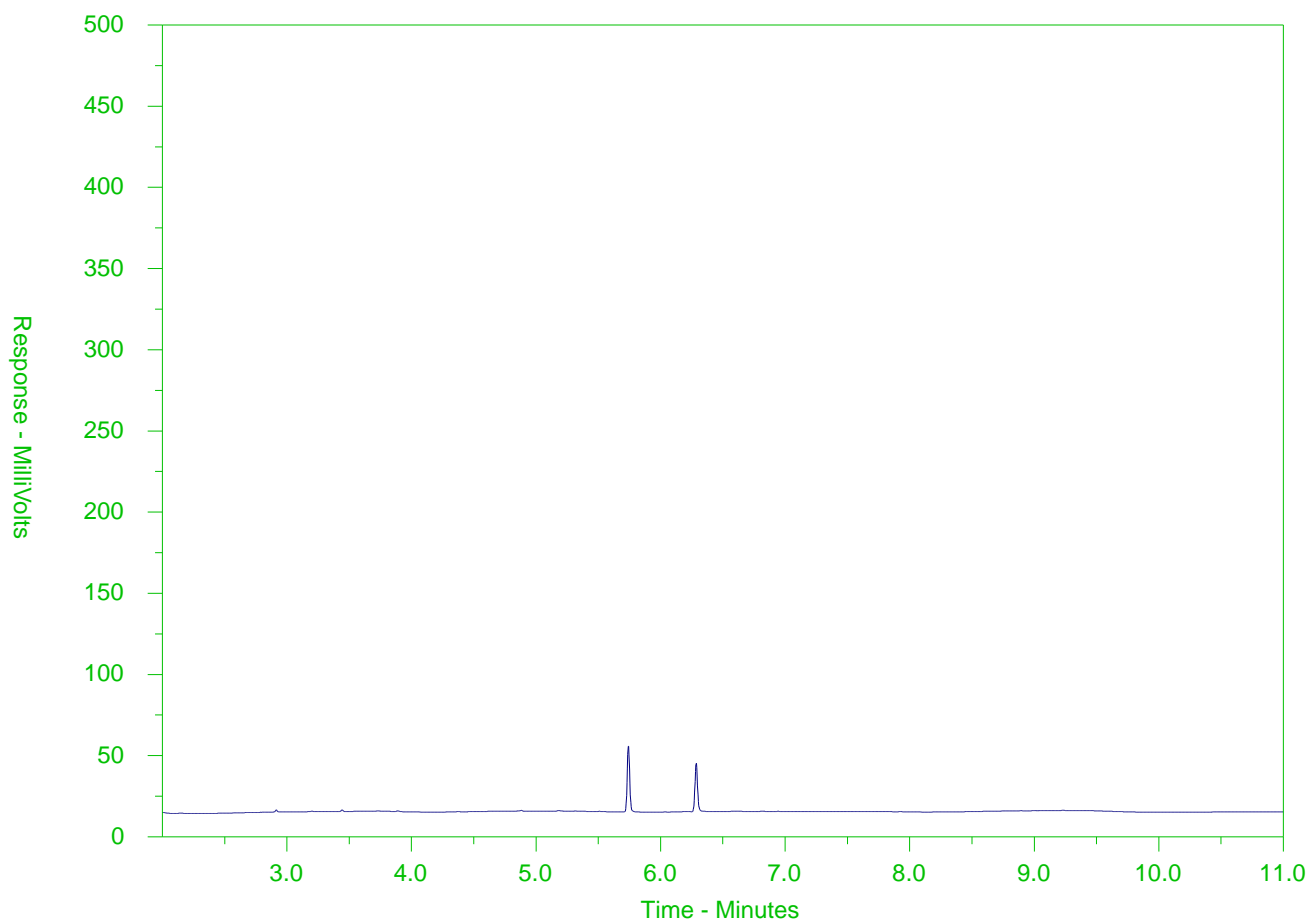
A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at [www.alsglobal.com](http://www.alsglobal.com).



# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2581860-2  
Client Sample ID: E265122



← EPH10-19 →		← EPH19-32 →	
nC10	nC19	nC32	
174°C	330°C	467°C	
346°F	626°F	873°F	
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →	
← Diesel/ Jet Fuels →			

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

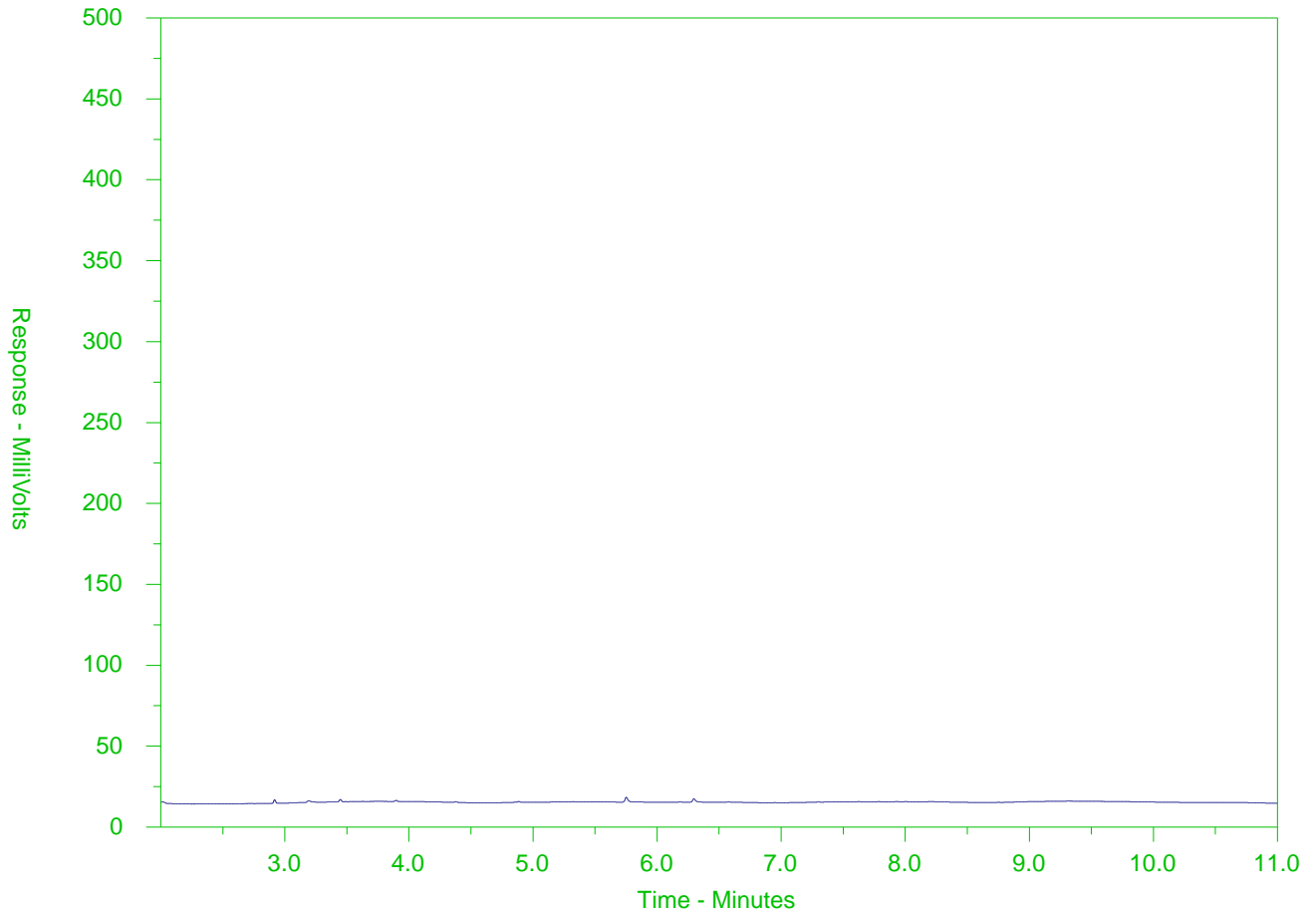
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at [www.alsglobal.com](http://www.alsglobal.com).

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2581860-3  
Client Sample ID: E265123



← EPH10-19 →		← EPH19-32 →	
nC10	nC19	nC32	
174°C	330°C	467°C	
346°F	626°F	873°F	
← Gasoline →	← Motor Oils/ Lube Oils/ Grease →		
← Diesel/ Jet Fuels →			

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

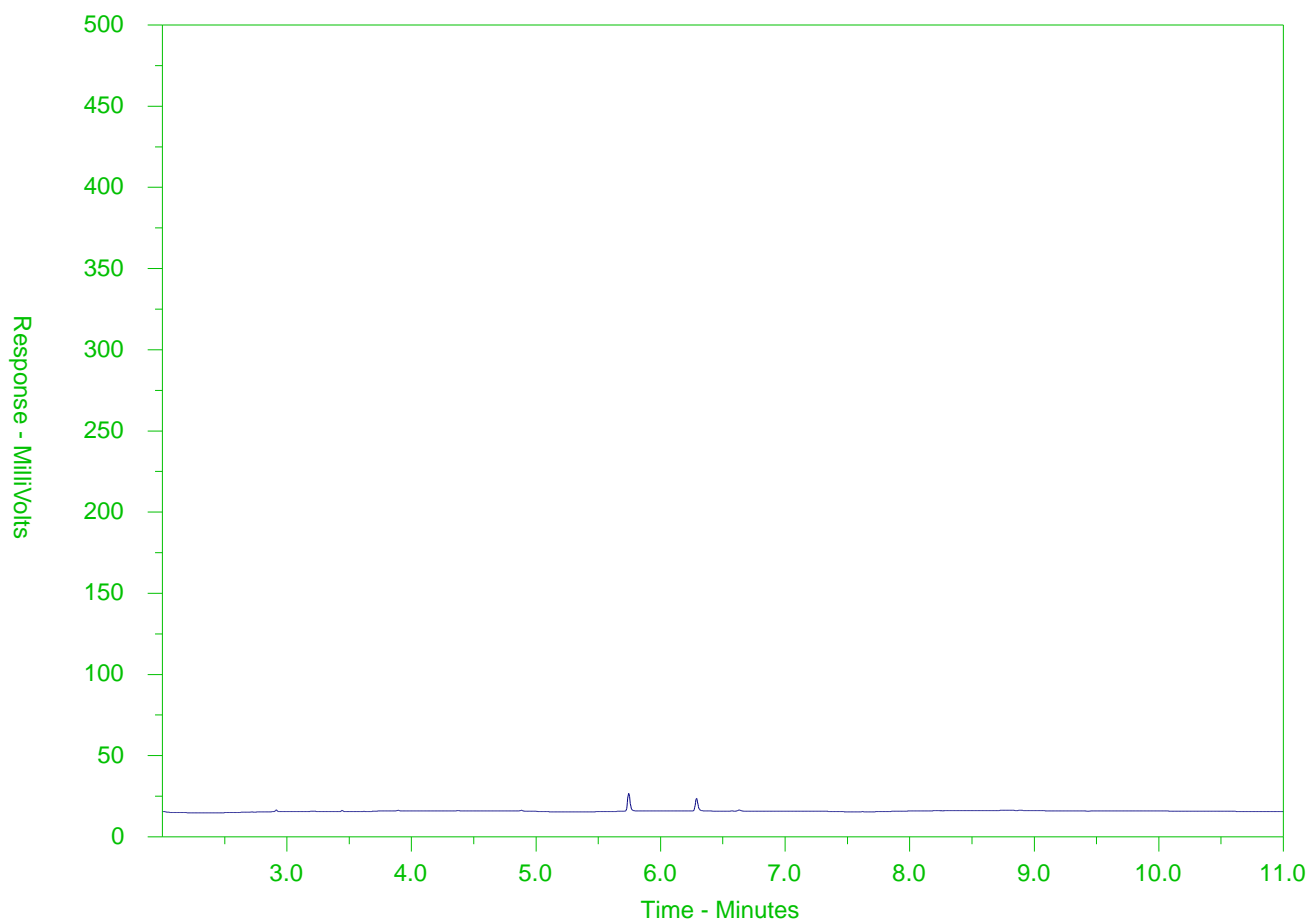
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at [www.alsglobal.com](http://www.alsglobal.com).

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2581860-4  
Client Sample ID: E265124



← EPH10-19 →		← EPH19-32 →	
nC10	nC19	nC32	
174°C	330°C	467°C	
346°F	626°F	873°F	
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →	
← Diesel/ Jet Fuels →			

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

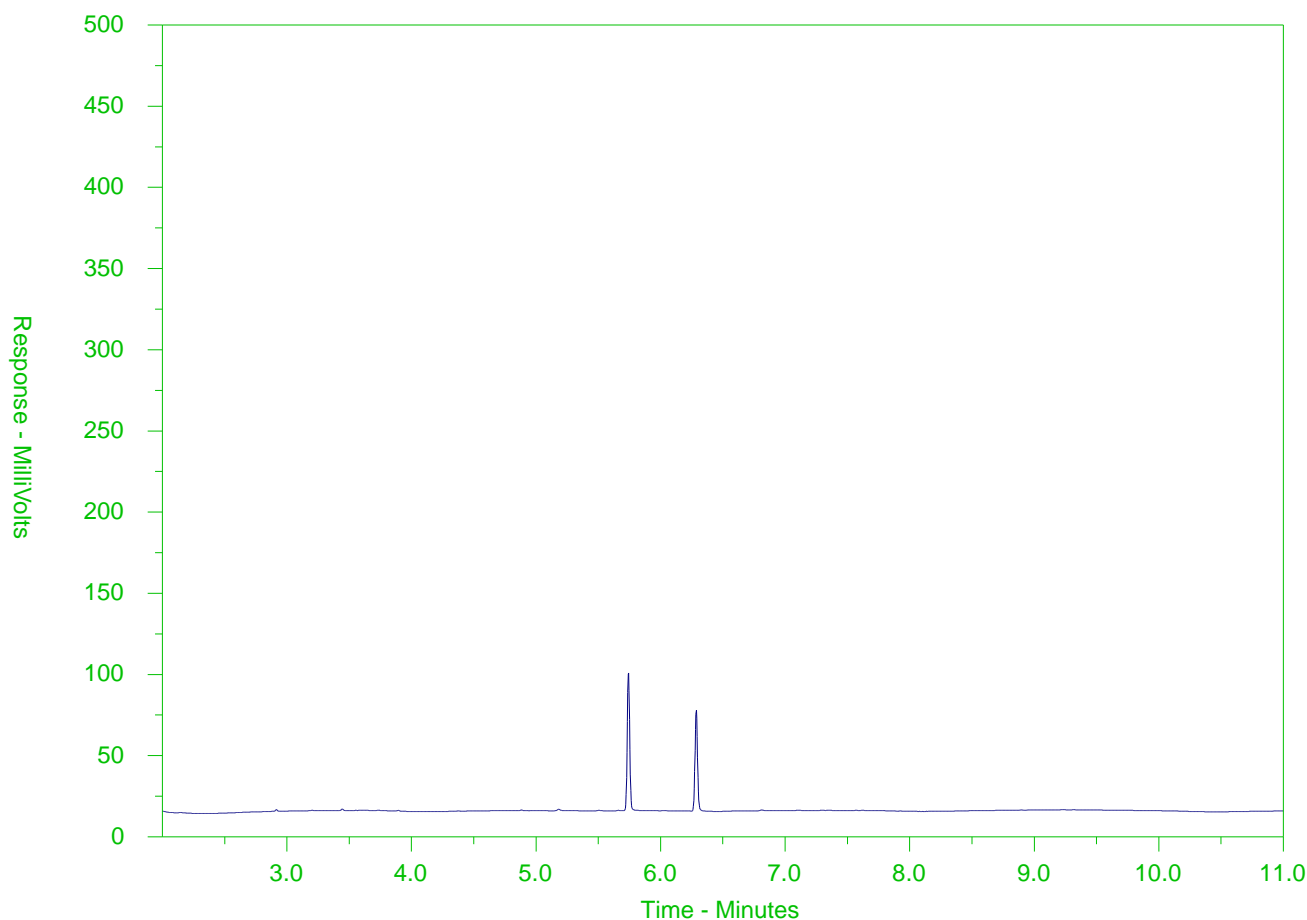
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at [www.alsglobal.com](http://www.alsglobal.com).

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2581860-5  
Client Sample ID: E265125



← EPH10-19 →		← EPH19-32 →	
nC10	nC19	nC32	
174°C	330°C	467°C	
346°F	626°F	873°F	
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →	
← Diesel/ Jet Fuels →			

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

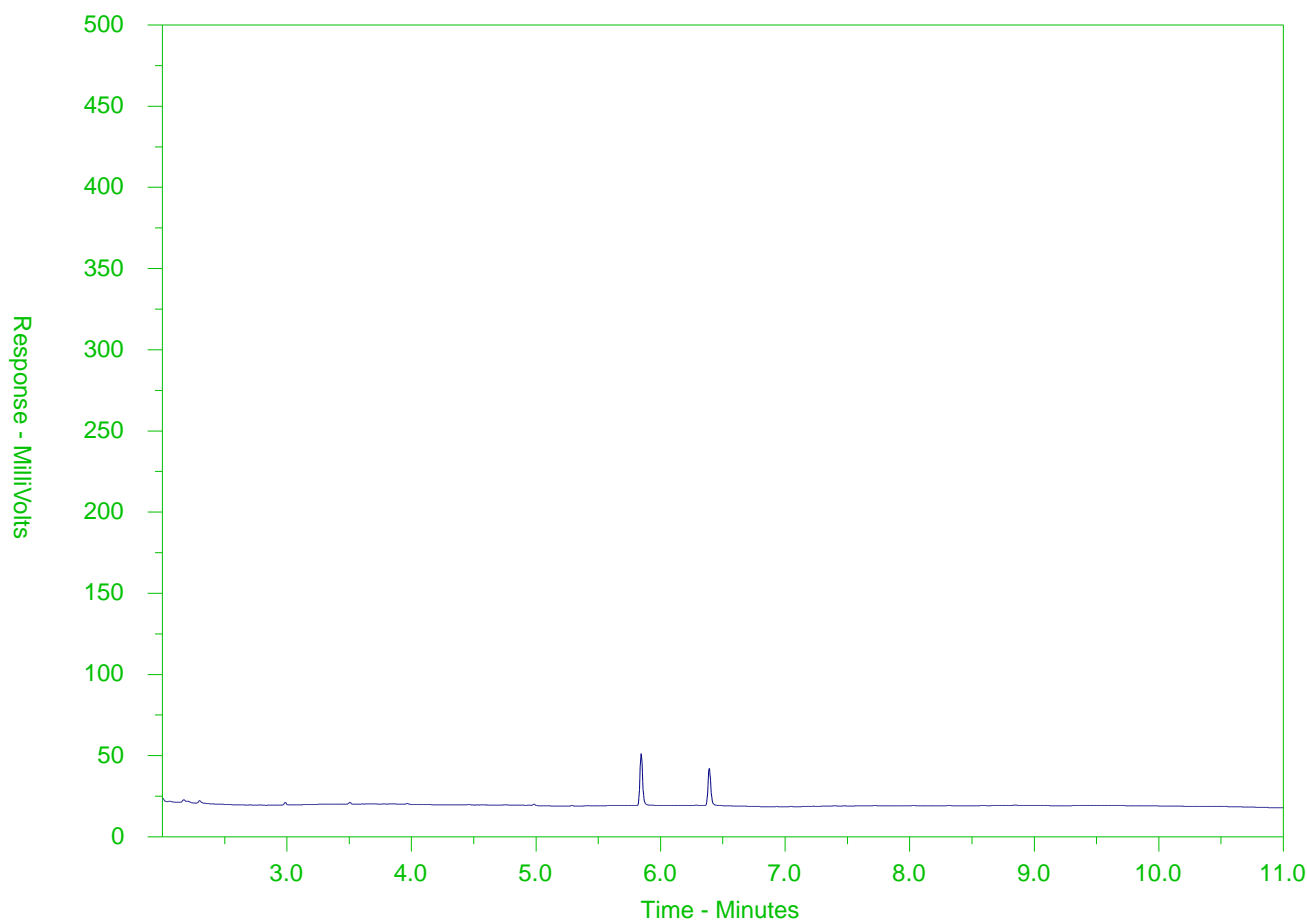
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at [www.alsglobal.com](http://www.alsglobal.com).

# BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2581860-6  
Client Sample ID: E265127



← EPH10-19 →		← EPH19-32 →	
nC10	nC19	nC32	
174°C	330°C	467°C	
346°F	626°F	873°F	
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →	
← Diesel/ Jet Fuels →			

The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Note: This chromatogram was produced using GC conditions that are specific to the ALS Canada EPH method. Refer to the ALS Canada EPH Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at [www.alsglobal.com](http://www.alsglobal.com).



www.alsglobal.com

Cha



L2581860-COFC

COC Number: 20 -

Page 1 of 1

<b>Report To</b> Contact and company name below will appear on the final report Company: Sperling Hansen Associates Inc. Contact: Scott Garthwaite Phone: 778-471-7088 Company address below will appear on the final report Street: 1225 East Keith Road City/Province: North Vancouver, B.C. Postal Code: V7J 1J3		<b>Reports / Recipients</b> Select Report Format: <input type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL) Merge QC/QCI Reports with COA <input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> N/A <input checked="" type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: sgarthwaite@sperlinghansen.com Email 2: chetherington@sperlinghansen.com Email 3:		<b>Turnaround Time (TAT) Requested</b> <input checked="" type="checkbox"/> Routine [R] if received by 3pm M-F - no surcharges apply <input type="checkbox"/> 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum <input type="checkbox"/> 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum <input type="checkbox"/> 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum <input type="checkbox"/> 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum <input type="checkbox"/> Same day [E2] if received by 10am M-S - 200% rush surcharge. Additional fees may apply to rush requests on weekends, statutory holidays and non-routine tests Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm am/pm For all tests with rush TATs requested, please contact your AM to confirm availability.		<b>AFIX ALS BARCODE LABEL HERE</b> (ALS use only)																																																																																																																																																												
<b>Invoice To</b> Same as Report To <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> NO Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO Company: Contact:		<b>Invoice Recipients</b> Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: chetherington@sperlinghansen.com Email 2:		<b>Analysis Request</b> Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">NUMBER OF CONTAINERS</th> <th colspan="16">Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below</th> <th rowspan="2">SAMPLES ON HOLD</th> <th rowspan="2">EXTENDED STORAGE REQUIRED</th> <th rowspan="2">SUSPECTED HAZARD (see notes)</th> </tr> <tr> <th>ammonia</th> <th>Anions, temp, pH, conductivity</th> <th>Total Alkalinity</th> <th>TSS</th> <th>Dissolved Metals (F/P)</th> <th>chloride</th> <th>sulfate</th> <th>Turbidity</th> <th>BTEX</th> <th>EPH/VP</th> <th>Nitrite</th> <th>nitrate</th> <th>fluoride</th> </tr> </thead> <tbody> <tr> <td>8</td> <td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td> </tr> <tr> <td>8</td> <td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td> </tr> <tr> <td>8</td> <td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td> </tr> <tr> <td>8</td> <td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td> </tr> <tr> <td>8</td> <td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td> </tr> <tr> <td>8</td> <td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td> </tr> </tbody> </table>						NUMBER OF CONTAINERS	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)	ammonia	Anions, temp, pH, conductivity	Total Alkalinity	TSS	Dissolved Metals (F/P)	chloride	sulfate	Turbidity	BTEX	EPH/VP	Nitrite	nitrate	fluoride	8	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R				8	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R				8	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R				8	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R				8	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R				8	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R			
NUMBER OF CONTAINERS	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)																																																																																																																																															
	ammonia	Anions, temp, pH, conductivity	Total Alkalinity	TSS	Dissolved Metals (F/P)	chloride	sulfate	Turbidity	BTEX	EPH/VP	Nitrite	nitrate	fluoride																																																																																																																																																					
8	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R																																																																																																																																																		
8	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R																																																																																																																																																		
8	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R																																																																																																																																																		
8	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R																																																																																																																																																		
8	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R																																																																																																																																																		
8	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R																																																																																																																																																		
<b>Project Information</b> ALS Account # / Quote #: 20050 Cranbrook Job #: 20050 Cranbrook PO / AFE: LSD:		<b>Oil and Gas Required Fields (client use)</b> AFE/Cost Center: PO# Major/Minor Code: Routing Code: Requisitioner: Location:		<b>ALS Lab Work Order # (ALS use only):</b> ALS Contact: Dean Watt Sampler: T. McBride																																																																																																																																																														
<b>ALS Sample #</b> (ALS use only)	<b>Sample Identification and/or Coordinates</b> (This description will appear on the report)	<b>Date</b> (dd-mmm-yy)	<b>Time</b> (hh:mm)	<b>Sample Type</b>															<b>NUMBER OF CONTAINERS</b>	<b>ammonia</b>	<b>Anions, temp, pH, conductivity</b>	<b>Total Alkalinity</b>	<b>TSS</b>	<b>Dissolved Metals (F/P)</b>	<b>chloride</b>	<b>sulfate</b>	<b>Turbidity</b>	<b>BTEX</b>	<b>EPH/VP</b>	<b>Nitrite</b>	<b>nitrate</b>	<b>fluoride</b>	<b>SAMPLES ON HOLD</b>	<b>EXTENDED STORAGE REQUIRED</b>	<b>SUSPECTED HAZARD (see notes)</b>																																																																																																																															
	TH4-A / E265129	26-04-2021	-	Groundwater	8	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R																																																																																																																																										
	E265122	"	-	Groundwater	8	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R																																																																																																																																										
	E265123	"	-	Groundwater	8	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R																																																																																																																																										
	E265124	"	-	Groundwater	8	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R																																																																																																																																										
	E265125	"	-	Groundwater	8	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R																																																																																																																																										
	E265127	"	-	Groundwater	8	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R																																																																																																																																										



Sperling Hansen Associates Inc.  
ATTN: Scott Garthwaite  
#8 - 1225 East Keith Road  
North Vancouver BC V7J 1J3

Date Received: 30-JUL-21  
Report Date: 11-AUG-21 15:04 (MT)  
Version: FINAL

Client Phone: 604-986-7723

## Certificate of Analysis

Lab Work Order #: L2621315  
Project P.O. #: NOT SUBMITTED  
Job Reference: 20050 CRANBROOK  
C of C Numbers:  
Legal Site Desc:

Patryk Wojciak, B.Sc., P.Chem.  
Account Manager

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

ADDRESS: 2559 29 Street NE, Calgary, AB T1Y 7B5 Canada | Phone: +1 403 291 9897 | Fax: +1 403 291 0298  
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

## ALS ENVIRONMENTAL ANALYTICAL REPORT

11-AUG-21 15:04 (MT)

Version: FINAL

Sample ID Description Sampled Date Sampled Time Client ID		L2621315-1 Groundwater 28-JUL-21 12:00 TH4-A / E265129	L2621315-2 Groundwater 28-JUL-21 12:00 E265122	L2621315-3 Groundwater 28-JUL-21 12:00 E265123	L2621315-4 Groundwater 28-JUL-21 12:00 E265124	L2621315-5 Groundwater 28-JUL-21 12:00 E265125
Grouping	Analyte					
<b>WATER</b>						
<b>Physical Tests</b>	Hardness (as CaCO3) (mg/L)	306	269	280	293	55.1
	Temperature (Degree C)	17.0	17.4	17.6	18.4	18.4
	Total Suspended Solids (mg/L)	760	3570	50.2	10900	20.2
	Turbidity (NTU)	233	3130	8.77	>4000	4.45
<b>Anions and Nutrients</b>	Alkalinity, Total (as CaCO3) (mg/L)	321	561	275	2770	330
	Ammonia as N (mg/L)	<0.0050	0.0247	0.0081	0.0207	<0.0050
	Bicarbonate (HCO3) (mg/L)	392	684	335	3380	402
	Carbonate (CO3) (mg/L)	<5.0	<5.0	<5.0	<5.0	<5.0
	Chloride (Cl) (mg/L)	23.5	12.3	31.8	16.9	1.71
	Conductivity (EC) (uS/cm)	597	515	551	584	551
	Fluoride (F) (mg/L)	0.035	0.038	0.035	0.038	2.10
	Hydroxide (OH) (mg/L)	<5.0	<5.0	<5.0	<5.0	<5.0
	Nitrate and Nitrite (as N) (mg/L)	1.70	1.46	0.143	1.35	0.0822
	Nitrate (as N) (mg/L)	1.70	1.46	0.143	1.35	0.0822
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	0.0015	<0.0010
	pH (pH)	7.59	7.70	7.57	7.62	8.08
	Sulfate (SO4) (mg/L)	27.0	16.4	19.8	27.4	5.30
<b>Dissolved Metals</b>	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0028	0.0040	0.0011	0.0027	0.0031
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	0.00026	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00023	0.00041	0.00018	0.00029	0.00090
	Barium (Ba)-Dissolved (mg/L)	0.187	0.143	0.116	0.196	0.205
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	0.029	<0.010	0.099
	Cadmium (Cd)-Dissolved (mg/L)	0.0000178	0.0000104	0.0000790	0.0000069	0.0000083
	Calcium (Ca)-Dissolved (mg/L)	59.5	52.1	43.5	56.4	10.2
	Chromium (Cr)-Dissolved (mg/L)	0.00256	0.00457	0.00072	0.00049	0.00097
	Cobalt (Co)-Dissolved (mg/L)	0.00038	0.00079	0.00069	0.00023	<0.00010
	Copper (Cu)-Dissolved (mg/L)	0.00072	0.00050	0.00456	<0.00020	0.00111
	Iron (Fe)-Dissolved (mg/L)	0.087	0.011	0.109	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.0058	0.0050	0.0815	0.0058	0.0213
	Magnesium (Mg)-Dissolved (mg/L)	38.4	33.8	41.6	37.0	7.23
	Manganese (Mn)-Dissolved (mg/L)	0.00709	0.0223	0.0243	0.00970	0.00320
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050



# ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2621315-6 Groundwater 28-JUL-21 12:00 E265127				
Grouping	Analyte					
<b>WATER</b>						
<b>Physical Tests</b>	Hardness (as CaCO3) (mg/L)	289				
	Temperature (Degree C)	19.3				
	Total Suspended Solids (mg/L)	11.1				
	Turbidity (NTU)	2.38				
<b>Anions and Nutrients</b>	Alkalinity, Total (as CaCO3) (mg/L)	299				
	Ammonia as N (mg/L)	<0.0050				
	Bicarbonate (HCO3) (mg/L)	364				
	Carbonate (CO3) (mg/L)	<5.0				
	Chloride (Cl) (mg/L)	5.72				
	Conductivity (EC) (uS/cm)	522				
	Fluoride (F) (mg/L)	<0.020				
	Hydroxide (OH) (mg/L)	<5.0				
	Nitrate and Nitrite (as N) (mg/L)	0.0748				
	Nitrate (as N) (mg/L)	0.0748				
	Nitrite (as N) (mg/L)	<0.0010				
	pH (pH)	7.64				
	Sulfate (SO4) (mg/L)	12.8				
<b>Dissolved Metals</b>	Dissolved Mercury Filtration Location	FIELD				
	Dissolved Metals Filtration Location	FIELD				
	Aluminum (Al)-Dissolved (mg/L)	0.0015				
	Antimony (Sb)-Dissolved (mg/L)	<0.00010				
	Arsenic (As)-Dissolved (mg/L)	0.00012				
	Barium (Ba)-Dissolved (mg/L)	0.390				
	Beryllium (Be)-Dissolved (mg/L)	<0.000020				
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050				
	Boron (B)-Dissolved (mg/L)	<0.010				
	Cadmium (Cd)-Dissolved (mg/L)	0.0000919				
	Calcium (Ca)-Dissolved (mg/L)	52.8				
	Chromium (Cr)-Dissolved (mg/L)	0.00282				
	Cobalt (Co)-Dissolved (mg/L)	0.00016				
	Copper (Cu)-Dissolved (mg/L)	0.00227				
	Iron (Fe)-Dissolved (mg/L)	0.025				
	Lead (Pb)-Dissolved (mg/L)	<0.000050				
	Lithium (Li)-Dissolved (mg/L)	0.0016				
	Magnesium (Mg)-Dissolved (mg/L)	38.2				
	Manganese (Mn)-Dissolved (mg/L)	0.00480				
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050				

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2621315-1 Groundwater 28-JUL-21 12:00 TH4-A / E265129	L2621315-2 Groundwater 28-JUL-21 12:00 E265122	L2621315-3 Groundwater 28-JUL-21 12:00 E265123	L2621315-4 Groundwater 28-JUL-21 12:00 E265124	L2621315-5 Groundwater 28-JUL-21 12:00 E265125
Grouping	Analyte					
<b>WATER</b>						
<b>Dissolved Metals</b>	Molybdenum (Mo)-Dissolved (mg/L)	0.00463	0.00976	0.00732	0.0100	0.00135
	Nickel (Ni)-Dissolved (mg/L)	0.0145	0.0274	0.0217	0.0180	0.00114
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	2.54	2.35	2.81	2.46	1.60
	Selenium (Se)-Dissolved (mg/L)	0.000432	0.000211	0.000580	0.000568	<0.000050
	Silicon (Si)-Dissolved (mg/L)	7.36	6.97	5.80	7.18	4.39
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	20.8	14.1	19.1	19.0	128
	Strontium (Sr)-Dissolved (mg/L)	0.278	0.235	0.317	0.278	0.0760
	Sulfur (S)-Dissolved (mg/L)	10.8	6.59	8.36	10.9	2.40
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	0.000025	0.000014	<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	0.00023	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Dissolved (mg/L)	0.00507	0.00383	0.00370	0.00532	0.00118
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	0.00055	0.00051
	Zinc (Zn)-Dissolved (mg/L)	0.0037	0.0020	0.175	<0.0010	0.0022
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

# ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2621315-6 Groundwater 28-JUL-21 12:00 E265127				
Grouping	Analyte					
<b>WATER</b>						
<b>Dissolved Metals</b>	Molybdenum (Mo)-Dissolved (mg/L)	0.00175				
	Nickel (Ni)-Dissolved (mg/L)	0.00720				
	Phosphorus (P)-Dissolved (mg/L)	<0.050				
	Potassium (K)-Dissolved (mg/L)	2.24				
	Selenium (Se)-Dissolved (mg/L)	0.000203				
	Silicon (Si)-Dissolved (mg/L)	5.23				
	Silver (Ag)-Dissolved (mg/L)	<0.000010				
	Sodium (Na)-Dissolved (mg/L)	5.05				
	Strontium (Sr)-Dissolved (mg/L)	0.199				
	Sulfur (S)-Dissolved (mg/L)	5.54				
	Thallium (Tl)-Dissolved (mg/L)	<0.000010				
	Tin (Sn)-Dissolved (mg/L)	<0.00010				
	Titanium (Ti)-Dissolved (mg/L)	<0.00030				
	Uranium (U)-Dissolved (mg/L)	0.00363				
	Vanadium (V)-Dissolved (mg/L)	<0.00050				
	Zinc (Zn)-Dissolved (mg/L)	0.0141				
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030				

## Reference Information

### Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
<b>BE-D-L-CCMS-CL</b>	Water	Diss. Be (low) in Water by CRC ICPMS 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.	APHA 3030B/6020A (mod)
<b>CL-L-IC-N-CL</b>	Water	Chloride in Water by IC Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.	EPA 300.1 (mod)
<b>F-L-IC-CL</b>	Water	Fluoride	APHA 4110 B-Ion Chromatography
<b>HARDNESS-CALC-CL</b>	Water	Hardness 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.	APHA 2340 B
<b>HG-D-CVAA-CL</b>	Water	Dissolved Mercury in Water by CVAAS 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.	APHA 3030B/EPA 1631E (mod)
<b>MET-D-CCMS-CL</b>	Water	Dissolved Metals in Water by CRC ICPMS 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.	APHA 3030B/6020A (mod)
<b>N2N3-CALC-CL</b>	Water	Nitrate+Nitrite	CALCULATION
<b>NH3-L-F-CL</b>	Water	Ammonia, Total (as N) This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
<b>NO2-L-IC-N-CL</b>	Water	Nitrite in Water by IC (Low Level) Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.	EPA 300.1 (mod)
<b>NO3-L-IC-N-CL</b>	Water	Nitrate in Water by IC (Low Level) Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.	EPA 300.1 (mod)
<b>PH/EC/ALK-CL</b>	Water	pH, Conductivity and Total Alkalinity All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed) pH measurement is determined from the activity of the hydrogen ions using a hydrogen electrode and a reference electrode. Alkalinity measurement is based on the sample's capacity to neutralize acid Conductivity measurement is based on the sample's capacity to convey an electric current	APHA 4500H,2510,2320
<b>SO4-L-IC-N-CL</b>	Water	Sulfate in Water by IC Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.	EPA 300.1 (mod)
<b>TEMP-CL</b>	Water	Temperature	APHA 2550-Thermometer
<b>TSS-L-CL</b>	Water	Total Suspended Solids 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, and by drying the filter at 104 deg. C.	APHA 2540 D-Gravimetric
<b>TURBIDITY-CL</b>	Water	Turbidity This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.	APHA 2130 B-Nephelometer

\*\* 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
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA

### Chain of Custody Numbers:

## Reference Information

### 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.*

## Quality Control Report

Workorder: L2621315

Report Date: 11-AUG-21

Page 1 of 5

Client: Sperling Hansen Associates Inc.

#8 - 1225 East Keith Road

North Vancouver BC V7J 1J3

Contact: Scott Garthwaite

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>BE-D-L-CCMS-CL</b>								
<b>Water</b>								
<b>Batch</b>	<b>R5546923</b>							
<b>WG3593345-2</b>	<b>LCS</b>	<b>TMRM</b>						
Beryllium (Be)-Dissolved			96.0		%		80-120	09-AUG-21
<b>WG3593345-1</b>	<b>MB</b>							
Beryllium (Be)-Dissolved			<0.000020		mg/L		0.00002	09-AUG-21
<b>CL-L-IC-N-CL</b>								
<b>Water</b>								
<b>Batch</b>	<b>R5544557</b>							
<b>WG3590662-6</b>	<b>LCS</b>							
Chloride (Cl)			99.3		%		85-115	31-JUL-21
<b>WG3590662-5</b>	<b>MB</b>							
Chloride (Cl)			<0.10		mg/L		0.1	31-JUL-21
<b>F-L-IC-CL</b>								
<b>Water</b>								
<b>Batch</b>	<b>R5544557</b>							
<b>WG3590662-6</b>	<b>LCS</b>							
Fluoride (F)			91.8		%		85-115	31-JUL-21
<b>WG3590662-5</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	31-JUL-21
<b>HG-D-CVAA-CL</b>								
<b>Water</b>								
<b>Batch</b>	<b>R5546057</b>							
<b>WG3592354-6</b>	<b>LCS</b>							
Mercury (Hg)-Dissolved			89.1		%		80-120	07-AUG-21
<b>WG3592354-5</b>	<b>MB</b>							
Mercury (Hg)-Dissolved			<0.0000050		mg/L		0.000005	07-AUG-21
<b>MET-D-CCMS-CL</b>								
<b>Water</b>								
<b>Batch</b>	<b>R5546923</b>							
<b>WG3593345-2</b>	<b>LCS</b>	<b>TMRM</b>						
Aluminum (Al)-Dissolved			100.2		%		80-120	09-AUG-21
Antimony (Sb)-Dissolved			99.6		%		80-120	09-AUG-21
Arsenic (As)-Dissolved			99.4		%		80-120	09-AUG-21
Barium (Ba)-Dissolved			104.2		%		80-120	09-AUG-21
Bismuth (Bi)-Dissolved			100.6		%		80-120	09-AUG-21
Boron (B)-Dissolved			91.4		%		80-120	09-AUG-21
Cadmium (Cd)-Dissolved			97.1		%		80-120	09-AUG-21
Calcium (Ca)-Dissolved			97.5		%		80-120	09-AUG-21
Chromium (Cr)-Dissolved			98.8		%		80-120	09-AUG-21
Cobalt (Co)-Dissolved			97.8		%		80-120	09-AUG-21
Copper (Cu)-Dissolved			95.4		%		80-120	09-AUG-21

## Quality Control Report

Workorder: L2621315

Report Date: 11-AUG-21

Page 2 of 5

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-D-CCMS-CL</b>		<b>Water</b>						
<b>Batch</b>	<b>R5546923</b>							
<b>WG3593345-2</b>	<b>LCS</b>	<b>TMRM</b>						
Iron (Fe)-Dissolved			101.7		%		80-120	09-AUG-21
Lead (Pb)-Dissolved			99.4		%		80-120	09-AUG-21
Lithium (Li)-Dissolved			99.8		%		80-120	09-AUG-21
Magnesium (Mg)-Dissolved			99.1		%		80-120	09-AUG-21
Manganese (Mn)-Dissolved			98.6		%		80-120	09-AUG-21
Molybdenum (Mo)-Dissolved			103.8		%		80-120	09-AUG-21
Nickel (Ni)-Dissolved			96.7		%		80-120	09-AUG-21
Phosphorus (P)-Dissolved			102.6		%		70-130	09-AUG-21
Potassium (K)-Dissolved			98.2		%		80-120	09-AUG-21
Selenium (Se)-Dissolved			95.9		%		80-120	09-AUG-21
Silicon (Si)-Dissolved			102.1		%		60-140	09-AUG-21
Silver (Ag)-Dissolved			98.5		%		80-120	09-AUG-21
Sodium (Na)-Dissolved			97.9		%		80-120	09-AUG-21
Strontium (Sr)-Dissolved			106.8		%		80-120	09-AUG-21
Sulfur (S)-Dissolved			97.0		%		80-120	09-AUG-21
Thallium (Tl)-Dissolved			99.3		%		80-120	09-AUG-21
Tin (Sn)-Dissolved			100.8		%		80-120	09-AUG-21
Titanium (Ti)-Dissolved			95.8		%		80-120	09-AUG-21
Uranium (U)-Dissolved			95.8		%		80-120	09-AUG-21
Vanadium (V)-Dissolved			99.5		%		80-120	09-AUG-21
Zinc (Zn)-Dissolved			97.1		%		80-120	09-AUG-21
Zirconium (Zr)-Dissolved			104.9		%		80-120	09-AUG-21
<b>WG3593345-1</b>	<b>MB</b>							
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	09-AUG-21
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-21
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-21
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-21
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	09-AUG-21
Boron (B)-Dissolved			<0.010		mg/L		0.01	09-AUG-21
Cadmium (Cd)-Dissolved			<0.0000050		mg/L		0.000005	09-AUG-21
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	09-AUG-21
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-21
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-21
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	09-AUG-21

## Quality Control Report

Workorder: L2621315

Report Date: 11-AUG-21

Page 3 of 5

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-D-CCMS-CL</b>	<b>Water</b>							
<b>Batch</b>	<b>R5546923</b>							
<b>WG3593345-1 MB</b>								
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	09-AUG-21
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	09-AUG-21
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	09-AUG-21
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	09-AUG-21
Manganese (Mn)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-21
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	09-AUG-21
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	09-AUG-21
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	09-AUG-21
Potassium (K)-Dissolved			<0.050		mg/L		0.05	09-AUG-21
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	09-AUG-21
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	09-AUG-21
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	09-AUG-21
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	09-AUG-21
Strontium (Sr)-Dissolved			<0.00020		mg/L		0.0002	09-AUG-21
Sulfur (S)-Dissolved			<0.50		mg/L		0.5	09-AUG-21
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	09-AUG-21
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	09-AUG-21
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	09-AUG-21
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	09-AUG-21
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	09-AUG-21
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	09-AUG-21
Zirconium (Zr)-Dissolved			<0.00020		mg/L		0.0002	09-AUG-21
<b>NH3-L-F-CL</b>	<b>Water</b>							
<b>Batch</b>	<b>R5543745</b>							
<b>WG3589917-2 LCS</b>								
Ammonia as N			97.8		%		85-115	03-AUG-21
<b>WG3589917-1 MB</b>								
Ammonia as N			<0.0050		mg/L		0.005	03-AUG-21
<b>NO2-L-IC-N-CL</b>	<b>Water</b>							
<b>Batch</b>	<b>R5544557</b>							
<b>WG3590662-6 LCS</b>								
Nitrite (as N)			99.8		%		90-110	31-JUL-21
<b>WG3590662-5 MB</b>								
Nitrite (as N)			<0.0010		mg/L		0.001	31-JUL-21
<b>NO3-L-IC-N-CL</b>	<b>Water</b>							



## Quality Control Report

Workorder: L2621315

Report Date: 11-AUG-21

Page 4 of 5

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>NO3-L-IC-N-CL</b>	<b>Water</b>							
Batch	R5544557							
<b>WG3590662-6</b>	<b>LCS</b>							
Nitrate (as N)			99.4		%		90-110	31-JUL-21
<b>WG3590662-5</b>	<b>MB</b>							
Nitrate (as N)			<0.0050		mg/L		0.005	31-JUL-21
<b>PH/EC/ALK-CL</b>	<b>Water</b>							
Batch	R5547726							
<b>WG3593972-3</b>	<b>LCS</b>							
Conductivity (EC)			97.6		%		90-110	09-AUG-21
Alkalinity, Total (as CaCO3)			104.9		%		85-115	09-AUG-21
<b>WG3593972-1</b>	<b>MB</b>							
Conductivity (EC)			<2.0		uS/cm		2	09-AUG-21
Bicarbonate (HCO3)			<5.0		mg/L		5	09-AUG-21
Carbonate (CO3)			<5.0		mg/L		5	09-AUG-21
Hydroxide (OH)			<5.0		mg/L		5	09-AUG-21
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	09-AUG-21
<b>SO4-L-IC-N-CL</b>	<b>Water</b>							
Batch	R5544557							
<b>WG3590662-6</b>	<b>LCS</b>							
Sulfate (SO4)			98.6		%		85-115	31-JUL-21
<b>WG3590662-5</b>	<b>MB</b>							
Sulfate (SO4)			<0.050		mg/L		0.05	31-JUL-21
<b>TSS-L-CL</b>	<b>Water</b>							
Batch	R5544649							
<b>WG3588650-2</b>	<b>LCS</b>							
Total Suspended Solids			97.2		%		85-115	03-AUG-21
<b>WG3588650-1</b>	<b>MB</b>							
Total Suspended Solids			<1.0		mg/L		1	03-AUG-21
<b>TURBIDITY-CL</b>	<b>Water</b>							
Batch	R5537176							
<b>WG3588163-2</b>	<b>LCS</b>							
Turbidity			96.0		%		85-115	31-JUL-21
<b>WG3588163-1</b>	<b>MB</b>							
Turbidity			<0.10		NTU		0.1	31-JUL-21

# Quality Control Report

Workorder: L2621315

Report Date: 11-AUG-21

Page 5 of 5

## Legend:

---

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

## Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

---

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



www.alsglobal.ca



L2621315-COFC

# istody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

COC Number: 20 -

Page 1 of 1

<b>Report To</b> Contact and company name below will appear on the final report Company: Sperling Hansen Associates Inc. Contact: Scott Garthwaite Phone: 778-471-7088 Company address below will appear on the final report Street: 1225 East Keith Road City/Province: North Vancouver, B.C. Postal Code: V7J 1J3		<b>Reports / Recipients</b> Select Report Format: <input type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL) Merge QC/QCI Reports with COA <input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> N/A <input checked="" type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: sgarthwaite@sperlinghansen.com Email 2: chetherington@sperlinghansen.com Email 3:		<b>Turnaround Time (TAT) Requested</b> <input checked="" type="checkbox"/> Routine [R] if received by 3pm M-F - no surcharges apply <input type="checkbox"/> 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum <input type="checkbox"/> 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum <input type="checkbox"/> 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum <input type="checkbox"/> 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum <input type="checkbox"/> Same day [E2] if received by 10am M-S - 200% rush surcharge. Additional fees may apply to rush requests on weekends, statutory holidays and non-routine tests Date and Time Required for all E&P TATs: dd-mm-yy hh:mm am/pm		<b>AFFIX ALS BARCODE LABEL HERE</b> (ALS use only)																																																																																																																																
<b>Invoice To</b> Same as Report To <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> NO Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO Company: Contact:		<b>Invoice Recipients</b> Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: chetherington@sperlinghansen.com Email 2:		For all tests with rush TATs requested, please contact your AM to confirm availability.																																																																																																																																		
<b>Project Information</b> ALS Account # / Quote #: Q80923 Job #: 20050 Cranbrook PO / AFE: LSD:		<b>Oil and Gas Required Fields (client use)</b> AFE/Cost Center: PO# Major/Minor Code: Routing Code: Requisitioner: Location:		<b>Analysis Request</b> Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below <table border="1"> <thead> <tr> <th rowspan="2">NUMBER OF CONTAINERS</th> <th colspan="12">Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below</th> <th rowspan="2">SAMPLES ON HOLD</th> <th rowspan="2">EXTENDED STORAGE REQUIRED</th> <th rowspan="2">SUSPECTED HAZARD (see notes)</th> </tr> <tr> <th>ammonia</th> <th>Anions, temp, pH, conductivity</th> <th>Total Alkalinity</th> <th>TSS</th> <th>Dissolved Metals (F/P)</th> <th>chloride</th> <th>sulfate</th> <th>Turbidity</th> <th>Nitrite</th> <th>nitrate</th> <th>fluoride</th> </tr> </thead> <tbody> <tr> <td>4</td> <td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td> </tr> <tr> <td>4</td> <td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td> </tr> <tr> <td>4</td> <td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td> </tr> <tr> <td>4</td> <td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td> </tr> <tr> <td>4</td> <td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td> </tr> <tr> <td>4</td> <td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td> </tr> </tbody> </table>		NUMBER OF CONTAINERS	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below												SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)	ammonia	Anions, temp, pH, conductivity	Total Alkalinity	TSS	Dissolved Metals (F/P)	chloride	sulfate	Turbidity	Nitrite	nitrate	fluoride	4	R	R	R	R	R	R	R	R	R	R	R	R	R				4	R	R	R	R	R	R	R	R	R	R	R	R	R				4	R	R	R	R	R	R	R	R	R	R	R	R	R				4	R	R	R	R	R	R	R	R	R	R	R	R	R				4	R	R	R	R	R	R	R	R	R	R	R	R	R				4	R	R	R	R	R	R	R	R	R	R	R	R	R			
NUMBER OF CONTAINERS	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below												SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)																																																																																																																							
	ammonia	Anions, temp, pH, conductivity	Total Alkalinity	TSS	Dissolved Metals (F/P)	chloride	sulfate	Turbidity	Nitrite	nitrate	fluoride																																																																																																																											
4	R	R	R	R	R	R	R	R	R	R	R	R	R																																																																																																																									
4	R	R	R	R	R	R	R	R	R	R	R	R	R																																																																																																																									
4	R	R	R	R	R	R	R	R	R	R	R	R	R																																																																																																																									
4	R	R	R	R	R	R	R	R	R	R	R	R	R																																																																																																																									
4	R	R	R	R	R	R	R	R	R	R	R	R	R																																																																																																																									
4	R	R	R	R	R	R	R	R	R	R	R	R	R																																																																																																																									
<b>ALS Lab Work Order # (ALS use only):</b>		<b>ALS Contact:</b> Dean Watt		<b>Sampler:</b>																																																																																																																																		
<b>ALS Sample #</b> (ALS use only)	<b>Sample Identification and/or Coordinates</b> (This description will appear on the report)	<b>Date</b> (dd-mm-yy)	<b>Time</b> (hh:mm)	<b>Sample Type</b>													<b>SAMPLES ON HOLD</b>	<b>EXTENDED STORAGE REQUIRED</b>	<b>SUSPECTED HAZARD (see notes)</b>																																																																																																																			
1	TH4-A / E265129	28-07-21	-	Groundwater																																																																																																																																		
2	E265122	"	-	Groundwater																																																																																																																																		
3	E265123	"	-	Groundwater																																																																																																																																		
4	E265124	"	-	Groundwater																																																																																																																																		
5	E265125	"	-	Groundwater																																																																																																																																		
6	E265127	"	-	Groundwater																																																																																																																																		

<b>Drinking Water (DW) Samples<sup>1</sup> (client use)</b> Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO Are samples for human consumption/ use? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		<b>Notes / Specify Limits for result evaluation by selecting from drop-down below</b> (Excel COC only) British Columbia Contaminated Sites Regulation Stage 10 Amendment (NOV, 2017) British Columbia Approved and Working Water Quality Guidelines (MAY, 2015)		<b>SAMPLE RECEIPT DETAILS (ALS use only)</b> Cooling Method: <input type="checkbox"/> NONE <input type="checkbox"/> ICE <input type="checkbox"/> ICE PACKS <input type="checkbox"/> NONE <input type="checkbox"/> FROZEN <input type="checkbox"/> COOLING INITIATED Submission Comments identified on Sample Receipt Notification: <input type="checkbox"/> YES <input type="checkbox"/> NO Cooler Custody Seals Intact: <input type="checkbox"/> YES <input type="checkbox"/> N/A Sample Custody Seals Intact: <input type="checkbox"/> YES <input type="checkbox"/> N/A INITIAL COOLER TEMPERATURES °C: FINAL COOLER TEMPERATURES °C:			
<b>SHIPMENT RELEASE (client use)</b> Released by: TM Date: July 29 1:00 PM Time:		<b>INITIAL SHIPMENT RECEPTION (ALS use only)</b> Received by: Date: Time:		<b>FINAL SHIPMENT RECEPTION (ALS use only)</b> Received by: Date: Time:			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

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

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

ALG 2020 FRONT



Sperling Hansen Associates Inc.  
ATTN: Scott Garthwaite  
#8 - 1225 East Keith Road  
North Vancouver BC V7J 1J3

Date Received: 09-NOV-21  
Report Date: 18-NOV-21 16:00 (MT)  
Version: FINAL

Client Phone: 604-986-7723

## Certificate of Analysis

Lab Work Order #: L2660703  
Project P.O. #: NOT SUBMITTED  
Job Reference: 20050 CRANBROOK  
C of C Numbers:  
Legal Site Desc:

Patryk Wojciak, B.Sc., P.Chem.  
Account Manager

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

ADDRESS: 2559 29 Street NE, Calgary, AB T1Y 7B5 Canada | Phone: +1 403 291 9897 | Fax: +1 403 291 0298  
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

## ALS ENVIRONMENTAL ANALYTICAL REPORT

18-NOV-21 16:00 (MT)

Version: FINAL

Sample ID Description Sampled Date Sampled Time Client ID		L2660703-1 Groundwater 07-NOV-21 12:00 TH4-A / E265129	L2660703-2 Groundwater 07-NOV-21 12:00 E265122	L2660703-3 Groundwater 07-NOV-21 12:00 E265123	L2660703-4 Groundwater 07-NOV-21 12:00 E265124	L2660703-5 Groundwater 07-NOV-21 12:00 E265125
Grouping	Analyte					
<b>WATER</b>						
<b>Physical Tests</b>	Hardness (as CaCO <sub>3</sub> ) (mg/L)	318	286	285	273	53.8
	Temperature (Degree C)	20.0	20.0	20.1	20.1	20.2
	Total Suspended Solids (mg/L)	108	69.2	31.8	79.2	19.4
	Turbidity (NTU)	62.8	39.3	16.7	58.6	8.18
<b>Anions and Nutrients</b>	Alkalinity, Total (as CaCO <sub>3</sub> ) (mg/L)	335	294	281	311	354
	Ammonia as N (mg/L)	0.0296	<0.0050	<0.0050	0.0067	0.0068
	Bicarbonate (HCO <sub>3</sub> ) (mg/L)	335	294	281	311	354
	Carbonate (CO <sub>3</sub> ) (mg/L)	<5.0	<5.0	<5.0	<5.0	<5.0
	Chloride (Cl) (mg/L)	26.6	12.8	32.8	9.79	1.91
	Conductivity (EC) (uS/cm)	673	567	608	569	593
	Fluoride (F) (mg/L)	0.027	0.090	0.120	0.108	2.12
	Hydroxide (OH) (mg/L)	<5.0	<5.0	<5.0	<5.0	<5.0
	Nitrate and Nitrite (as N) (mg/L)	1.84	1.54	0.194	1.08	0.0764
	Nitrate (as N) (mg/L)	1.83	1.54	0.194	1.08	0.0764
	Nitrite (as N) (mg/L)	0.0089	<0.0010	<0.0010	<0.0010	<0.0010
	pH (pH)	7.77	7.95	7.73	7.98	8.21
	Sulfate (SO <sub>4</sub> ) (mg/L)	30.8	18.9	22.5	21.7	6.57
<b>Dissolved Metals</b>	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0050	0.0011	<0.0010	0.0015	0.0026
	Antimony (Sb)-Dissolved (mg/L)	0.00023	<0.00010	0.00017	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00086	0.00015	<0.00010	0.00013	0.00090
	Barium (Ba)-Dissolved (mg/L)	0.180	0.147	0.117	0.169	0.204
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	0.010	<0.010	0.029	<0.010	0.095
	Cadmium (Cd)-Dissolved (mg/L)	0.0000718	0.0000061	0.0000562	0.0000098	0.0000052
	Calcium (Ca)-Dissolved (mg/L)	63.8	58.6	46.7	55.3	9.84
	Chromium (Cr)-Dissolved (mg/L)	0.00118	0.00145	0.00061	0.00074	0.00026
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Dissolved (mg/L)	0.0173	0.00042	0.00397	0.00063	0.00039
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)	0.000065	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.0063	0.0054	0.0935	0.0062	0.0192
	Magnesium (Mg)-Dissolved (mg/L)	38.6	34.0	40.8	32.7	7.10
	Manganese (Mn)-Dissolved (mg/L)	0.00417	0.00051	0.00013	0.00014	0.00201
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050

\* 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		L2660703-6 Groundwater 07-NOV-21 12:00 E265127				
Grouping	Analyte					
<b>WATER</b>						
<b>Physical Tests</b>	Hardness (as CaCO <sub>3</sub> ) (mg/L)	286				
	Temperature (Degree C)	20.4				
	Total Suspended Solids (mg/L)	14.8				
	Turbidity (NTU)	8.26				
<b>Anions and Nutrients</b>	Alkalinity, Total (as CaCO <sub>3</sub> ) (mg/L)	321				
	Ammonia as N (mg/L)	<0.0050				
	Bicarbonate (HCO <sub>3</sub> ) (mg/L)	321				
	Carbonate (CO <sub>3</sub> ) (mg/L)	<5.0				
	Chloride (Cl) (mg/L)	6.96				
	Conductivity (EC) (uS/cm)	562				
	Fluoride (F) (mg/L)	0.024				
	Hydroxide (OH) (mg/L)	<5.0				
	Nitrate and Nitrite (as N) (mg/L)	0.328				
	Nitrate (as N) (mg/L)	0.328				
	Nitrite (as N) (mg/L)	<0.0010				
	pH (pH)	7.86				
	Sulfate (SO <sub>4</sub> ) (mg/L)	15.3				
<b>Dissolved Metals</b>	Dissolved Mercury Filtration Location	FIELD				
	Dissolved Metals Filtration Location	FIELD				
	Aluminum (Al)-Dissolved (mg/L)	0.0018				
	Antimony (Sb)-Dissolved (mg/L)	0.00013				
	Arsenic (As)-Dissolved (mg/L)	0.00059				
	Barium (Ba)-Dissolved (mg/L)	0.393				
	Beryllium (Be)-Dissolved (mg/L)	<0.000020				
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050				
	Boron (B)-Dissolved (mg/L)	<0.010				
	Cadmium (Cd)-Dissolved (mg/L)	0.000146				
	Calcium (Ca)-Dissolved (mg/L)	53.7				
	Chromium (Cr)-Dissolved (mg/L)	0.00302				
	Cobalt (Co)-Dissolved (mg/L)	<0.00010				
	Copper (Cu)-Dissolved (mg/L)	0.00781				
	Iron (Fe)-Dissolved (mg/L)	<0.010				
	Lead (Pb)-Dissolved (mg/L)	<0.000050				
	Lithium (Li)-Dissolved (mg/L)	0.0016				
	Magnesium (Mg)-Dissolved (mg/L)	36.8				
	Manganese (Mn)-Dissolved (mg/L)	0.00109				
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050				

\* 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		L2660703-1 Groundwater 07-NOV-21 12:00 TH4-A / E265129	L2660703-2 Groundwater 07-NOV-21 12:00 E265122	L2660703-3 Groundwater 07-NOV-21 12:00 E265123	L2660703-4 Groundwater 07-NOV-21 12:00 E265124	L2660703-5 Groundwater 07-NOV-21 12:00 E265125
Grouping	Analyte					
<b>WATER</b>						
<b>Dissolved Metals</b>	Molybdenum (Mo)-Dissolved (mg/L)	0.00129	0.000802	0.00257	0.000811	0.000856
	Nickel (Ni)-Dissolved (mg/L)	0.00314	0.00056	0.00366	<0.00050	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	3.25	2.26	2.64	2.21	1.45
	Selenium (Se)-Dissolved (mg/L)	0.000538	0.000264	0.000574	0.000303	<0.000050
	Silicon (Si)-Dissolved (mg/L)	7.16	7.02	5.82	6.64	4.23
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	23.2	14.6	19.5	15.4	125
	Strontium (Sr)-Dissolved (mg/L)	0.280	0.238	0.313	0.248	0.0720
	Sulfur (S)-Dissolved (mg/L)	10.9	6.60	7.73	7.19	2.07
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Dissolved (mg/L)	0.00127	0.00086	0.00103	0.00116	0.00081
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Dissolved (mg/L)	0.00526	0.00418	0.00390	0.00533	0.00112
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	0.0153	0.0013	0.0641	0.0018	<0.0010
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

\* 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		L2660703-6 Groundwater 07-NOV-21 12:00 E265127				
Grouping	Analyte					
<b>WATER</b>						
<b>Dissolved Metals</b>	Molybdenum (Mo)-Dissolved (mg/L)	0.000979				
	Nickel (Ni)-Dissolved (mg/L)	0.00179				
	Phosphorus (P)-Dissolved (mg/L)	<0.050				
	Potassium (K)-Dissolved (mg/L)	2.37				
	Selenium (Se)-Dissolved (mg/L)	0.000189				
	Silicon (Si)-Dissolved (mg/L)	5.05				
	Silver (Ag)-Dissolved (mg/L)	<0.000010				
	Sodium (Na)-Dissolved (mg/L)	5.93				
	Strontium (Sr)-Dissolved (mg/L)	0.188				
	Sulfur (S)-Dissolved (mg/L)	5.11				
	Thallium (Tl)-Dissolved (mg/L)	<0.000010				
	Tin (Sn)-Dissolved (mg/L)	<0.00010				
	Titanium (Ti)-Dissolved (mg/L)	<0.00030				
	Uranium (U)-Dissolved (mg/L)	0.00351				
	Vanadium (V)-Dissolved (mg/L)	<0.00050				
	Zinc (Zn)-Dissolved (mg/L)	0.0188				
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030				

\* 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	Magnesium (Mg)-Dissolved	MS-B	L2660703-1, -2, -3, -4, -5, -6
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2660703-1, -2, -3, -4, -5, -6

### Qualifiers for Individual Parameters Listed:

Qualifier	Description
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**
<b>BE-D-L-CCMS-CL</b>	Water	Diss. Be (low) 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.			
<b>CL-L-IC-N-CL</b>	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
<b>F-L-IC-CL</b>	Water	Fluoride	APHA 4110 B-Ion Chromatography
<b>HARDNESS-CALC-CL</b>	Water	Hardness	APHA 2340 B
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.			
<b>HG-D-CVAA-CL</b>	Water	Dissolved Mercury in Water by CVAAS	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.			
<b>MET-D-CCMS-CL</b>	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.			
<b>N2N3-CALC-CL</b>	Water	Nitrate+Nitrite	CALCULATION
<b>NH3-L-F-CL</b>	Water	Ammonia, Total (as N)	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
<b>NO2-L-IC-N-CL</b>	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.			
<b>NO3-L-IC-N-CL</b>	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.			
<b>PH/EC/ALK-CL</b>	Water	pH, Conductivity and Total Alkalinity	APHA 4500H,2510,2320
All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed) pH measurement is determined from the activity of the hydrogen ions using a hydrogen electrode and a reference electrode. Alkalinity measurement is based on the sample's capacity to neutralize acid Conductivity measurement is based on the sample's capacity to convey an electric current			
<b>SO4-L-IC-N-CL</b>	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
<b>TEMP-CL</b>	Water	Temperature	APHA 2550-Thermometer
<b>TSS-L-CL</b>	Water	Total Suspended Solids	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, and by drying the filter at 104 deg. C.			
<b>TURBIDITY-CL</b>	Water	Turbidity	APHA 2130 B-Nephelometer
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.

## Reference Information

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
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA

### Chain of Custody Numbers:

#### 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.

## Quality Control Report

Workorder: L2660703

Report Date: 18-NOV-21

Page 1 of 6

Client: Sperling Hansen Associates Inc.

#8 - 1225 East Keith Road

North Vancouver BC V7J 1J3

Contact: Scott Garthwaite

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>BE-D-L-CCMS-CL</b>								
<b>Water</b>								
<b>Batch</b>	<b>R5645697</b>							
<b>WG3657367-2</b>	<b>LCS</b>							
Beryllium (Be)-Dissolved			89.4		%		80-120	12-NOV-21
<b>WG3657367-1</b>	<b>MB</b>							
Beryllium (Be)-Dissolved			<0.000020		mg/L		0.00002	12-NOV-21
<b>CL-L-IC-N-CL</b>								
<b>Water</b>								
<b>Batch</b>	<b>R5643976</b>							
<b>WG3657216-6</b>	<b>LCS</b>							
Chloride (Cl)			101.4		%		85-115	09-NOV-21
<b>WG3657216-5</b>	<b>MB</b>							
Chloride (Cl)			<0.10		mg/L		0.1	09-NOV-21
<b>F-L-IC-CL</b>								
<b>Water</b>								
<b>Batch</b>	<b>R5643976</b>							
<b>WG3657216-6</b>	<b>LCS</b>							
Fluoride (F)			102.2		%		85-115	09-NOV-21
<b>WG3657216-5</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	09-NOV-21
<b>HG-D-CVAA-CL</b>								
<b>Water</b>								
<b>Batch</b>	<b>R5640916</b>							
<b>WG3656315-7</b>	<b>DUP</b>	<b>L2660703-1</b>						
Mercury (Hg)-Dissolved		<0.0000050	<0.0000050	RPD-NA	mg/L	N/A	20	10-NOV-21
<b>WG3656315-6</b>	<b>LCS</b>							
Mercury (Hg)-Dissolved			103.0		%		80-120	10-NOV-21
<b>WG3656315-5</b>	<b>MB</b>							
Mercury (Hg)-Dissolved			<0.0000050		mg/L		0.000005	10-NOV-21
<b>WG3656315-8</b>	<b>MS</b>	<b>L2660703-1</b>						
Mercury (Hg)-Dissolved			100.0		%		70-130	10-NOV-21
<b>MET-D-CCMS-CL</b>								
<b>Water</b>								
<b>Batch</b>	<b>R5645697</b>							
<b>WG3657367-2</b>	<b>LCS</b>							
Aluminum (Al)-Dissolved			94.5		%		80-120	12-NOV-21
Antimony (Sb)-Dissolved			97.3		%		80-120	12-NOV-21
Arsenic (As)-Dissolved			93.0		%		80-120	12-NOV-21
Barium (Ba)-Dissolved			92.0		%		80-120	12-NOV-21
Bismuth (Bi)-Dissolved			93.9		%		80-120	12-NOV-21
Boron (B)-Dissolved			89.0		%		80-120	12-NOV-21
Cadmium (Cd)-Dissolved			92.0		%		80-120	12-NOV-21
Calcium (Ca)-Dissolved			90.1		%		80-120	12-NOV-21

## Quality Control Report

Workorder: L2660703

Report Date: 18-NOV-21

Page 2 of 6

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-D-CCMS-CL</b>	<b>Water</b>							
<b>Batch</b>	<b>R5645697</b>							
<b>WG3657367-2</b>	<b>LCS</b>							
Chromium (Cr)-Dissolved			92.7		%		80-120	12-NOV-21
Cobalt (Co)-Dissolved			92.8		%		80-120	12-NOV-21
Copper (Cu)-Dissolved			91.2		%		80-120	12-NOV-21
Iron (Fe)-Dissolved			104.9		%		80-120	12-NOV-21
Lead (Pb)-Dissolved			91.7		%		80-120	12-NOV-21
Lithium (Li)-Dissolved			92.8		%		80-120	12-NOV-21
Magnesium (Mg)-Dissolved			93.3		%		80-120	12-NOV-21
Manganese (Mn)-Dissolved			92.8		%		80-120	12-NOV-21
Molybdenum (Mo)-Dissolved			97.6		%		80-120	12-NOV-21
Nickel (Ni)-Dissolved			91.3		%		80-120	12-NOV-21
Phosphorus (P)-Dissolved			96.0		%		70-130	12-NOV-21
Potassium (K)-Dissolved			93.7		%		80-120	12-NOV-21
Selenium (Se)-Dissolved			87.5		%		80-120	12-NOV-21
Silicon (Si)-Dissolved			92.0		%		60-140	12-NOV-21
Silver (Ag)-Dissolved			88.4		%		80-120	12-NOV-21
Sodium (Na)-Dissolved			94.6		%		80-120	12-NOV-21
Strontium (Sr)-Dissolved			94.8		%		80-120	12-NOV-21
Sulfur (S)-Dissolved			91.0		%		80-120	12-NOV-21
Thallium (Tl)-Dissolved			93.9		%		80-120	12-NOV-21
Tin (Sn)-Dissolved			90.3		%		80-120	12-NOV-21
Titanium (Ti)-Dissolved			93.9		%		80-120	12-NOV-21
Uranium (U)-Dissolved			86.3		%		80-120	12-NOV-21
Vanadium (V)-Dissolved			91.6		%		80-120	12-NOV-21
Zinc (Zn)-Dissolved			91.8		%		80-120	12-NOV-21
Zirconium (Zr)-Dissolved			90.1		%		80-120	12-NOV-21
<b>WG3657367-1</b>	<b>MB</b>							
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	12-NOV-21
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-21
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-21
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-21
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-21
Boron (B)-Dissolved			<0.010		mg/L		0.01	12-NOV-21
Cadmium (Cd)-Dissolved			<0.0000050		mg/L		0.000005	12-NOV-21
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	12-NOV-21



Workorder: L2660703

Page 3 of 6

NO2-L-IC-N-CL Water

## Quality Control Report

Workorder: L2660703

Report Date: 18-NOV-21

Page 4 of 6

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>NO2-L-IC-N-CL</b>	<b>Water</b>							
Batch	R5643976							
<b>WG3657216-6 LCS</b>								
Nitrite (as N)			105.3		%		90-110	09-NOV-21
<b>WG3657216-5 MB</b>								
Nitrite (as N)			<0.0010		mg/L		0.001	09-NOV-21
<b>NO3-L-IC-N-CL</b>	<b>Water</b>							
Batch	R5643976							
<b>WG3657216-6 LCS</b>								
Nitrate (as N)			101.5		%		90-110	09-NOV-21
<b>WG3657216-5 MB</b>								
Nitrate (as N)			<0.0050		mg/L		0.005	09-NOV-21
<b>PH/EC/ALK-CL</b>	<b>Water</b>							
Batch	R5641081							
<b>WG3656090-8 LCS</b>								
Conductivity (EC)			102.0		%		90-110	09-NOV-21
Alkalinity, Total (as CaCO3)			108.6		%		85-115	09-NOV-21
<b>WG3656090-7 MB</b>								
Conductivity (EC)			<2.0		uS/cm		2	09-NOV-21
Bicarbonate (HCO3)			<5.0		mg/L		5	09-NOV-21
Carbonate (CO3)			<5.0		mg/L		5	09-NOV-21
Hydroxide (OH)			<5.0		mg/L		5	09-NOV-21
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	09-NOV-21
<b>SO4-L-IC-N-CL</b>	<b>Water</b>							
Batch	R5643976							
<b>WG3657216-6 LCS</b>								
Sulfate (SO4)			101.0		%		85-115	09-NOV-21
<b>WG3657216-5 MB</b>								
Sulfate (SO4)			<0.050		mg/L		0.05	09-NOV-21
<b>TSS-L-CL</b>	<b>Water</b>							
Batch	R5648777							
<b>WG3657247-2 LCS</b>								
Total Suspended Solids			93.8		%		85-115	13-NOV-21
<b>WG3657247-1 MB</b>								
Total Suspended Solids			<1.0		mg/L		1	13-NOV-21
<b>TURBIDITY-CL</b>	<b>Water</b>							



## Quality Control Report

Workorder: L2660703

Report Date: 18-NOV-21

Page 5 of 6

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TURBIDITY-CL		Water						
Batch	R5640257							
WG3656088-2	LCS							
Turbidity			92.0		%		85-115	10-NOV-21
WG3656088-1	MB							
Turbidity			<0.10		NTU		0.1	10-NOV-21

# Quality Control Report

Workorder: L2660703

Report Date: 18-NOV-21

Page 6 of 6

## Legend:

---

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

## Sample Parameter Qualifier Definitions:

---

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

---

## Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

---

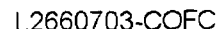
The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.





**Canada Toll Free: 1 800 668 9878**



of

REFER TO BACK PAGE FOR AIS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY      YELLOW - CLIENT COPY

AUG 2020 FROM

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

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

---

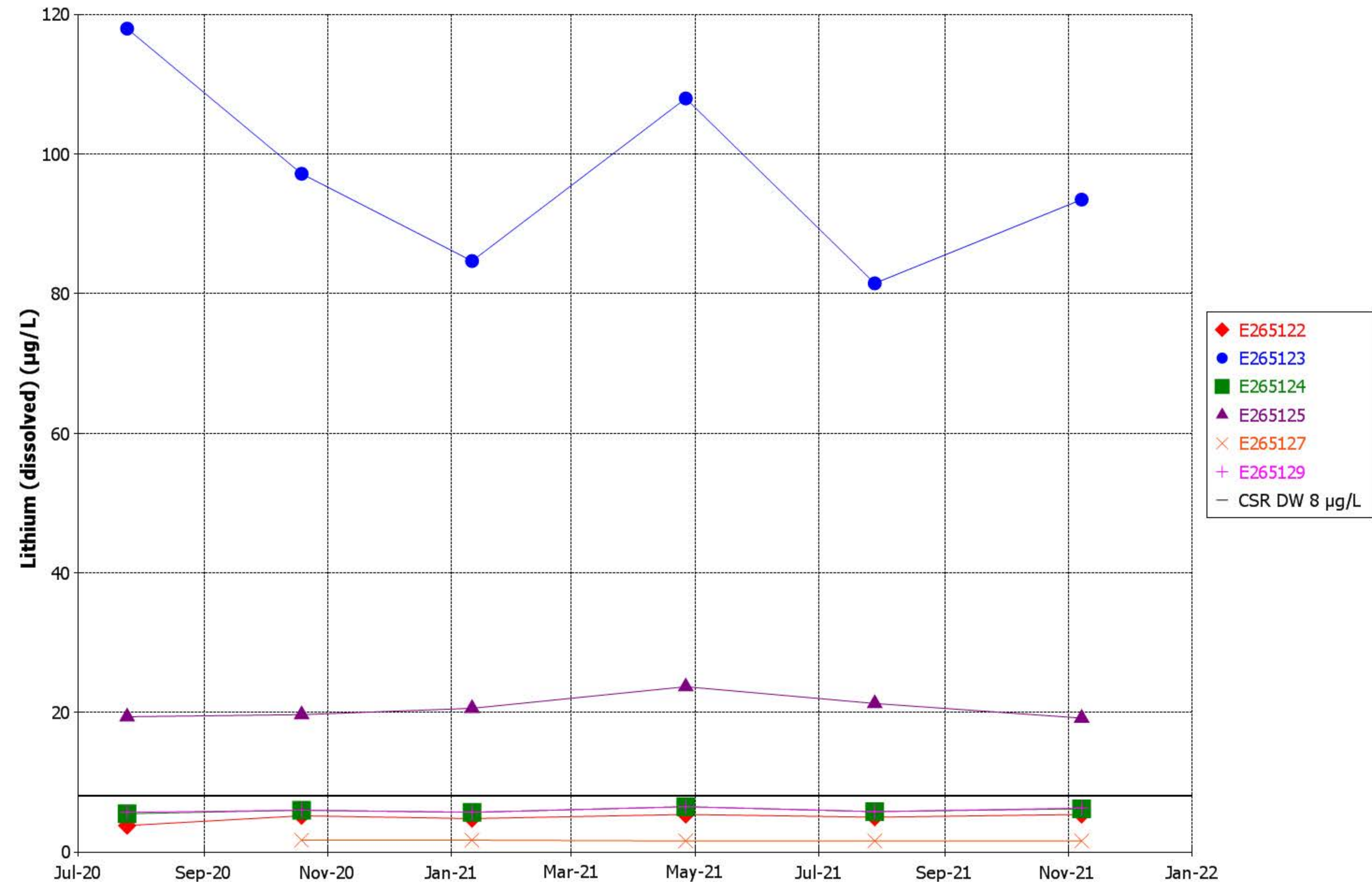
---

**APPENDIX D**  
**Trending Figures**

---

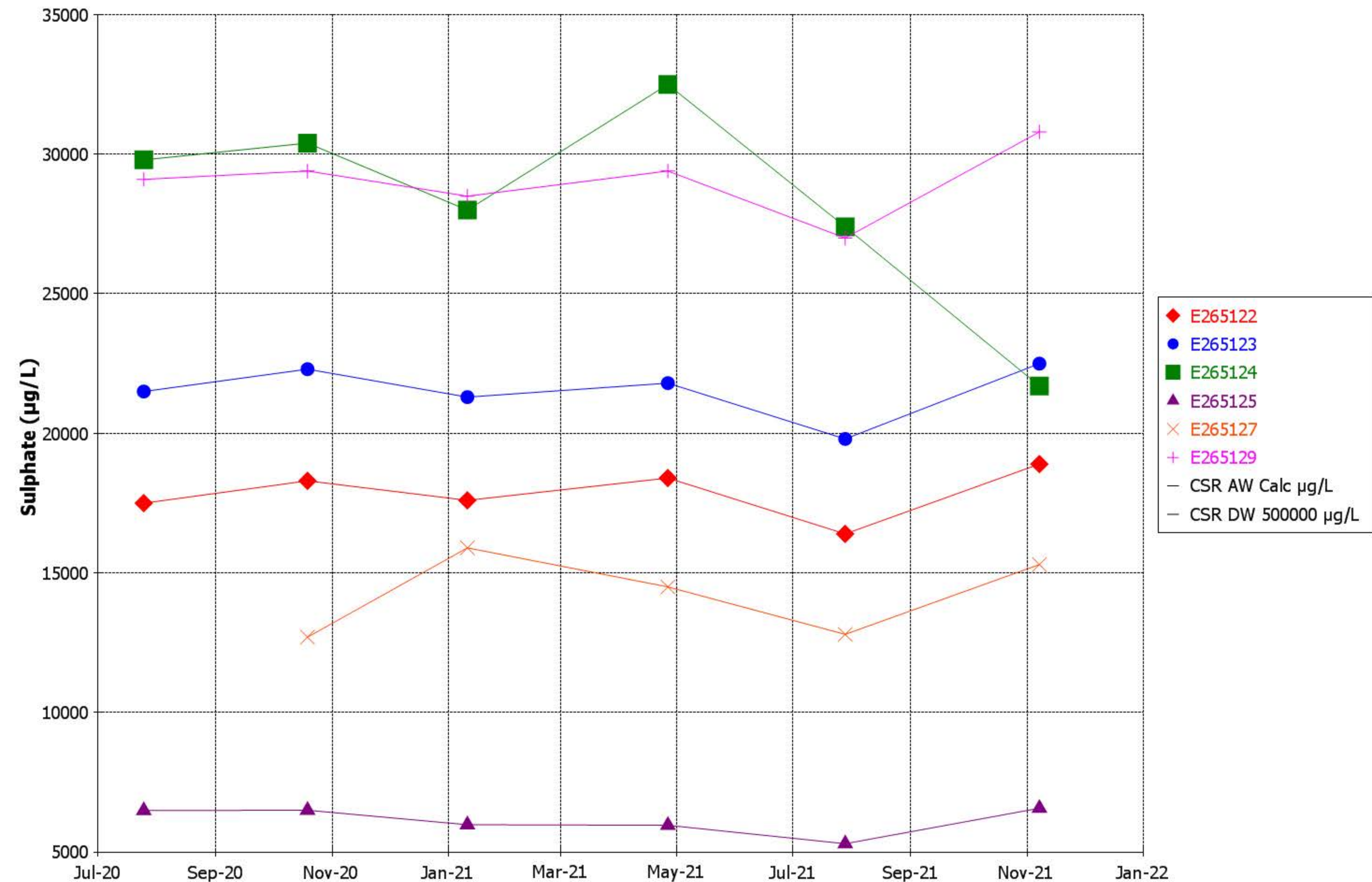
---

# Time Series Plot For Lithium (dissolved) Old Cranbrook Landfill

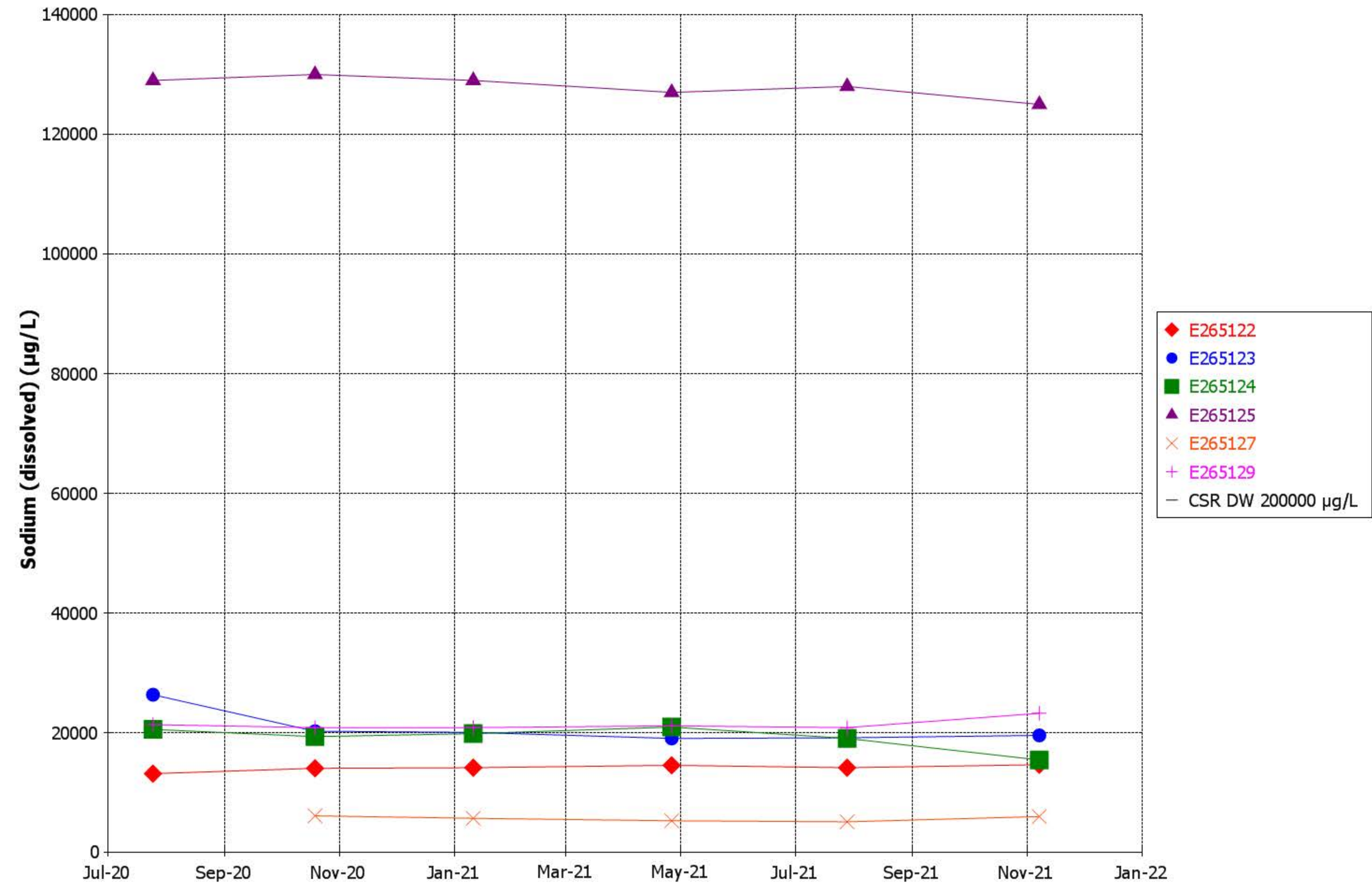




# Time Series Plot For Sulphate Old Cranbrook Landfill

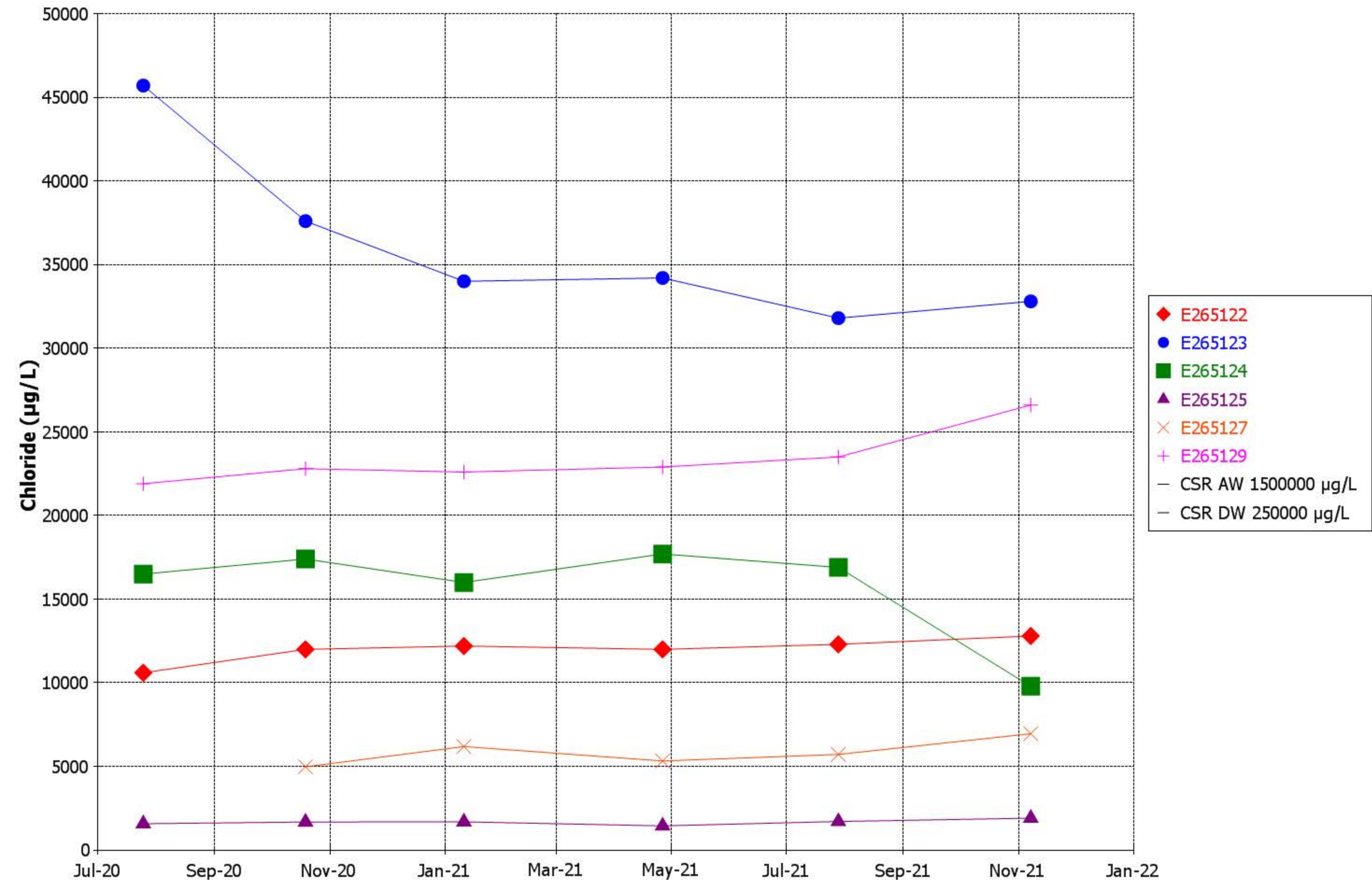


# Time Series Plot For Sodium (dissolved) Old Cranbrook Landfill

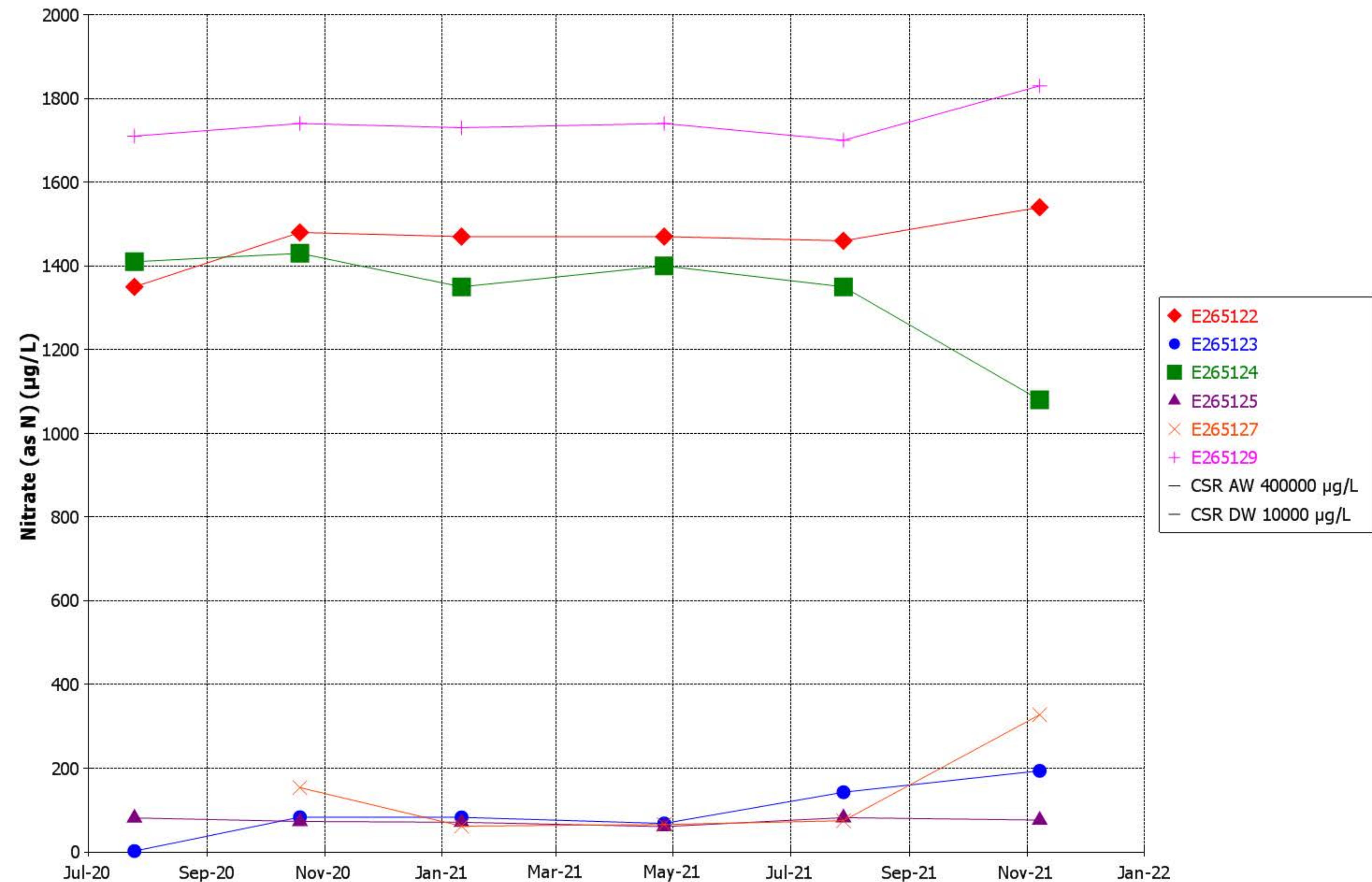




# Time Series Plot For Chloride Old Cranbrook Landfill

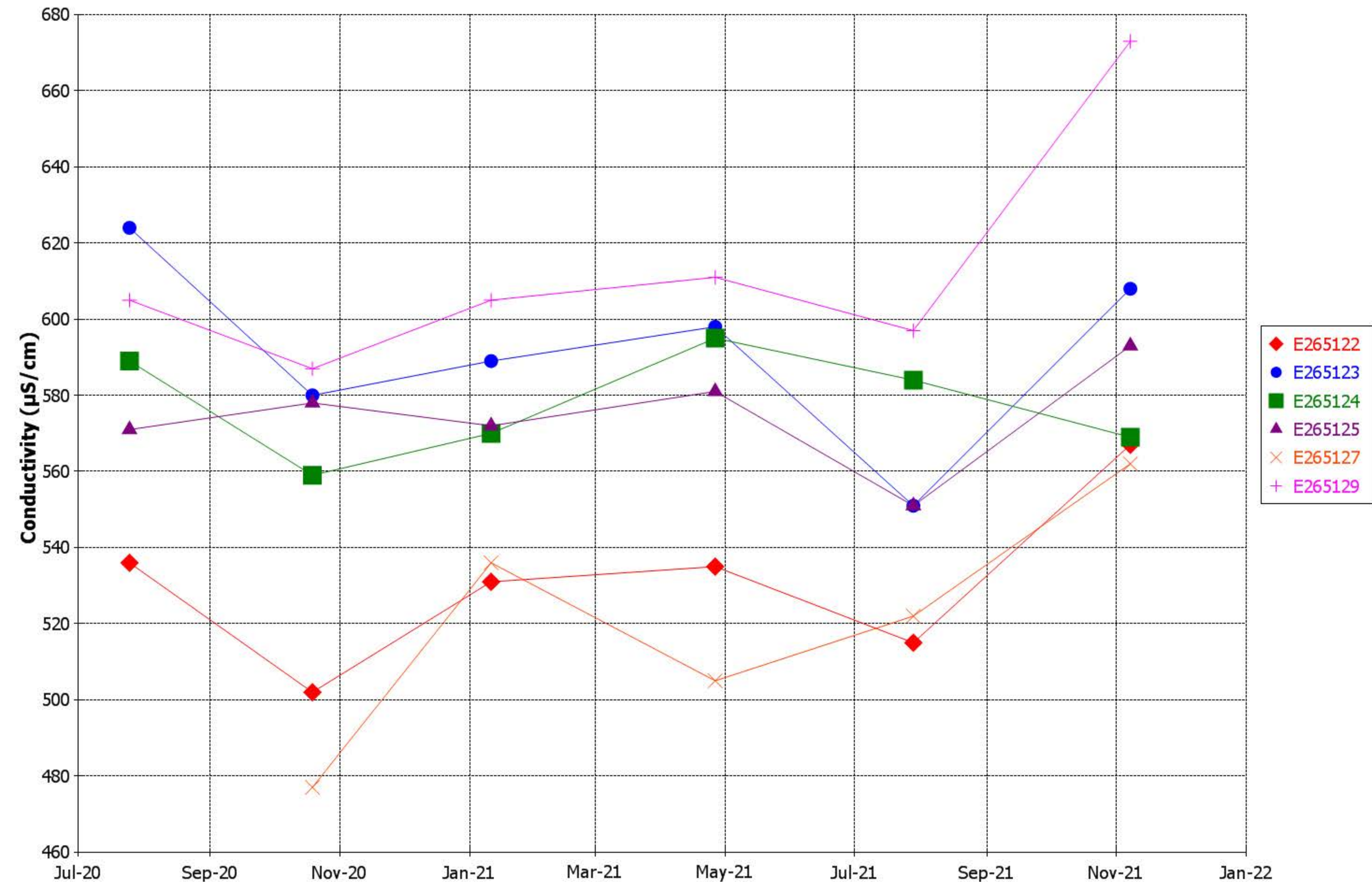


# Time Series Plot For Nitrate (as N) Old Cranbrook Landfill





# Time Series Plot For Conductivity Old Cranbrook Landfill





# Time Series Plot For Fluoride Old Cranbrook Landfill

