

Hosmer Septage Ponds 2021 Groundwater Monitoring Annual Report

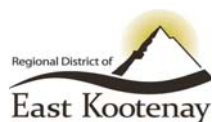


PREPARED FOR: REGIONAL DISTRICT OF EAST KOOTENAY

PREPARED BY: SPERLING HANSEN ASSOCIATES

January, 2022

PRJ21063



- 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 Bear Environmental Ltd. (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 until 2025.

In 2021, sampling events occurred in January, April, July, and November. 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.

1.1 Location and Setting

The Hosmer site is located in the sub-region of Elk Valley within the RDEK. The site is approximately 5 km north of the community of Hosmer. The latitude and longitude are 49.63563 N and 114.92165 W respectively.



Photo 1-1. Hosmer Site Layout.

1.2 Site Operations

The site is around 1 hectare in size, and consists of two unlined septic waste disposal basins. The basins are located central on the site and occupy approximately 0.44 hectares.

Due to the potential for contamination when septic waste comes into contact with water, it is required to monitor the groundwater on and surrounding the site to observe any impacts from the exfiltration ponds. There are 5 groundwater wells at the Hosmer site, which are monitored quarterly in January, April, July, and November. The well locations are identified in Figure 1.

The property operates under certificate permit PE-6901, which is attached to this report as Appendix A.

2. MONITORING PROGRAM

Per the Site's Permit, the RDEK is authorized to discharge septic tank pumpage and sewage holding tank effluent at 22.7 m³/day from domestic and other sources through infiltration basins to the ground approximately 6.5 km north of Hosmer, BC. A groundwater monitoring program is not included in the Permit, likely due to its published date of 1983.

Per Section 85 of the BC Municipal Wastewater regulation, a discharger must install monitoring wells in sufficient number and orientation, as determined by a qualified professional, to measure background and receiving environment water quality. This includes at least 4 wells per aquifer, one of which must be a background monitoring well. A total of five (5) monitoring wells exist, and all were sampled in accordance to the BC Field Sampling Manual in 2021.

2.1 Methodology

BEAR conducts the field sampling at the seven RDEK sites. Each well sampled is tested for a set of parameters that are intended to determine any site impact on the groundwater. 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 are tested Quarterly and Yearly.

Table 2-1. Groundwater Monitoring Parameters.

Site	Quarterly Params	Yearly Params
Hosmer Septage Treatment Pond	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
	Fecal and Total Coliform	Fecal and Total Coliform
	Dissolved Metals	Dissolved Metals
		BTEX
		EPH/VPH

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

2.2 Groundwater Flow

The Hosmer site is located approximately 150 m directly east of the Elk River and immediately west of the Crowsnest Highway 3. The river is the closest surface water body to the Site. According to the BC Water Resources Atlas, there are no mapped aquifers underlying the site. Based on regional topography, groundwater is inferred to flow south west in the same direction as the Elk River. 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. Based on water levels collected in 2021, local groundwater appears to flow west toward the Elk River, however based on groundwater quality observed at the upgradient and downgradient wells, local groundwater likely flows radially away from the site rather than in one set direction. Additionally, it should be noted that the Hosmer septage ponds are at a lower elevation than the Highway and is in a similarly low-lying area to the old gravel pit across the Highway. This should be considered when assessing impact to groundwater from the surrounding land uses.

Well details and water level (depth to water bgs) are shown in the 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)
E265105	2" PVC	5.110	4.515	4.820	5.165
E265106	2" PVC	4.510	3.870	4.075	4.420
E265107	2" PVC	5.285	4.835	5.065	5.330
E265108	2" PVC	5.680	5.205	5.455	5.725
E265104	2" PVC	5.840	5.075	5.410	5.840

2.3 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.

2.4 Regulatory Criteria

The permit of operation for the site, published in 1983, does not specify water quality guidelines or standards to be used for comparison to assess groundwater. SHA has used the standards that are appropriate for the site to be consistent with the other solid waste sites in the RDEK.

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. A search for water wells revealed that there are no water wells within 500m of the Site. Information from the BC Water Atlas indicates that there are no mapped aquifers underlying the Site. Although current DW use appears to not apply to the site, without further investigation, future DW standards are assumed to apply. Note that future drinking water use applies where information is unavailable or inadequate to demonstrate an absence of drinking water aquifers below a site.

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 150m east of Elk River, therefore the Aquatic Life for Freshwater (AW) standards will apply.

Based on surrounding water use the following standards are considered to apply:

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

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

3. RESULTS

Permit PE-6901 does not outline parameters for monitoring. SHA has continued the monitoring program employed by EcoLogic for the past several years which are consistent with landfill leachate parameters analysed throughout the RDEK.

The parameters tested during in 2021 include:

- temperature, conductivity, pH, nitrite, nitrate, ammonia nitrogen, fluoride, sulphate, chloride, hardness, alkalinity, total suspended solids, fecal and total coliform.

*It should be noted that Section c) of Appendix 1 of PE-6901 states that “The characteristics of the effluent shall be equivalent or better than typical ‘septic tank pumpage’ and typical holding tank effluent from residential, commercial, and industrial sources.”

Appendix B attached shows the water quality analysis conducted by ALS Environmental, and Table B-1 provides the water quality analysis alongside the applicable water standards. Laboratory certificates are attached in Appendix C.

3.1 Exceedances

The following parameters were above BC CSR Schedule 3.2 DW standards in one or more wells:

- Barium
- Manganese
- Selenium
- Sodium
- Strontium
- Ammonia
- Chloride
- Nitrate (as N)
- Nitrate and Nitrite (as N)
- Lithium (dissolved)

Table 3-1 presents a summary of exceedances by analyte. Details are provided in the sections below.

Table 3-1. Summary of Exceedances by Analyte

	E265104	E265105	E265107	E265108
Lab Results				
Dissolved Metals				
Barium (dissolved)	X			
Lithium (dissolved)	X	X	X	X
Manganese (dissolved)	X		X	
Selenium (dissolved)	X			
Sodium (dissolved)			X	
Strontium (dissolved)			X	
General and Inorganic Parameters				
Ammonia (total, as N)	X	X	X	X
Chloride	X		X	X
Nitrate (as N)			X	X
Nitrate + Nitrite (as N)			X	X

Note that E.Coli and Fecal Coliform were present in some wells in numbers that exceed Canadian Drinking Water Standards.

Table 3-2 below shows maximum concentrations.

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

Parameter	BC CSR DW Standard	Maximum Concentration (mg/L)	Well Name
E.Coli	*No detectable bacteria per 100 mL	<100	E265106, E265108
Fecal Coliforms	*No detectable bacteria per 100 mL	1,060	E265104
Barium (dissolved)	1,000 µg/L	1,120	E265104
Lithium (dissolved)	8 µg/L	57.2	E265108
Manganese (dissolved)	1,500 µg/L	1,820	E265107
Selenium (dissolved)	10 µg/L	41.8	E265104
Sodium (dissolved)	200 µg/L	231	E265107
Strontium (dissolved)	2,500 µg/L	2,880	E265107
Chloride	250,000 µg/L	714,000	E265104
Nitrate (as N)	10 mg/L	135	E265108
Nitrate + Nitrite (as N)	10 mg/L	135	E265108

“*” Denotes applicable Canadian Drinking Water Standard as there is no BC CSR standards for coliforms. Green shading indicates a concentration above applicable standards.

Note: concentrations listed in the table are all above applicable DW standards. Maximum concentrations are shown in **bold**.

Table 3-3. Maximum Parameter Concentrations Above BC CSR AW Standards

Parameter	BC CSR AW Standard	Maximum Concentration (mg/L)	Well Name
Selenium (dissolved)	20 µg/L	41.8	E265104
Ammonia	Calculated*	118,000	E265107

“*” – Calculated based on temperature and pH

Note: concentrations listed in the table are all above applicable AW standards. Maximum concentrations are shown in **bold**.

3.2 Annual Event

The annual event in 2021 was completed in the same quarter as previous years, in April, as per the precedent set by EcoLogic. The annual event is the sampling event when select parameters that are only tested for once a year are completed. For Hosmer, these included hydrocarbons such as BTEX (benzene, toluene, ethylbenzene and xylene) and EPH/VPH (extractable petroleum hydrocarbons).

3.3 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 arsenic, cobalt, and 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 are 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 comparison limit for lithium, which explains why lithium was not a reported exceedance in previous years despite there being little difference between 2019 and 2020 results.

Thompson-Okanagan, the nearest region to the RDEK with a background concentration qualifier for lithium, has a qualified concentration in the Bulletin of 96 µg/L, or 0.096 mg/L. Arsenic has a background concentration of 0.013 mg/L, and Cobalt 0.02 mg/L. SHA recommends keeping a note of this and a close eye on these parameters in ongoing monitoring. 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 background concentrations for the Kootenay region.

4. DISCUSSION

All parameters tested were below applicable BC CSR Schedule 3.2 AW standards, except for dissolved selenium at well E265104 and ammonia at E265104, E265105, E265107, and E265108. The maximum concentration of selenium was found at E265104 at 41.8 µg/L versus the BC CSR AW standard of 20 µg/L. The maximum concentration of ammonia was found at E265107 at 118,000 µg/L versus the BC CSR AW calculated standard of 18,500 µg/L.

These maximums are calculated as the following times their respective standards:

- Selenium – 2.09
- Ammonia – 6.38

Parameters above applicable BC CSR Schedule 3.2 DW standards included the following.

- Barium
- Manganese
- Selenium
- Sodium
- Strontium
- Chloride
- Nitrate (as N)
- Nitrate and Nitrite (as N)
- Lithium (dissolved)

The maximum concentration of lithium was found at E265108 at 57.2 µg/L versus the BC CSR DW standard of 8 µg/L. The maximum concentration of barium was found at E265104 at 1,120 µg/L versus the BC CSR DW standard of 1,000 µg/L. The maximum manganese concentration was found at E265107 at 1,820 mg/L versus the BC CSR DW standard of 1,500 µg/L. The maximum selenium concentration was found at E265104 at 41.8 µg/L versus the BC CSR DW standard of 10 µg/L. The maximum sodium concentration was found at E265107 at 231 µg/L versus the BC CSR DW standard of 200 µg/L. The maximum strontium concentration was found at E265107 at 2,880 µg/L versus the BC CSR DW standard of 2,500 µg/L. The maximum chloride concentration was found at E265104 at 714,000 µg/L versus the BC CSR DW standard of 250,000 µg/L. The maximum nitrate concentration was found at E265108 at 135 µg/L versus the BC CSR DW standard of 10 µg/L. Similarly, the max nitrate + nitrite concentration was also found at E265108 at 135 µg/L versus the BC CSR DW standard of 10 µg/L.

These maximums are calculated as the following times their respective standards:

- Barium – 1.12
- Manganese – 1.28
- Selenium – 4.18
- Sodium – 1.16
- Strontium – 1.15
- Chloride – 2.86
- Nitrate (as N) – 13.5
- Nitrate and Nitrite (as N) – 13.5
- Lithium – 7.15

Note that bacterial coliforms and elevated nitrate were also found in site groundwater indicating expected local impacts from the sewage infiltration basins.

Dissolved metals are found at the site groundwater in concentrations above some CSR DW and AW limits. As shown by the maximums and the amount they are over the corresponding limit, it can be observed that the dissolved metals are exceeding the DW limits by a factor less than 2, with the exception of lithium. Nitrate and lithium display similar occurrences at Wasa, the RDEK's other infiltration site.

The lithium, nitrate, and E. Coli and Fecal Coliform results are consistent with concentrations observed in 2020.

As mentioned in Section 2.2 above with regard to groundwater flow direction, wells both upgradient and downgradient of the Hosmer septage ponds exhibit similar water quality, indicating that there is not one exclusive path in which groundwater flows away from the site. As such, it is difficult to assume background water quality at the identified background well locations, and it should be considered that all monitoring wells show some degree of impact from the nearby presence of the septage ponds.

SHA reviewed Site and surrounding water use per CSR Protocol 21. Although current DW use appears to not apply to the site, without further investigation of the underlying unmapped aquifer, future DW standards are assumed to apply.

Based on this information regarding current water use, and results that show that there are several exceedances to the CSR DW and AW standards, SHA considers the impacts of the sewage infiltration basin to the surrounding environment to be occurring at a level that is expected of an unlined, natural attenuation site.

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 as Appendix D.

- Figure 2 – Barium
- Figure 3 – Manganese
- Figure 4 – Selenium
- Figure 5 – Sodium
- Figure 6 – Strontium
- Figure 7 – Chloride
- Figure 8 – Nitrate (as N)
- Figure 9 – Nitrate and Nitrite (as N)
- Figure 10 – Lithium (dissolved)
- Figure 11 – Selenium
- Figure 12 – Ammonia

Sulfate, sodium, chloride, nitrate, and nitrite are graphed because they are typical landfill indicators. As shown in the graphs, sodium, nitrate, and chloride are above applicable DW limits. Due to the dissolved metals not being analyzed in July and November, it could not be determined whether the metals exceedances were an isolated peak in concentrations during the April event, or if this trend continued in the rest of the year. The status of the dissolved metals will be confirmed in the January event of 2022.

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

Some parameters generally associated with sewage effluent including nitrate, E. Coli, and fecal coliforms were noted above applicable BC CSR DW Standards, but below BC CSR AW standards in Site groundwater. Although there appears to be local impacts to groundwater from the Site's sewage infiltration basins, SHA considers the overall impacts to human health and the surrounding environment to be low based on Site and surrounding water use.

Other metals parameters that appear slightly elevated included lithium, manganese, selenium, sodium, and strontium that may be related to Site impacts. In conducting analyses for seven different sites within the RDEK with similar exceedances of lithium under the CSR DW limit, SHA believes these elevated concentrations are a region-wide occurrence caused by existing background concentrations rather than impacts caused by activities at the solid waste sites.

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 Q2 in April 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
Sr. Civil Technologist

7. REFERENCES

Eco/Logic Environmental, Hosmer Septage Treatment Ponds Groundwater Monitoring Report 2019, prepared for the Regional District of East Kootenay.

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

Ministry of Environment, BC Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture Summary Report, August 2019.

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:

**HOSMER SEPTAGE
TREATMENT POND
MONITORING LOCATIONS**

SCALE:
N/A

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

PROJECT NO:
21063

DESIGNED

DRAWN

CHECKED

DRAWING NO:

Figure 1

APPENDICES

APPENDIX A
Permit



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 .. PE-6901

JUL 13 1983

REGISTERED MAIL:

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



*C.C.
R.D.
File in
front of
folder.*

Dear Sir:

Re: LETTER OF TRANSMITTAL

Enclosed is a copy of Permit No. PE-6901 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.

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.

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.

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

MB:as

Enclosure



MINISTRY OF ENVIRONMENT

PERMIT

Under the Provisions of the Waste Management Act

The Regional District of East Kootenay

19 - 24th Avenue South, Cranbrook, British Columbia VIC 3H8

is hereby authorized to discharge septic tank pumpage and sewage holding tank effluent
from domestic and other sources

located in the Elk Valley

to the ground approximately 6.5 kilometers north of Hosmer, British Columbia

This permit has been issued under the terms and conditions prescribed in the attached appendices
01, A-1, B-1, C-1

M. Baillargeon
Regional Waste Manager

Date issued JUL 13 1983, 19
Amendments dated, 19
, 19
, 19

Permit No. PE-6901



MINISTRY OF ENVIRONMENT
WASTE MANAGEMENT BRANCH

APPENDIX No. 01

to Permit No. PE-6901

E209899

- (a) The discharge of effluent to which this appendix is applicable is to land known and described as 0.42 hectares on a portion of Parcel 35, District Lot 4588, Kootenay District
(Source of operation)
- as shown on attached Appendix A-1
- (b) The quantity of effluent which may be discharged is an average of 22.7 cubic metres per day
- (c) The characteristics of the effluent shall be equivalent to or better than typical septic tank pumpage and typical holding tank effluent from residential, commercial and industrial sources
- (d) The works authorized are infiltration basins
- approximately as shown on the attached Appendix A-1
- (e) The land from which the effluent originates and to which this appendix is appurtenant is in the Elk Valley
- (f) Those works authorized and proposed must be completed and in operation before discharge commences

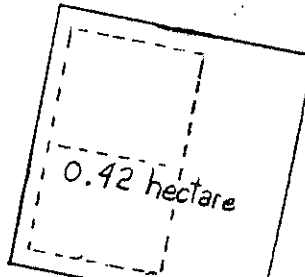
Date issued JUL 13 1983, 19
Date amended, 19
, 19

Regional Waste Manager



SITE PLAN

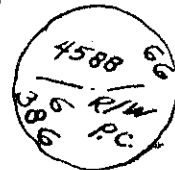
LOCATION
OF
DISCHARGE



Drawing not
to scale.

Parcel 35, D.L. 4588, K.D.

Centre of access to be 125 metres
South of P.Con#6 as shown on Plan 6060
D.L. 4588, K.D. Crowsnest Highway #3



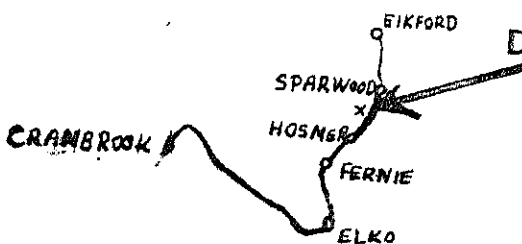
125m

P.Con #6

HQSMEB 6.5 Km

Crowsnest Hwy. #3

LOCATION MAP



LOCATION
OF
DISCHARGE

REGIONAL DISTRICT OF EAST KOOTENAY

(Name of applicant(s))

April 15/83

(Date)

(Signature of applicant(s) or agent)

(FOR OFFICE USE ONLY)

JUL 13 1983

(Date issued)

(Director of Pollution Control)

Appendix A-1 to Permit No. PE-6901



MINISTRY OF ENVIRONMENT
WASTE MANAGEMENT BRANCH

APPENDIX No. B-1
to Permit No. PE-6901

A. OPERATION

1. Septic tank pumpage and sewage holding tank effluent are to be discharged to infiltration basins and dried before removal to a landfill site. The dried sludge is to be covered with inert material immediately after placement in the landfill.
2. The minimum freeboard in the infiltration basins shall be 0.6 metre. The infiltration basin area is to be fenced and locked to prevent unauthorized access. Notice must be posted on the site to make the public aware of the type of facility being operated.

JUL 13 1983

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

M. Baillargeon
Regional Waste Manager



MINISTRY OF ENVIRONMENT
WASTE MANAGEMENT BRANCH

APPENDIX No. C-1

to Permit No. PE-6901

MONITORING:

Monthly records of the quantity of septic tank pumpage and holding tank effluent discharged to the basins, in cubic metres per day, and the names of operators having access to the facility shall be maintained and retained for periodic inspection.

Date issued JUL 13 1983, 19
Date amended, 19
, 19

M. Baillargeon
Regional Waste Manager

APPENDIX B
Water Quality Results

Table B-1 Water Quality Analysis

Analyte	Unit	Guideline																																
		CSR AW	CSR DW																															
Lab Results																																		
Anions and Cations in meq/L unit																																		
Aluminum (meq/L) (calculated)	meq/L	NG	NG	<0.00011	0.0001	0.00016	<0.00056			0.00507	0.00023	0.00024	<0.00011			0.00255	0.00018	<0.00011				0.00049	0.00024	0.00032	<0.00056				0.00036	0.00064	0.00085	<0.00056		
Barium (meq/L) (calculated)	meq/L	NG	NG	0.00269	0.00514	0.00603	0.0163			0.00186	0.00513	0.00925	0.00329			0.00188	0.00264	0.00215				0.00421	0.00531	0.00566	0.00644				0.00706	0.00667	0.00855	0.00960		
Bicarbonate (HCO3) (meq/L) (calculated)	meq/L	NG	NG	4.05	6.08	6.97	11.6	6.57	7.33	3.95	7.69	12.8	4.65	4.44	7.97	4.03	6.24	4.74	5.00	6.49		8.11	9.15	11.3	14.4	8.34	10.2		9.01	9.88	10.4	10.2	11.6	
Boron (meq/L) (calculated)	meq/L	NG	NG	<0.0028	0.0097	0.0086	0.016			<0.0028	0.011	0.012	0.0033			<0.0028	<0.0028	<0.0028				0.024	0.0366	0.0327	0.0333				0.026	0.0291	0.039	0.0427		
Calcium (meq/L) (calculated)	meq/L	NG	NG	3.73	5.54	6.84	22.3	5.29	6.09	3.63	6.79	10.8	4.91			4.01	5.29	4.99	4.13	5.34		4.24	7.58	9.43	13.0	4.53	9.68		4.72	4.48	10.0	9.88	5.14	
Carbonate (CO3) (meq/L) (calculated)	meq/L	NG	NG	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	
Chloride (meq/L) (calculated)	meq/L	NG	NG	0.285	1.67	4.03	20.1	2.54	2.42	0.0759	1.99	4.88	0.291	0.0595	2.73	0.0581	0.212	0.127	0.0528	0.109		2.45	6.12	6.57	15.1	3.44	5.11		3.3	3.39	2.93	7.19	5.02	
Chromium (meq/L) (calculated)	meq/L	NG	NG	0.000087	<0.000058	0.000022	<0.000029			0.000016	<0.000058	0.000098	<0.000058			0.0000075	<0.000058	<0.000058				0.0000024	0.0000087	0.000006	<0.000029				0.000018	0.000013	<0.000029	<0.000029		
Copper (meq/L) (calculated)	meq/L	NG	NG	0.000023	0.000041	0.0000538	0.000085			0.000024	0.000015	0.000029	0.000016			0.000015	0.000026	0.000015				0.000011	0.0000614	0.0000585	0.000079				0.000012	0.000014	0.000038	0.000031		
Fluoride (meq/L) (calculated)	meq/L	NG	NG	0.00695	0.00900	<0.0053	<0.0053	0.00579	0.00732	0.00805	0.012	0.0063	0.00611	0.00769	0.010	0.00848	0.00653	0.00563	0.00753	0.00795		0.02	0.017	0.0084	0.0068	0.010	0.020		0.014	0.023	0.0058	<0.0053	0.0124	
Hydroxide (OH) (meq/L) (calculated)	meq/L	NG	NG	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29	<0.29		<0.29	<0.29	<0.29	<0.29	<0.29	<0.29		<0.29	<0.29	<0.29	<0.29	<0.29	
Lead (meq/L) (calculated)	meq/L	NG	NG	<0.0000048	0.00000095	0.00000236	<0.0000024			0.0000117	<0.0000048	<0.0000048	<0.0000048			0.00000085	<0.0000048	<0.0000048				0.00000079	0.00000066	0.00000065	<0.0000024				<0.0000048	0.00000130	<0.0000024	<0.0000024		
Lithium (meq/L) (calculated)	meq/L	NG	NG	0.00061	0.00164	0.00182	0.00553			0.00075	0.00210	0.0039	0.0011			0.00081	0.0010	0.00098				0.00222	0.00382	0.00463	0.00571				0.00278	0.00288	0.00444	0.00824		
Magnesium (meq/L) (calculated)	meq/L	NG	NG	1.14	1.87	1.98	8.31	1.42	1.71	1.37	2.33	3.5	1.64	1.37	2.4	1.5	1.91	1.87	1.46	1.88		1.36	2.05	2.23	3.37	1.15	2.13		1.44	1.34	2.44	2.57	1.35	
Potassium (meq/L) (calculated)	meq/L	NG	NG	0.0494	0.17	0.166	0.412			0.023	0.160	0.312	0.0811			0.017	0.020	0.015				0.737	0.778	0.880	1.4				0.885	0.721	0.79	1.13		
Sodium (meq/L) (calculated)	meq/L	NG	NG	0.386	1.2	2.4	1.5			0.108	0.805	2.85	0.295			0.111	0.184	0.148				1.97	3.28	4.2	10.0				2.52	2.4	2.86	4.78		
Strontium (meq/L) (calculated)	meq/L	NG	NG	0.00368	0.0114	0.0138	0.0441			0.00402	0.019	0.0338	0.00950			0.00381	0.00566	0.00491				0.0235	0.0397	0.0416	0.0658				0.0288	0.0317	0.0557	0.0521		
Sulfate (meq/L) (calculated)	meq/L	NG	NG	0.145	0.107	0.170	0.0976	0.110	0.117	0.743	0.35	0.170	1.5	0.904	0.783	0.799	1.3	1.05	0.802	1.12		1.12	0.0090	0.502	0.641	0.631	0.0845	0.287		0.0058	0.013	0.262	0.964	0.0616
Zinc (meq/L) (calculated)	meq/L	NG	NG	0.000052	0.00016	0.000083	<0.00015			0.000095	0.00024	0.00015	<0.000031			0.000058	0.00012	0.000031				0.00010	0.000410	0.000358	0.000404				0.000055	0.00009	<0.00015	<0.00015		
Dissolved Metals																																		
Aluminum (dissolved)	µg/L	NG	NG	9500 ^{2,3}	<1.0	1	1.4	<5.0		45.6	2.1	2.2	<1.0			22.9	1.6	<1.0				4.4	2.2	2.9	<5.0				3.2	5.8	7.6	<5.0		
Antimony (dissolved)	µg/L	90	6	<0.10	<0.10	0.11	<0.50			<0.10	<0.10	0.13	<0.10			<0.10	0.11	<0.10				0.12	0.3	0.23	<0.50				0.11	0.24	<0.50	<0.50		
Arsenic (dissolved)	µg/L	50	10	<0.10	0.14	0.14	<0.50			0.15	0.39	0.87	<0.10			0.17	0.13	<0.10				21.5	3.56	0.92	0.96				18.6	17	0.9	<0.50		
Barium (dissolved)	µg/L	10000	1000	185	353	414	1120			128	352	635	226			129	181	148				289	365	389	442				485	458	587	659		
Beryllium (dissolved)	µg/L	1.5	8	<0.020	<0.020	<0.020	<0.10			<0.020	<0.020	<0.020	<0.020			<0.020	<0.020	<0.020				<0.020	<0.020	<0.020	<0.10				<0.020	<0.020	<0.10	<0.10		
Bismuth (dissolved)	µg/L	NG	NG	<0.050	<0.050	<0.050	<0.25			<0.050	<0.050	<0.050	<0.050			<0.050	<0.050	<0.050				<0.020	<0.020	<0.020	<0.10				<0.020	<0.020	<0.10	<0.10		
Boron (dissolved)	µg/L	12000	5000	<10	35	31	56			<10	38	45	12			<10	<10	<10				85	132	118	120				92	105	140	154		
Cadmium (dissolved)	mg/L	Calc ^{1,3}	0.005	0.0000752	0.000368	0.000328	0.000312			0.0000778	0.000119	0.000147	0.0000615			0.0000345	0.0000427	0.0000312				0.0000094	0.0000675	0.000189	0.000396				0.0000083	0.0000183	0.00015	0.000105		
Calcium (dissolved)	µg/L	NG	NG	74700	111000	137000	446000	106000	122000	28900	136000	216000	95300	77900	147000	80300	106000	106000				84900	152000	189000	269000				94500	89600	201000	198000	103000	
Chromium (dissolved)	µg/L	10 ^{1,2}	50 ^{1,2}	<0.15	0.15	0.39	<0.50			0.28	<0.10	0.17	<0.10			0.13	<0.10	<0.10				0.42	0.15	0.11	<0.50				0.31	0.22	<0.50	<0.50		
Cobalt (dissolved)	µg/L	40	20 ^{2,3}	<0.10	0.6	0.41	2.59			0.17	1.99	5.58	0.53			<0.10	<0.10	<0.10				2.66	8.1	3.39	6.06				2.98	3.67	1.99	1.80		
Copper (dissolved)	µg/L	Calc ^{1,3}	1500 ^{2,4}	0.73	1.3	1.71	2.7			0.75	0.48	0.91	0.50			0.48	0.84	0.49				0.36	1.95	1.86	2.5				0.37	0.46	1.2	1.0		
Hardness, Total (dissolved as CaCO3)	mg/L	NG	NG	244	361	442	1530	336	392	275	456	713	327	263	488	275	361	344			279	308	362					308	292	624	622	323	811	
Iron (dissolved)	µg/L	NG	NG	6500 ^{2,3}	<1.0	12	<1.0	<5.0		233	1320	5420	<1.0			29	<1.0	<1.0				15000	6240	781	365				18100	13900	<5.0	<5.0		
Lead (dissolved)	µg/L	Calc ^{1,4}	10 ¹	<0.050	0.098	0.244	<0.25			1.21	<0.050	<0.050	<0.050			0.088	<0.050	<0.050				0.082	0.068	0.067	<0.25				<0.050	0.135</				

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 10:03 (MT)
Version: FINAL

Client Phone: 604-986-7723

Certificate of Analysis

Lab Work Order #: L2548126
Project P.O. #: NOT SUBMITTED
Job Reference: 20050 HOSMER
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 10:03 (MT)

Version: FINAL

Sample ID Description Sampled Date Sampled Time Client ID		L2548126-1 GROUNDWATER 13-JAN-21 12:00 E265104	L2548126-2 GROUNDWATER 13-JAN-21 12:00 E265105	L2548126-3 GROUNDWATER 13-JAN-21 12:00 E265106	L2548126-4 GROUNDWATER 13-JAN-21 12:00 MW6	L2548126-5 GROUNDWATER 13-JAN-21 12:00 MW7
Grouping	Analyte					
WATER						
Physical Tests	Hardness (as CaCO ₃) (mg/L)	442	713	361	584	624
	Total Suspended Solids (mg/L)	6.1	258	1190	636	4060
Anions and Nutrients	Alkalinity, Total (as CaCO ₃) (mg/L)	349	641	312	567	518
	Ammonia as N (mg/L)	4.94 ^{DLM}	24.9 ^{DLM}	0.0434	53.8 ^{DLM}	56.4 ^{DLM}
	Bicarbonate (HCO ₃) (mg/L)	425	782	381	692	632
	Carbonate (CO ₃) (mg/L)	<5.0	<5.0	<5.0	<5.0	<5.0
	Chloride (Cl) (mg/L)	143 ^{DLHC}	173 ^{DLHC}	7.52	233 ^{DLHC}	104 ^{DLHC}
	Conductivity (EC) (uS/cm)	1060	1560	625	1900	2010
	Fluoride (F) (mg/L)	<0.10 ^{DLHC}	0.12 ^{DLHC}	0.124	0.16 ^{DLHC}	0.11 ^{DLHC}
	Hydroxide (OH) (mg/L)	<5.0	<5.0	<5.0	<5.0	<5.0
	Nitrate and Nitrite (as N) (mg/L)	7.41	2.17	0.437	35.6	120
	Nitrate (as N) (mg/L)	7.39 ^{DLHC}	2.16 ^{DLHC}	0.434	35.5 ^{DLHC}	120 ^{DLHC}
	Nitrite (as N) (mg/L)	0.0234 ^{DLHC}	0.0074 ^{DLHC}	0.0024	0.0660 ^{DLHC}	0.0855 ^{DLHC}
	pH (pH)	7.63	7.57	7.64	7.47	7.26
	Sulfate (SO ₄) (mg/L)	8.17 ^{DLHC}	8.18 ^{DLHC}	64.0 ^{DLHC}	30.8 ^{DLHC}	12.6 ^{DLHC}
Bacteriological Tests	MPN - E. Coli (MPN/100mL)	<1	<10 ^{DLM}	<100 ^{DLM}	<10 ^{DLM}	<100 ^{DLM}
	Coliform Bacteria - Fecal (CFU/100mL)	<1	10 ^{DLM}	<100 ^{DLM}	<10 ^{DLM}	<100 ^{DLM}
	MPN - Total Coliforms (MPN/100mL)	<1	63 ^{DLM}	100 ^{DLM}	10 ^{DLM}	<100 ^{DLM}
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0014	0.0022	0.0016	0.0029	0.0076 ^{DLDS}
	Antimony (Sb)-Dissolved (mg/L)	0.00011	0.00013	0.00011	0.00023	<0.00050 ^{DLDS}
	Arsenic (As)-Dissolved (mg/L)	0.00014	0.00087	0.00013	0.00092	0.00090 ^{DLDS}
	Barium (Ba)-Dissolved (mg/L)	0.414	0.635	0.181	0.389	0.587 ^{DLDS}
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.00010 ^{DLDS}
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.00025 ^{DLDS}
	Boron (B)-Dissolved (mg/L)	0.031	0.045	<0.010	0.118	0.140 ^{DLDS}
	Cadmium (Cd)-Dissolved (mg/L)	0.000328	0.000147	0.0000427	0.000189	0.000150 ^{DLDS}
	Calcium (Ca)-Dissolved (mg/L)	137	216	106	189	201 ^{DLDS}
	Chromium (Cr)-Dissolved (mg/L)	0.00038	0.00017	<0.00010	0.00010	<0.00050 ^{DLDS}
	Cobalt (Co)-Dissolved (mg/L)	0.00041	0.00558	<0.00010	0.00339	0.00199 ^{DLDS}
	Copper (Cu)-Dissolved (mg/L)	0.00171	0.00091	0.00084	0.00186	0.0012 ^{DLDS}
	Iron (Fe)-Dissolved (mg/L)	<0.010	5.42	<0.010	0.781	<0.050 ^{DLDS}
	Lead (Pb)-Dissolved (mg/L)	0.000244	<0.000050	<0.000050	0.000067	<0.00025 ^{DLDS}
	Lithium (Li)-Dissolved (mg/L)	0.0126	0.0270	0.0072	0.0321	0.0308 ^{DLDS}
	Magnesium (Mg)-Dissolved (mg/L)	24.1	42.0	23.2	27.1	29.7 ^{DLDS}

* 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		L2548126-1 GROUNDWATER 13-JAN-21 12:00 E265104	L2548126-2 GROUNDWATER 13-JAN-21 12:00 E265105	L2548126-3 GROUNDWATER 13-JAN-21 12:00 E265106	L2548126-4 GROUNDWATER 13-JAN-21 12:00 MW6	L2548126-5 GROUNDWATER 13-JAN-21 12:00 MW7
Grouping	Analyte					
WATER						
Dissolved Metals	Manganese (Mn)-Dissolved (mg/L)	0.317	1.42 ^{RRV}	0.00595	1.09	0.645 ^{DLDS}
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050 ^{DLDS}
	Molybdenum (Mo)-Dissolved (mg/L)	0.000548	0.00137	0.000553	0.00494	0.00726 ^{DLDS}
	Nickel (Ni)-Dissolved (mg/L)	0.00445	0.0204	0.00062	0.0219	0.0122 ^{DLDS}
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.25 ^{DLDS}
	Potassium (K)-Dissolved (mg/L)	6.49	12.2	0.79	34.4	31.0 ^{DLDS}
	Selenium (Se)-Dissolved (mg/L)	0.000281	0.00129	0.00196	0.000609	<0.00025 ^{DLDS}
	Silicon (Si)-Dissolved (mg/L)	3.96	5.57	3.19	5.73	4.72 ^{DLDS}
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000050 ^{DLDS}
	Sodium (Na)-Dissolved (mg/L)	55.1	65.5 ^{RRV}	4.22	96.6 ^{RRV}	65.8 ^{DLDS}
	Strontium (Sr)-Dissolved (mg/L)	0.605	1.48	0.248	1.82	2.44 ^{DLDS}
	Sulfur (S)-Dissolved (mg/L)	2.75	3.05	21.1	11.4	5.8 ^{DLDS}
	Thallium (Tl)-Dissolved (mg/L)	0.000131	0.000197	<0.000010	0.000440	0.000181 ^{DLDS}
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00050 ^{DLDS}
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.0015 ^{DLDS}
	Uranium (U)-Dissolved (mg/L)	0.000516	0.00104	0.000905	0.00139	0.000361 ^{DLDS}
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.0025 ^{DLDS}
	Zinc (Zn)-Dissolved (mg/L)	0.0027	0.0048	0.0038	0.0117	<0.0050 ^{DLDS}
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.0010 ^{DLDS}

* 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	L2548126-1, -2, -3, -4, -5
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2548126-1, -2, -3, -4, -5
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2548126-1, -2, -3, -4, -5

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BE-D-L-CCMS-CL	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.			
CL-L-IC-N-CL	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
F-L-IC-CL	Water	Fluoride	APHA 4110 B-Ion Chromatography
FCC-MF-CL	Water	Fecal Coliform Count-MF	APHA 9222D
This analysis is carried out using procedures adapted from APHA Method 9222 "Membrane Filter Technique for Members of the Coliform Group". Coliform bacteria is enumerated by culturing and colony counting. A known sample volume is filtered through a 0.45 micron membrane filter. The test involves an initial 24 hour incubation at 44.5 degrees C of the filter with the appropriate growth medium. This method is specific for thermotolerant bacteria (Fecal) and is used for non-turbid water with a low background bacteria level.			
HARDNESS-CALC-CL	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.			
HG-D-CVAA-CL	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.			
MET-D-CCMS-CL	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.			
N2N3-CALC-CL	Water	Nitrate+Nitrite	CALCULATION
NH3-L-F-CL	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.			
NO2-L-IC-N-CL	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-CL	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.			
PH/EC/ALK-CL	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			
SO4-L-IC-N-CL	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Reference Information

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

TC-EC-MPN-CL Water Total Coliforms and E. Coli by MPN APHA METHOD 9223

This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the positive responses to a probability table.

TSS-L-CL 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:

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: L2548126

Report Date: 20-JAN-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
BE-D-L-CCMS-CL								
Batch R5349898								
WG3474441-2 LCS		TMRM						
Beryllium (Be)-Dissolved			99.2		%		80-120	16-JAN-21
WG3474441-1 MB								
Beryllium (Be)-Dissolved			<0.000020		mg/L		0.00002	16-JAN-21
CL-L-IC-N-CL								
Batch R5352816								
WG3475239-2 LCS								
Chloride (Cl)			100.4		%		85-115	14-JAN-21
WG3475239-1 MB								
Chloride (Cl)			<0.10		mg/L		0.1	14-JAN-21
F-L-IC-CL								
Batch R5352816								
WG3475239-2 LCS								
Fluoride (F)			99.3		%		85-115	14-JAN-21
WG3475239-1 MB								
Fluoride (F)			<0.020		mg/L		0.02	14-JAN-21
FCC-MF-CL								
Batch R5348371								
WG3474093-1 MB								
Coliform Bacteria - Fecal			<1		CFU/100mL		1	14-JAN-21
HG-D-CVAA-CL								
Batch R5353916								
WG3475612-2 LCS								
Mercury (Hg)-Dissolved			101.0		%		80-120	19-JAN-21
WG3475612-6 LCS								
Mercury (Hg)-Dissolved			99.1		%		80-120	19-JAN-21
WG3475612-1 MB								
Mercury (Hg)-Dissolved			<0.0000050		mg/L		0.000005	19-JAN-21
MET-D-CCMS-CL								
Batch R5349898								
WG3474441-2 LCS		TMRM						
Aluminum (Al)-Dissolved			102.3		%		80-120	16-JAN-21
Antimony (Sb)-Dissolved			98.7		%		80-120	16-JAN-21
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

Quality Control Report

Workorder: L2548126

Report Date: 20-JAN-21

Page 2 of 6

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-CL		Water						
Batch	R5349898							
WG3474441-2	LCS	TMRM						
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
WG3474441-1	MB							
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	16-JAN-21
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	16-JAN-21
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

Quality Control Report

Workorder: L2548126

Report Date: 20-JAN-21

Page 3 of 6

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-CL		Water						
Batch	R5349898							
WG3474441-1 MB								
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
NH3-L-F-CL		Water						
Batch	R5350127							
WG3474466-14 LCS								
Ammonia as N			106.0		%		85-115	16-JAN-21
WG3474466-13 MB								
Ammonia as N			<0.0050		mg/L		0.005	16-JAN-21

Quality Control Report

Workorder: L2548126

Report Date: 20-JAN-21

Page 4 of 6

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO2-L-IC-N-CL	Water							
Batch	R5352816							
WG3475239-2 LCS								
Nitrite (as N)			102.5		%		90-110	14-JAN-21
WG3475239-1 MB								
Nitrite (as N)			<0.0010		mg/L		0.001	14-JAN-21
NO3-L-IC-N-CL	Water							
Batch	R5352816							
WG3475239-2 LCS								
Nitrate (as N)			101.4		%		90-110	14-JAN-21
WG3475239-1 MB								
Nitrate (as N)			<0.0050		mg/L		0.005	14-JAN-21
PH/EC/ALK-CL	Water							
Batch	R5348677							
WG3474168-8 LCS								
Conductivity (EC)			99.2		%		90-110	14-JAN-21
Alkalinity, Total (as CaCO3)			102.1		%		85-115	14-JAN-21
WG3474168-7 MB								
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
SO4-L-IC-N-CL	Water							
Batch	R5352816							
WG3475239-2 LCS								
Sulfate (SO4)			102.2		%		85-115	14-JAN-21
WG3475239-1 MB								
Sulfate (SO4)			<0.050		mg/L		0.05	14-JAN-21
TC-EC-MPN-CL	Water							
Batch	R5348340							
WG3474076-1 MB								
MPN - E. Coli			<1		MPN/100mL		1	14-JAN-21
MPN - Total Coliforms			<1		MPN/100mL		1	14-JAN-21
TSS-L-CL	Water							
Batch	R5353016							
WG3474759-8 LCS								
Total Suspended Solids			90.6		%		85-115	18-JAN-21
WG3474759-7 MB								



Quality Control Report

Workorder: L2548126

Report Date: 20-JAN-21

Page 5 of 6

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TSS-L-CL	Water							
Batch	R5353016							
WG3474759-7	MB							
Total Suspended Solids			<1.0		mg/L		1	18-JAN-21

Quality Control Report

Workorder: L2548126

Report Date: 20-JAN-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

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.



COC Number: 20 -

Canada Toll Free: 1 800 668 9878

Page of

Report To		Contact and company name below will appear on the final report		Reports / Recipients		Turnaround Time (TAT)							
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 - n		 L2548126-COFC							
Contact: Scott Garthwaite		Merge QC/QCI Reports with COA <input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> N/A		<input type="checkbox"/> 4 day [P4] if received by 3pm M-F - 2t									
Phone: 778-471-7088		<input checked="" type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked		<input type="checkbox"/> 3 day [P3] if received by 3pm M-F - 2									
Company address below will appear on the final report		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX		<input type="checkbox"/> 2 day [P2] if received by 3pm M-F - 5									
Street: 1225 East Keith Road		Email 1 or Fax: sgarthwaite@sperlinghansen.com		<input type="checkbox"/> 1 day [E] if received by 3pm M-F - 10									
City/Province: North Vancouver, B.C.		Email 2: chetherington@sperlinghansen.com		Same day [E2] if received by 10am M-F - fees may apply to rush requests on week routine tests									
Postal Code: V7J 1J3		Email 3:		Date and Time Required for all E&P TATs:		dd-mmm-yy hh:mm am/pm							
Invoice To: Same as Report To <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> NO		Invoice Recipients		For all tests with rush TATs requested, please contact your AM to confirm availability.									
Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX		Analysis Request									
Company:		Email 1 or Fax: rhajafari@sperlinghansen.com		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below									
Contact:		Email 2:											
Project Information		Oil and Gas Required Fields (client use)		NUMBER OF CONTAINERS									
ALS Account # / Quote #:		AFE/Cost Center:											
Job #: 20050 Hosmer		Major/Minor Code:		Anions									
PO / AFE:		Requisitioner:											
LSD:		Location:		Total Alkalinity									
ALS Lab Work Order # (ALS use only):		ALS Contact: Dean Watt											
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		TSS			
E265104		13-01-21		13-01-21		13-01-21		Groundwater					
E265105		13-01-21		13-01-21		13-01-21		Groundwater		Dissolved Metals (F/P)			
E265106		13-01-21		13-01-21		13-01-21		Groundwater					
MW6		13-01-21		13-01-21		13-01-21		Groundwater		Total Metals (P)			
MW7		13-01-21		13-01-21		13-01-21		Groundwater					
										Ammonia			
										Fecal and Total Coliform			

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 09:55 (MT)
Version: FINAL

Client Phone: 604-986-7723

Certificate of Analysis

Lab Work Order #: L2581831
Project P.O. #: NOT SUBMITTED
Job Reference: 20050 HOSMER
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

Sample ID Description Sampled Date Sampled Time Client ID		L2581831-1 Water 28-APR-21 08:00 E265104	L2581831-2 Water 28-APR-21 08:00 E265105	L2581831-3 Water 28-APR-21 08:00 E265106	L2581831-4 Water 28-APR-21 08:00 MW6	L2581831-5 Water 28-APR-21 08:00 MW7
Grouping	Analyte					
WATER						
Physical Tests	Hardness (as CaCO3) (mg/L)	1530	327	344	818	622
	Temperature (Degree C)	20.5	20.6	20.4	20.4	20.4
	Total Suspended Solids (mg/L)	28.2	7.4	252	103	772
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	582	233	237	721	510
	Ammonia as N (mg/L)	32.1	4.19	0.0082	118	78.3
	Bicarbonate (HCO3) (mg/L)	710	284	289	879	622
	Carbonate (CO3) (mg/L)	<5.0	<5.0	<5.0	<5.0	<5.0
	Chloride (Cl) (mg/L)	714 ^{DLHC}	10.3	4.51	534 ^{DLHC}	255 ^{DLHC}
	Conductivity (EC) (uS/cm)	2670	586	531	3090	1930
	Fluoride (F) (mg/L)	<0.10	0.116	0.107	0.13	<0.10
	Hydroxide (OH) (mg/L)	<5.0	<5.0	<5.0	<5.0	<5.0
	Nitrate and Nitrite (as N) (mg/L)	<0.025 ^{DLHC}	2.22	0.554	1.86 ^{DLHC}	8.07 ^{DLHC}
	Nitrate (as N) (mg/L)	<0.025 ^{DLHC}	2.22	0.554	1.84 ^{DLHC}	8.06 ^{DLHC}
	Nitrite (as N) (mg/L)	<0.0050 ^{DLHC}	0.0010	<0.0010	0.0174 ^{DLHC}	0.0080 ^{DLHC}
	pH (pH)	7.60 ^{DLHC}	8.04	7.91	7.34 ^{DLHC}	7.42 ^{DLHC}
	Sulfate (SO4) (mg/L)	4.69 ^{DLM}	72.0	50.2 ^{DLM}	30.3 ^{DLM}	46.3 ^{DLM}
Bacteriological Tests	Coliform Bacteria - Fecal (CFU/100mL)	1060 ^{DLA}	<1	<5	<2	<5
	MPN - Total Coliforms (MPN/100mL)	6600	<1	1	1	<1
Dissolved Metals	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 ^{DLDS}	<0.0010	<0.0010	<0.0050 ^{DLDS}	<0.0050 ^{DLDS}
	Antimony (Sb)-Dissolved (mg/L)	<0.00050 ^{DLDS}	<0.00010	<0.00010	<0.00050 ^{DLDS}	<0.00050 ^{DLDS}
	Arsenic (As)-Dissolved (mg/L)	<0.00050 ^{DLDS}	<0.00010	<0.00010	0.00096	<0.00050 ^{DLDS}
	Barium (Ba)-Dissolved (mg/L)	1.12	0.226	0.148	0.442	0.659
	Beryllium (Be)-Dissolved (mg/L)	<0.00010 ^{DLDS}	<0.000020	<0.000020	<0.00010 ^{DLDS}	<0.00010 ^{DLDS}
	Bismuth (Bi)-Dissolved (mg/L)	<0.00025 ^{DLDS}	<0.000050	<0.000050	<0.00025 ^{DLDS}	<0.00025 ^{DLDS}
	Boron (B)-Dissolved (mg/L)	0.056	0.012	<0.010	0.120	0.154
	Cadmium (Cd)-Dissolved (mg/L)	0.000312	0.0000615	0.0000312	0.000396	0.000105
	Calcium (Ca)-Dissolved (mg/L)	446 ^{DLDS}	98.3	100	260 ^{DLDS}	198 ^{DLDS}
	Chromium (Cr)-Dissolved (mg/L)	<0.00050 ^{DLDS}	<0.00010	<0.00010	<0.00050 ^{DLDS}	<0.00050 ^{DLDS}
	Cobalt (Co)-Dissolved (mg/L)	0.00259	0.00053	<0.00010	0.00606	0.00180
	Copper (Cu)-Dissolved (mg/L)	0.0027	0.00050	0.00049	0.0025	0.0010 ^{DLDS}
	Iron (Fe)-Dissolved (mg/L)	<0.050 ^{DLDS}	<0.010	<0.010	0.365 ^{DLDS}	<0.050 ^{DLDS}
	Lead (Pb)-Dissolved (mg/L)	<0.00025 ^{DLDS}	<0.000050	<0.000050	<0.00025 ^{DLDS}	<0.00025 ^{DLDS}
	Lithium (Li)-Dissolved (mg/L)	0.0384	0.0078	0.0068	0.0396	0.0572
	Magnesium (Mg)-Dissolved (mg/L)	101	19.9	22.7	41.0	31.2

* 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		L2581831-1 Water 28-APR-21 08:00 E265104	L2581831-2 Water 28-APR-21 08:00 E265105	L2581831-3 Water 28-APR-21 08:00 E265106	L2581831-4 Water 28-APR-21 08:00 MW6	L2581831-5 Water 28-APR-21 08:00 MW7
Grouping	Analyte					
WATER						
Dissolved Metals	Manganese (Mn)-Dissolved (mg/L)	1.61	0.317	0.00043	1.82	0.618
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.00328	0.000707	0.000592	0.00811	0.00243
	Nickel (Ni)-Dissolved (mg/L)	0.0133	0.00266	<0.00050	0.0433	0.0111
	Phosphorus (P)-Dissolved (mg/L)	<0.25 ^{DLDS}	<0.050	<0.050	<0.25 ^{DLDS}	<0.25 ^{DLDS}
	Potassium (K)-Dissolved (mg/L)	16.1	3.17	0.59	54.7	44.3
	Selenium (Se)-Dissolved (mg/L)	0.0418	0.00850	0.00643	0.00125	0.00034
	Silicon (Si)-Dissolved (mg/L)	13.3	2.66	2.94	6.60	4.93
	Silver (Ag)-Dissolved (mg/L)	<0.000050 ^{DLDS}	<0.000010	<0.000010	<0.000050 ^{DLDS}	<0.000050 ^{DLDS}
	Sodium (Na)-Dissolved (mg/L)	34.4	6.79	3.40	231	110
	Strontium (Sr)-Dissolved (mg/L)	1.93	0.416	0.215	2.88	2.28
	Sulfur (S)-Dissolved (mg/L)	133	26.3	19.7	16.5	21.1
	Thallium (Tl)-Dissolved (mg/L)	0.000399 ^{DLDS}	0.000086	<0.000010	0.000659 ^{DLDS}	0.000159 ^{DLDS}
	Tin (Sn)-Dissolved (mg/L)	<0.00050 ^{DLDS}	<0.00010	<0.00010	<0.00050 ^{DLDS}	<0.00050 ^{DLDS}
	Titanium (Ti)-Dissolved (mg/L)	<0.0015 ^{DLDS}	<0.00030	<0.00030	<0.0015 ^{DLDS}	<0.0015 ^{DLDS}
	Uranium (U)-Dissolved (mg/L)	0.00287 ^{DLDS}	0.000618	0.000921	0.00220 ^{DLDS}	0.00103 ^{DLDS}
	Vanadium (V)-Dissolved (mg/L)	<0.0025 ^{DLDS}	<0.00050	<0.00050	<0.0025 ^{DLDS}	<0.0025 ^{DLDS}
	Zinc (Zn)-Dissolved (mg/L)	<0.0050 ^{DLDS}	<0.0010	0.0010	0.0132 ^{DLDS}	<0.0050 ^{DLDS}
	Zirconium (Zr)-Dissolved (mg/L)	<0.0010 ^{DLDS}	<0.00030	<0.00030	<0.0010 ^{DLDS}	<0.0010 ^{DLDS}
Volatile Organic Compounds	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 (%)	105.9	97.7	100.8	103.1	102.0
	Surrogate: 3,4-Dichlorotoluene (%)	72.5	80.2	73.5	86.9	82.9
	Surrogate: 1,4-Difluorobenzene (%)	94.9	95.4	94.4	95.0	97.1
Hydrocarbons	EPH10-19 (ug/L)	190	<100	<100	260	<100
	EPH19-32 (ug/L)	480	<100	<100	<100	<100
	VPH (C6-C10) (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
	Surrogate: 2-Bromobenzotrifluoride (%)	84.2	83.9	77.6	85.4	82.0

* 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	L2581831-1, -2, -3, -4, -5
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2581831-1, -2, -3, -4, -5
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2581831-1, -2, -3, -4, -5
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L2581831-1, -2, -3, -4, -5
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2581831-1, -2, -3, -4, -5

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
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**
BE-D-L-CCMS-CL	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.			
BTXSM-HS-MS-CL	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.			
CL-L-IC-N-CL	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
EPH-L-ME-FID-CL	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.			
F-L-IC-CL	Water	Fluoride	APHA 4110 B-Ion Chromatography
FCC-MF-CL	Water	Fecal Coliform Count-MF	APHA 9222D
This analysis is carried out using procedures adapted from APHA Method 9222 "Membrane Filter Technique for Members of the Coliform Group". Coliform bacteria is enumerated by culturing and colony counting. A known sample volume is filtered through a 0.45 micron membrane filter. The test involves an initial 24 hour incubation at 44.5 degrees C of the filter with the appropriate growth medium. This method is specific for thermotolerant bacteria (Fecal) and is used for non-turbid water with a low background bacteria level.			
HARDNESS-CALC-CL	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.			
HG-D-CVAA-CL	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.			
MET-D-CCMS-CL	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.			
N2N3-CALC-CL	Water	Nitrate+Nitrite	CALCULATION
NH3-L-F-CL	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.			
NO2-L-IC-N-CL	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-CL	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)

Reference Information

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

PH/EC/ALK-CL 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

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

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

TC-MPN-CL Water Total Coliform APHA 9223B

This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the positive responses to a probability table.

Recommended Holding Time:

Sample: 1 day

Reference: APHA

TEMP-CL Water Temperature APHA 2550-Thermometer

TSS-L-CL 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.

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:

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: L2581831

Report Date: 10-MAY-21

Page 1 of 10

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
BE-D-L-CCMS-CL		Water						
Batch	R5450760							
WG3529562-3 DUP		L2581831-2						
Beryllium (Be)-Dissolved		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	05-MAY-21
WG3529562-2 LCS		TMRM						
Beryllium (Be)-Dissolved			98.4		%		80-120	05-MAY-21
WG3529562-1 MB								
Beryllium (Be)-Dissolved			<0.000020		mg/L		0.00002	05-MAY-21
WG3529562-4 MS		L2581831-2						
Beryllium (Be)-Dissolved			96.4		%		70-130	05-MAY-21
BTXSM-HS-MS-CL		Water						
Batch	R5452336							
WG3530033-3 DUP		L2581831-1						
Benzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-MAY-21
Ethylbenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-MAY-21
Methyl-tert-Butyl Ether		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-MAY-21
o-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-MAY-21
m+p-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-MAY-21
Styrene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-MAY-21
Toluene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-MAY-21
WG3530033-2 LCS								
Benzene			104.0		%		70-130	04-MAY-21
Ethylbenzene			92.2		%		70-130	04-MAY-21
Methyl-tert-Butyl Ether			95.2		%		70-130	04-MAY-21
o-Xylene			98.2		%		70-130	04-MAY-21
m+p-Xylene			98.1		%		70-130	04-MAY-21
Styrene			91.9		%		70-130	04-MAY-21
Toluene			94.3		%		70-130	04-MAY-21
WG3530033-1 MB								
Benzene			<0.00050		mg/L		0.0005	04-MAY-21
Ethylbenzene			<0.00050		mg/L		0.0005	04-MAY-21
Methyl-tert-Butyl Ether			<0.00050		mg/L		0.0005	04-MAY-21
o-Xylene			<0.00050		mg/L		0.0005	04-MAY-21
m+p-Xylene			<0.00050		mg/L		0.0005	04-MAY-21
Styrene			<0.00050		mg/L		0.0005	04-MAY-21
Toluene			<0.00050		mg/L		0.0005	04-MAY-21
Surrogate: 4-Bromofluorobenzene			105.6		%		70-130	04-MAY-21
Surrogate: 1,4-Difluorobenzene			97.7		%		70-130	04-MAY-21

Quality Control Report

Workorder: L2581831

Report Date: 10-MAY-21

Page 2 of 10

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTXSM-HS-MS-CL								
Water								
Batch R5452336								
WG3530033-4 MS L2581831-2								
Benzene			98.1		%		50-140	04-MAY-21
Ethylbenzene			92.0		%		50-140	04-MAY-21
Methyl-tert-Butyl Ether			92.4		%		50-140	04-MAY-21
o-Xylene			102.2		%		50-140	04-MAY-21
m+p-Xylene			100.6		%		50-140	04-MAY-21
Styrene			95.1		%		50-140	04-MAY-21
Toluene			87.0		%		50-140	04-MAY-21
CL-L-IC-N-CL								
Water								
Batch R5443764								
WG3527135-2 LCS								
Chloride (Cl)			98.1		%		85-115	29-APR-21
WG3527135-6 LCS								
Chloride (Cl)			101.0		%		85-115	29-APR-21
WG3527135-1 MB								
Chloride (Cl)			<0.10		mg/L		0.1	29-APR-21
WG3527135-5 MB								
Chloride (Cl)			<0.10		mg/L		0.1	29-APR-21
EPH-L-ME-FID-CL								
Water								
Batch R5453956								
WG3527874-2 LCS								
EPH10-19			105.0		%		70-130	06-MAY-21
EPH19-32			102.0		%		70-130	06-MAY-21
WG3527874-1 MB								
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
F-L-IC-CL								
Water								
Batch R5443764								
WG3527135-2 LCS								
Fluoride (F)			93.5		%		85-115	29-APR-21
WG3527135-6 LCS								
Fluoride (F)			97.2		%		85-115	29-APR-21
WG3527135-1 MB								
Fluoride (F)			<0.020		mg/L		0.02	29-APR-21
WG3527135-5 MB								
Fluoride (F)			<0.020		mg/L		0.02	29-APR-21

Quality Control Report

Workorder: L2581831

Report Date: 10-MAY-21

Page 3 of 10

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
FCC-MF-CL	Water							
Batch R5443972								
WG3527311-3 MB								
Coliform Bacteria - Fecal			<1		CFU/100mL		1	29-APR-21
HG-D-CVAA-CL	Water							
Batch R5452466								
WG3529545-6 LCS								
Mercury (Hg)-Dissolved			92.0		%		80-120	05-MAY-21
WG3529545-5 MB								
Mercury (Hg)-Dissolved			<0.0000050		mg/L		0.000005	05-MAY-21
MET-D-CCMS-CL	Water							
Batch R5450760								
WG3529562-3 DUP		L2581831-2						
Aluminum (Al)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	05-MAY-21
Antimony (Sb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	05-MAY-21
Arsenic (As)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	05-MAY-21
Barium (Ba)-Dissolved		0.226	0.224		mg/L	1.3	20	05-MAY-21
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	05-MAY-21
Boron (B)-Dissolved		0.012	0.012		mg/L	3.0	20	05-MAY-21
Cadmium (Cd)-Dissolved		0.0000615	0.0000653		mg/L	6.0	20	05-MAY-21
Calcium (Ca)-Dissolved		98.3	97.0		mg/L	1.3	20	05-MAY-21
Chromium (Cr)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	05-MAY-21
Cobalt (Co)-Dissolved		0.00053	0.00053		mg/L	0.6	20	05-MAY-21
Copper (Cu)-Dissolved		0.00050	0.00054		mg/L	6.1	20	05-MAY-21
Iron (Fe)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	05-MAY-21
Lead (Pb)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	05-MAY-21
Lithium (Li)-Dissolved		0.0078	0.0076		mg/L	2.6	20	05-MAY-21
Magnesium (Mg)-Dissolved		19.9	19.5		mg/L	2.0	20	05-MAY-21
Manganese (Mn)-Dissolved		0.317	0.316		mg/L	0.2	20	05-MAY-21
Molybdenum (Mo)-Dissolved		0.000707	0.000725		mg/L	2.5	20	05-MAY-21
Nickel (Ni)-Dissolved		0.00266	0.00268		mg/L	0.8	20	05-MAY-21
Phosphorus (P)-Dissolved		<0.050	<0.050	RPD-NA	mg/L	N/A	20	05-MAY-21
Potassium (K)-Dissolved		3.17	3.14		mg/L	1.1	20	05-MAY-21
Selenium (Se)-Dissolved		0.00850	0.00862		mg/L	1.4	20	05-MAY-21
Silicon (Si)-Dissolved		2.66	2.63		mg/L	1.3	20	05-MAY-21
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	05-MAY-21
Sodium (Na)-Dissolved		6.79	6.67		mg/L	1.9	20	05-MAY-21

Quality Control Report

Workorder: L2581831

Report Date: 10-MAY-21

Page 4 of 10

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-CL		Water						
Batch	R5450760							
WG3529562-3	DUP	L2581831-2						
Strontium (Sr)-Dissolved		0.416	0.434		mg/L	4.2	20	05-MAY-21
Sulfur (S)-Dissolved		26.3	26.1		mg/L	0.9	20	05-MAY-21
Thallium (Tl)-Dissolved		0.000086	0.000084		mg/L	1.6	20	05-MAY-21
Tin (Sn)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	05-MAY-21
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	05-MAY-21
Uranium (U)-Dissolved		0.000618	0.000612		mg/L	0.9	20	05-MAY-21
Vanadium (V)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	05-MAY-21
Zinc (Zn)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	05-MAY-21
Zirconium (Zr)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	05-MAY-21
WG3529562-2	LCS	TMRM						
Aluminum (Al)-Dissolved			95.6		%		80-120	05-MAY-21
Antimony (Sb)-Dissolved			98.4		%		80-120	05-MAY-21
Arsenic (As)-Dissolved			91.1		%		80-120	05-MAY-21
Barium (Ba)-Dissolved			93.5		%		80-120	05-MAY-21
Bismuth (Bi)-Dissolved			96.9		%		80-120	05-MAY-21
Boron (B)-Dissolved			95.8		%		80-120	05-MAY-21
Cadmium (Cd)-Dissolved			92.3		%		80-120	05-MAY-21
Calcium (Ca)-Dissolved			90.5		%		80-120	05-MAY-21
Chromium (Cr)-Dissolved			90.4		%		80-120	05-MAY-21
Cobalt (Co)-Dissolved			94.0		%		80-120	05-MAY-21
Copper (Cu)-Dissolved			92.4		%		80-120	05-MAY-21
Iron (Fe)-Dissolved			93.4		%		80-120	05-MAY-21
Lead (Pb)-Dissolved			94.5		%		80-120	05-MAY-21
Lithium (Li)-Dissolved			107.5		%		80-120	05-MAY-21
Magnesium (Mg)-Dissolved			96.3		%		80-120	05-MAY-21
Manganese (Mn)-Dissolved			89.8		%		80-120	05-MAY-21
Molybdenum (Mo)-Dissolved			95.1		%		80-120	05-MAY-21
Nickel (Ni)-Dissolved			87.3		%		80-120	05-MAY-21
Phosphorus (P)-Dissolved			103.0		%		70-130	05-MAY-21
Potassium (K)-Dissolved			90.4		%		80-120	05-MAY-21
Selenium (Se)-Dissolved			87.8		%		80-120	05-MAY-21
Silicon (Si)-Dissolved			95.8		%		60-140	05-MAY-21
Silver (Ag)-Dissolved			95.0		%		80-120	05-MAY-21
Sodium (Na)-Dissolved			94.5		%		80-120	05-MAY-21

Quality Control Report

Workorder: L2581831

Report Date: 10-MAY-21

Page 5 of 10

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-CL	Water							
Batch	R5450760							
WG3529562-2	LCS	TMRM						
Strontium (Sr)-Dissolved			94.1		%		80-120	05-MAY-21
Sulfur (S)-Dissolved			100.6		%		80-120	05-MAY-21
Thallium (Tl)-Dissolved			96.6		%		80-120	05-MAY-21
Tin (Sn)-Dissolved			93.1		%		80-120	05-MAY-21
Titanium (Ti)-Dissolved			89.7		%		80-120	05-MAY-21
Uranium (U)-Dissolved			94.4		%		80-120	05-MAY-21
Vanadium (V)-Dissolved			93.3		%		80-120	05-MAY-21
Zinc (Zn)-Dissolved			91.8		%		80-120	05-MAY-21
Zirconium (Zr)-Dissolved			91.9		%		80-120	05-MAY-21
WG3529562-1	MB							
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
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

Quality Control Report

Workorder: L2581831

Report Date: 10-MAY-21

Page 6 of 10

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-CL	Water							
Batch	R5450760							
WG3529562-1 MB								
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
WG3529562-4 MS		L2581831-2						
Aluminum (Al)-Dissolved			97.2		%		70-130	05-MAY-21
Antimony (Sb)-Dissolved			99.4		%		70-130	05-MAY-21
Arsenic (As)-Dissolved			91.1		%		70-130	05-MAY-21
Barium (Ba)-Dissolved			N/A	MS-B	%		-	05-MAY-21
Bismuth (Bi)-Dissolved			94.9		%		70-130	05-MAY-21
Boron (B)-Dissolved			87.9		%		70-130	05-MAY-21
Cadmium (Cd)-Dissolved			89.0		%		70-130	05-MAY-21
Calcium (Ca)-Dissolved			N/A	MS-B	%		-	05-MAY-21
Chromium (Cr)-Dissolved			88.6		%		70-130	05-MAY-21
Cobalt (Co)-Dissolved			87.7		%		70-130	05-MAY-21
Copper (Cu)-Dissolved			86.6		%		70-130	05-MAY-21
Iron (Fe)-Dissolved			89.4		%		70-130	05-MAY-21
Lead (Pb)-Dissolved			94.0		%		70-130	05-MAY-21
Lithium (Li)-Dissolved			105.0		%		70-130	05-MAY-21
Magnesium (Mg)-Dissolved			N/A	MS-B	%		-	05-MAY-21
Manganese (Mn)-Dissolved			N/A	MS-B	%		-	05-MAY-21
Molybdenum (Mo)-Dissolved			95.5		%		70-130	05-MAY-21
Nickel (Ni)-Dissolved			85.7		%		70-130	05-MAY-21
Phosphorus (P)-Dissolved			98.3		%		70-130	05-MAY-21
Potassium (K)-Dissolved			96.4		%		70-130	05-MAY-21
Selenium (Se)-Dissolved			83.8		%		70-130	05-MAY-21
Silicon (Si)-Dissolved			97.6		%		70-130	05-MAY-21
Silver (Ag)-Dissolved			95.0		%		70-130	05-MAY-21
Sodium (Na)-Dissolved			99.0		%		70-130	05-MAY-21

Quality Control Report

Workorder: L2581831

Report Date: 10-MAY-21

Page 7 of 10

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-CL	Water							
Batch	R5450760							
WG3529562-4 MS		L2581831-2						
Strontium (Sr)-Dissolved			N/A	MS-B	%		-	05-MAY-21
Thallium (Tl)-Dissolved			95.0		%		70-130	05-MAY-21
Tin (Sn)-Dissolved			95.2		%		70-130	05-MAY-21
Titanium (Ti)-Dissolved			94.8		%		70-130	05-MAY-21
Uranium (U)-Dissolved			94.7		%		70-130	05-MAY-21
Vanadium (V)-Dissolved			93.6		%		70-130	05-MAY-21
Zinc (Zn)-Dissolved			89.2		%		70-130	05-MAY-21
Zirconium (Zr)-Dissolved			101.3		%		70-130	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	R5443764							
WG3527135-2 LCS								
Nitrite (as N)			99.9		%		90-110	29-APR-21
WG3527135-6 LCS								
Nitrite (as N)			105.1		%		90-110	29-APR-21
WG3527135-1 MB								
Nitrite (as N)			<0.0010		mg/L		0.001	29-APR-21
WG3527135-5 MB								
Nitrite (as N)			<0.0010		mg/L		0.001	29-APR-21
NO3-L-IC-N-CL	Water							
Batch	R5443764							
WG3527135-2 LCS								
Nitrate (as N)			98.8		%		90-110	29-APR-21
WG3527135-6 LCS								
Nitrate (as N)			101.8		%		90-110	29-APR-21
WG3527135-1 MB								
Nitrate (as N)			<0.0050		mg/L		0.005	29-APR-21
WG3527135-5 MB								
Nitrate (as N)			<0.0050		mg/L		0.005	29-APR-21
PH/EC/ALK-CL	Water							

Quality Control Report

Workorder: L2581831

Report Date: 10-MAY-21

Page 8 of 10

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-CL		Water						
Batch R5454752								
WG3531386-2 LCS								
Conductivity (EC)			102.7		%		90-110	07-MAY-21
Hydroxide (OH)					mg/L			07-MAY-21
Alkalinity, Total (as CaCO3)			104.2		%		85-115	07-MAY-21
WG3531386-1 MB								
Conductivity (EC)			<2.0		uS/cm		2	07-MAY-21
Bicarbonate (HCO3)			<5.0		mg/L		5	07-MAY-21
Carbonate (CO3)			<5.0		mg/L		5	07-MAY-21
Hydroxide (OH)			<5.0		mg/L		5	07-MAY-21
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	07-MAY-21
SO4-L-IC-N-CL		Water						
Batch R5443764								
WG3527135-2 LCS								
Sulfate (SO4)			98.4		%		85-115	29-APR-21
WG3527135-6 LCS								
Sulfate (SO4)			102.3		%		85-115	29-APR-21
WG3527135-1 MB								
Sulfate (SO4)			<0.050		mg/L		0.05	29-APR-21
WG3527135-5 MB								
Sulfate (SO4)			<0.050		mg/L		0.05	29-APR-21
TC-MPN-CL		Water						
Batch R5443962								
WG3527299-4 MB								
MPN - Total Coliforms			<1		MPN/100mL		1	29-APR-21
TSS-L-CL		Water						
Batch R5450071								
WG3528883-2 LCS								
Total Suspended Solids			91.6		%		85-115	04-MAY-21
WG3528883-1 MB								
Total Suspended Solids			<1.0		mg/L		1	04-MAY-21
VH-HS-FID-CL		Water						
Batch R5452338								
WG3530035-3 DUP		L2581831-1						
Volatile Hydrocarbons (VH6-10)		<0.10	<0.10	RPD-NA	mg/L	N/A	30	04-MAY-21
WG3530035-2 LCS								
Volatile Hydrocarbons (VH6-10)			110.7		%		70-130	04-MAY-21

Quality Control Report

Workorder: L2581831

Report Date: 10-MAY-21

Page 9 of 10

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VH-HS-FID-CL	Water							
Batch	R5452338							
WG3530035-1	MB							
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: L2581831

Report Date: 10-MAY-21

Page 10 of 10

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
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.

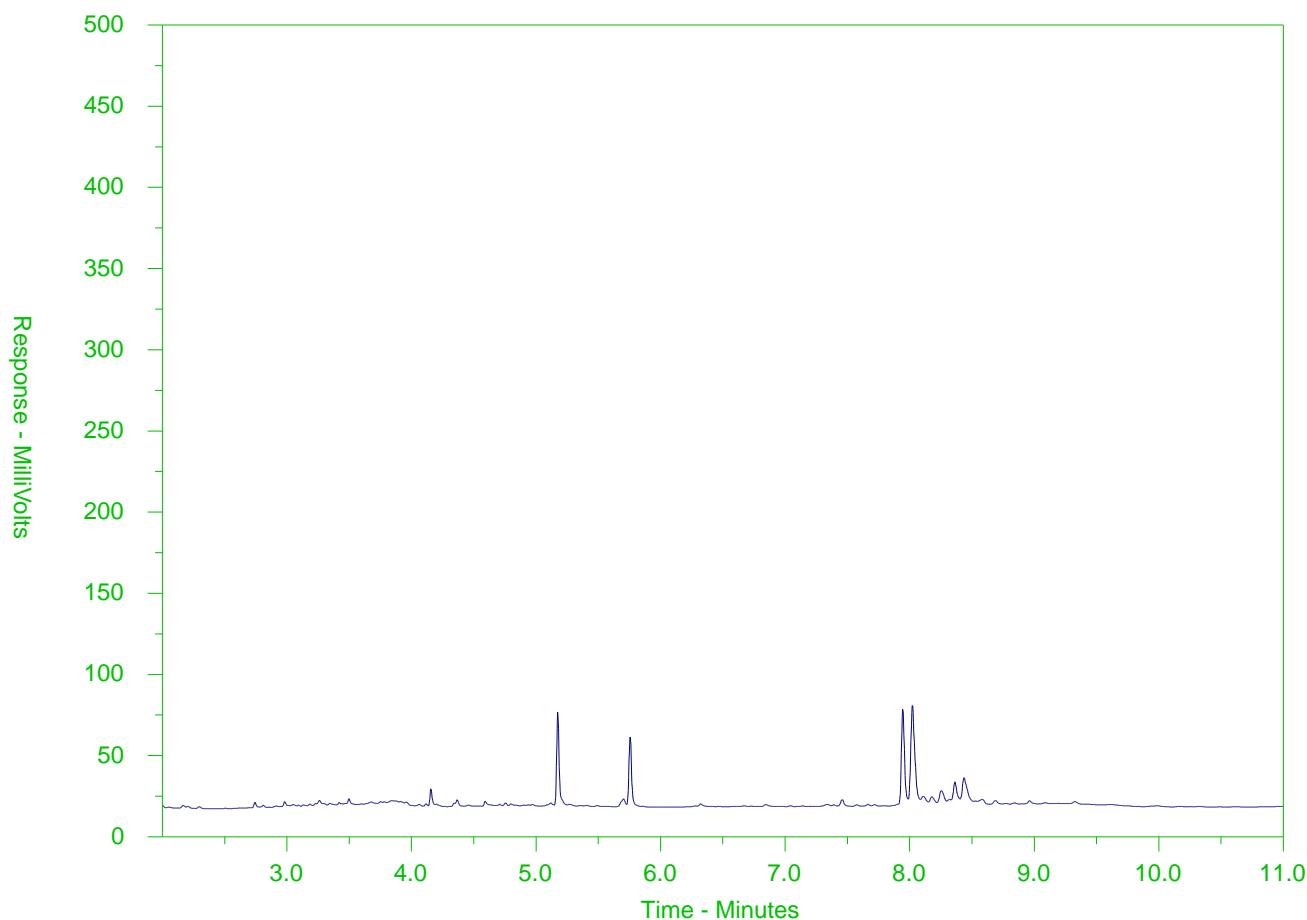
ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where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

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2581831-1
Client Sample ID: E265104



← 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.

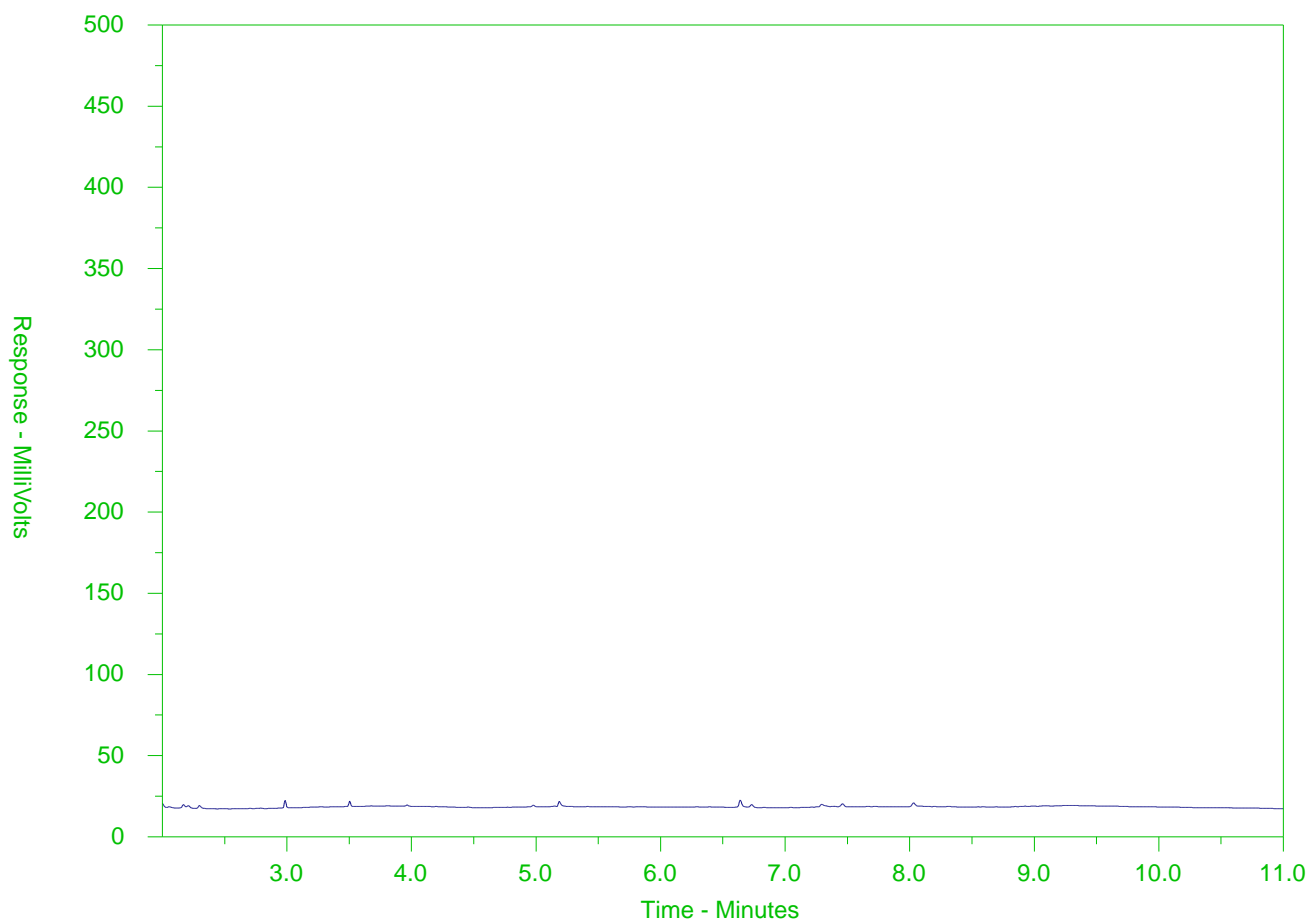
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2581831-2
Client Sample ID: E265105



← 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.

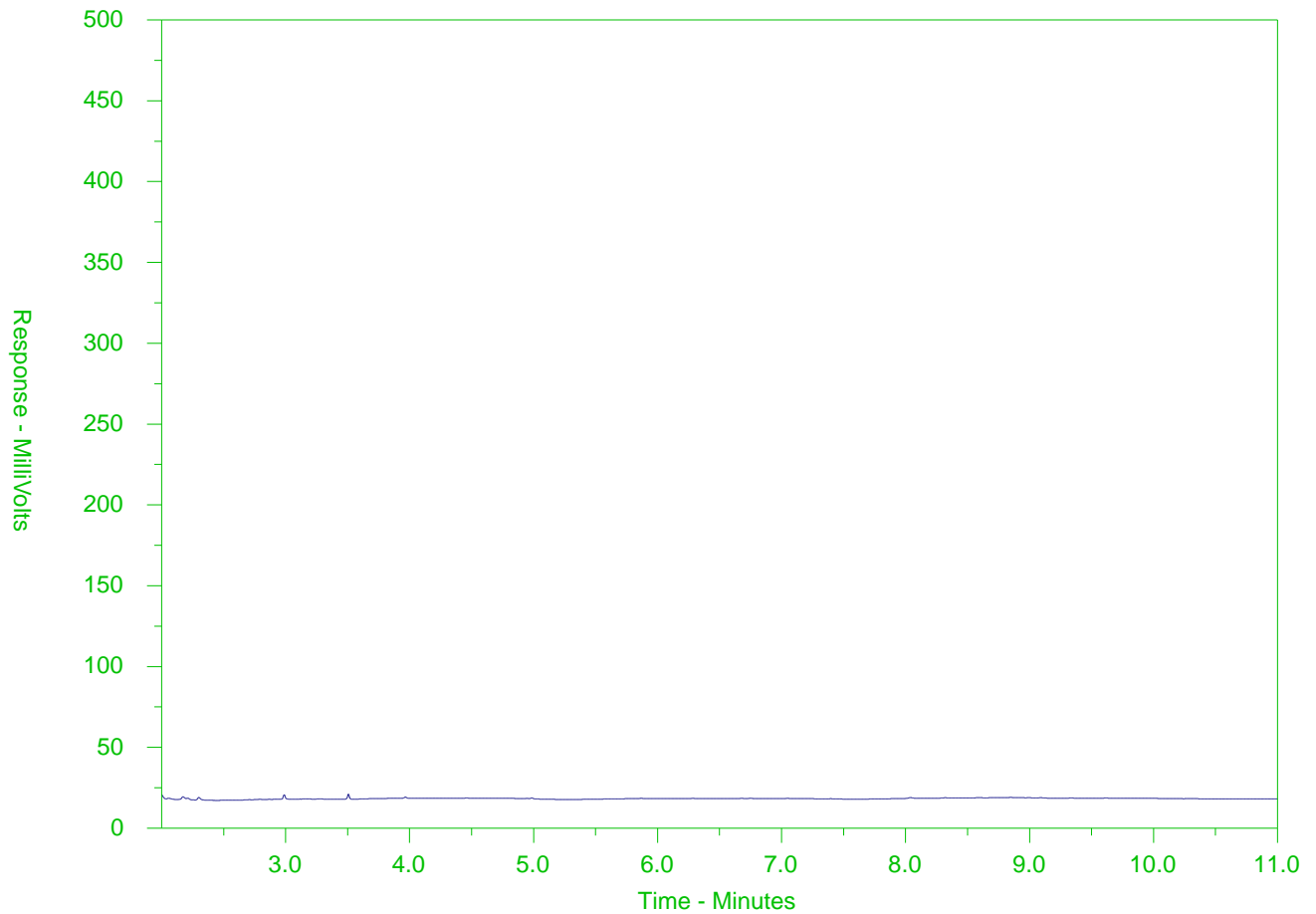
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2581831-3
Client Sample ID: E265106



← 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.

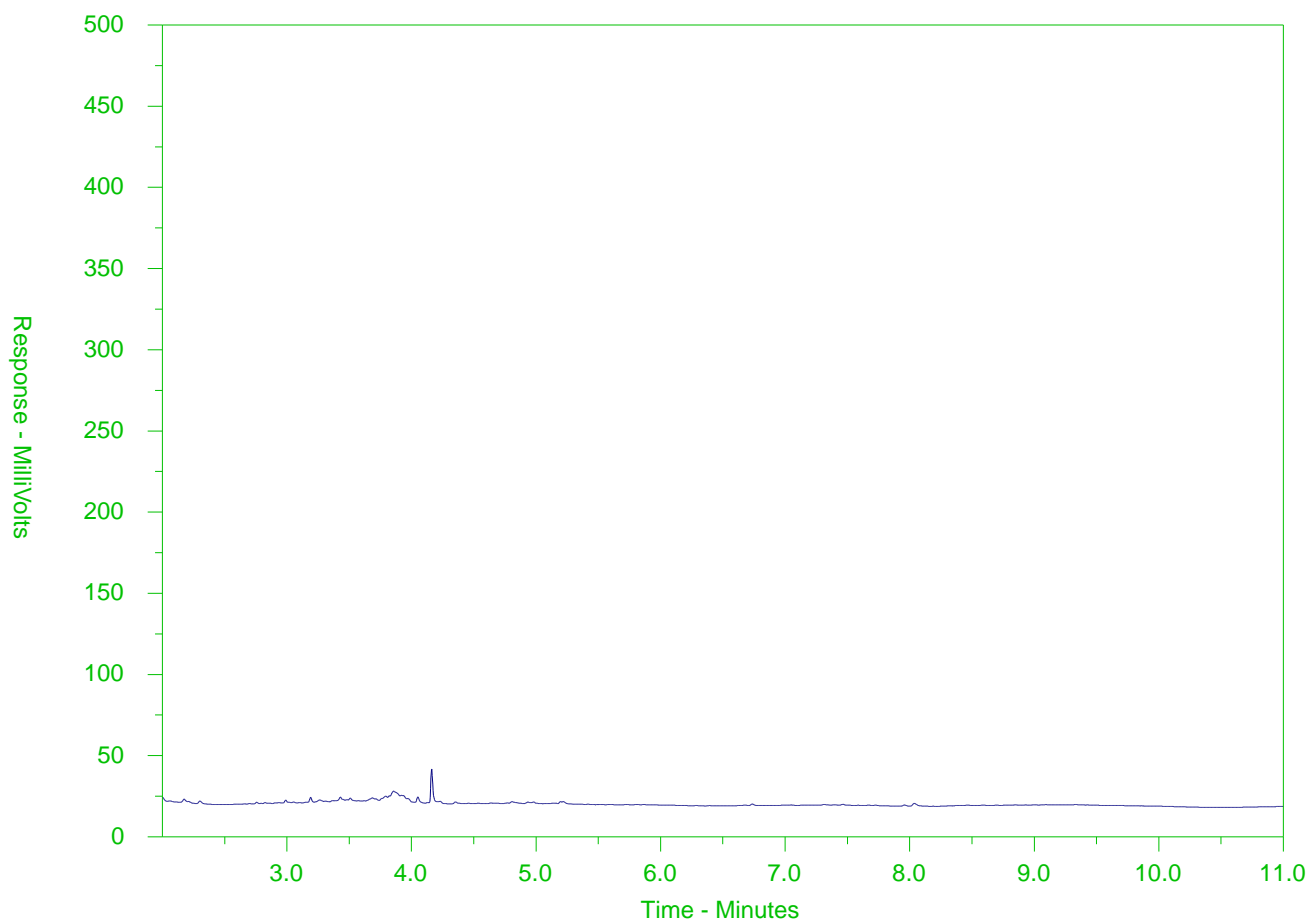
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2581831-4
Client Sample ID: MW6



← 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.

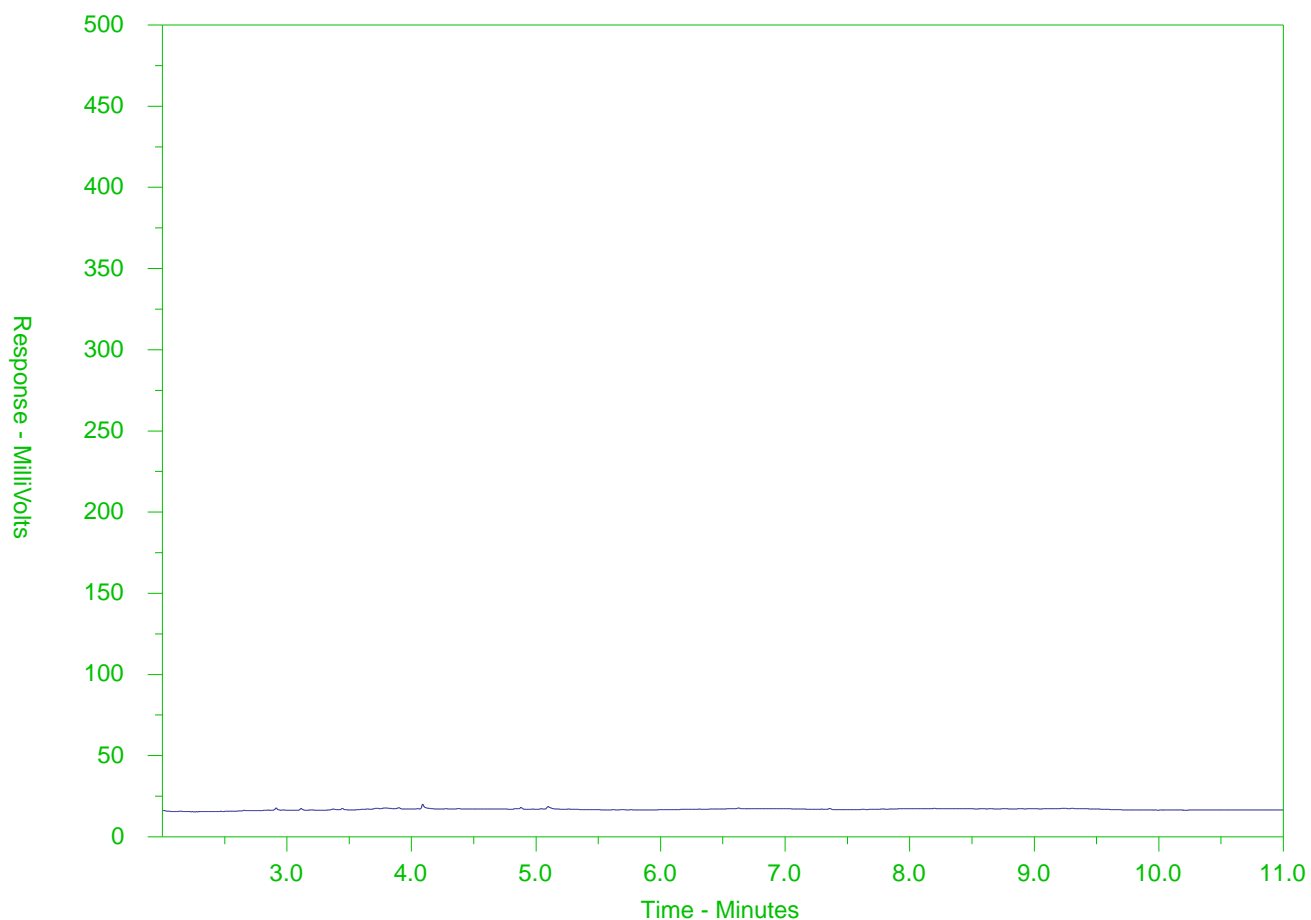
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

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.

BC EPH HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2581831-5
Client Sample ID: MW7



← 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 →			

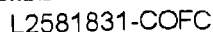
The BC EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

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.



COC Number: 20 -

: 1 800 668 9878

Page 1 of 1

REFER TO BACK PAGE FOR ALS 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**.

SAMPLES ARE SPREAD BETWEEN TWO COOLERS



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

Date Received: 28-JUL-21
Report Date: 05-AUG-21 17:37 (MT)
Version: FINAL REV. 2

Client Phone: 604-986-7723

Certificate of Analysis

Lab Work Order #: L2619475
Project P.O. #: NOT SUBMITTED
Job Reference: 10024,8971
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

Sample ID Description Sampled Date Sampled Time Client ID		L2619475-1 GROUNDWATER 27-JUL-21 12:00 E265104	L2619475-2 GROUNDWATER 27-JUL-21 12:00 E265105	L2619475-3 GROUNDWATER 27-JUL-21 12:00 E265106	L2619475-4 GROUNDWATER 27-JUL-21 12:00 E265107 (MW6)	L2619475-5 GROUNDWATER 27-JUL-21 12:00 E265108 (MW7)
Grouping	Analyte					
WATER						
Physical Tests	Hardness (as CaCO3) (mg/L)	336	263	279	284	323
	Temperature (Degree C)	22.3	22.0	21.9	21.8	21.8
	Total Suspended Solids (mg/L)	6.0	20.6	114	157	1790
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	329	222	250	417	582
	Ammonia as N (mg/L)	5.46	0.165	0.0139	47.9	84.6
	Bicarbonate (HCO3) (mg/L)	401	271	305	509	710
	Carbonate (CO3) (mg/L)	<5.0	<5.0	<5.0	<5.0	<5.0
	Chloride (Cl) (mg/L)	89.9	2.11	1.87	122	178
	Conductivity (EC) (uS/cm)	849	461	483	1120	1520
	Fluoride (F) (mg/L)	0.110	0.146	0.143	0.19	0.235
	Hydroxide (OH) (mg/L)	<5.0	<5.0	<5.0	<5.0	<5.0
	Nitrate (as N) (mg/L)	0.307	0.0301	0.0120	0.381	0.661
	Nitrite (as N) (mg/L)	0.0061	0.0020	<0.0010	0.0226	0.0388
	pH (pH)	7.72	7.87	7.80	7.57	7.45
	Sulfate (SO4) (mg/L)	5.29	43.4	38.5	4.06	2.96
Bacteriological Tests	Coliform Bacteria - Fecal (CFU/100mL)	<1	<1	<100 ^{DLM}	<100 ^{DLM}	<100 ^{DLM}
	MPN - Total Coliforms (MPN/100mL)	1	<1	9	3	3
Dissolved Metals	Dissolved Metals Filtration Location	LAB	LAB	LAB	LAB	LAB
	Calcium (Ca)-Dissolved (mg/L)	106	77.9	82.8	90.7	103
	Magnesium (Mg)-Dissolved (mg/L)	17.3	16.6	17.7	14.0	16.4

* 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	Chloride (Cl)	MS-B	L2619475-1, -2, -3, -4, -5
Matrix Spike	Ammonia as N	MS-B	L2619475-1, -2, -3, -4, -5

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
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**
CL-L-IC-N-CL	Water	Chloride in Water by IC Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.	EPA 300.1 (mod)
F-L-IC-CL	Water	Fluoride	APHA 4110 B-Ion Chromatography
FCC-MF-CL	Water	Fecal Coliform Count-MF This analysis is carried out using procedures adapted from APHA Method 9222 "Membrane Filter Technique for Members of the Coliform Group". Coliform bacteria is enumerated by culturing and colony counting. A known sample volume is filtered through a 0.45 micron membrane filter. The test involves an initial 24 hour incubation at 44.5 degrees C of the filter with the appropriate growth medium. This method is specific for thermotolerant bacteria (Fecal) and is used for non-turbid water with a low background bacteria level.	APHA 9222D
HARDNESS-CALC-CL	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
MET-DIS-ICP-CL	Water	Dissolved Metals by ICPOES "This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (APHA Method 3030B) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).	APHA 3030B/EPA 6010D
NH3-L-F-CL	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. Weston et al.	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
NO2-L-IC-N-CL	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)
NO3-L-IC-N-CL	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)
PH/EC/ALK-CL	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
SO4-L-IC-N-CL	Water	Sulfate in Water by IC Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.	EPA 300.1 (mod)
TC-MPN-CL	Water	Total Coliform This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the positive responses to a probability table. Recommended Holding Time: Sample: 1 day Reference: APHA	APHA 9223B
TEMP-CL	Water	Temperature	APHA 2550-Thermometer
TSS-L-CL	Water	Total Suspended Solids	APHA 2540 D-Gravimetric

Reference Information

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:

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 wwt - 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: L2619475

Report Date: 05-AUG-21

Page 1 of 4

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
CL-L-IC-N-CL		Water						
Batch	R5533137							
WG3586638-9	DUP	L2619475-5						
Chloride (Cl)		178	177		mg/L	0.2	20	28-JUL-21
WG3586638-8	LCS		100.9		%		85-115	28-JUL-21
Chloride (Cl)								
WG3586638-7	MB		<0.10		mg/L		0.1	28-JUL-21
Chloride (Cl)								
WG3586638-10	MS	L2619475-5	N/A	MS-B	%		-	28-JUL-21
Chloride (Cl)								
F-L-IC-CL		Water						
Batch	R5533137							
WG3586638-9	DUP	L2619475-5						
Fluoride (F)		0.235	0.241		mg/L	2.5	20	28-JUL-21
WG3586638-8	LCS		100.7		%		85-115	28-JUL-21
Fluoride (F)								
WG3586638-7	MB		<0.020		mg/L		0.02	28-JUL-21
Fluoride (F)								
WG3586638-10	MS	L2619475-5	112.7		%		75-125	28-JUL-21
Fluoride (F)								
FCC-MF-CL		Water						
Batch	R5533896							
WG3587028-1	MB		<1		CFU/100mL		1	28-JUL-21
Coliform Bacteria - Fecal								
MET-DIS-ICP-CL		Water						
Batch	R5543880							
WG3589956-2	LCS	TMRM						
Calcium (Ca)-Dissolved			99.9		%		80-120	04-AUG-21
Magnesium (Mg)-Dissolved			98.9		%		80-120	04-AUG-21
WG3589956-1	MB		<0.10		mg/L		0.1	04-AUG-21
Calcium (Ca)-Dissolved								
Magnesium (Mg)-Dissolved			<0.10		mg/L		0.1	04-AUG-21
NH3-L-F-CL		Water						
Batch	R5537382							
WG3588117-3	DUP	L2619475-2						
Ammonia as N		0.165	0.159		mg/L	3.6	20	30-JUL-21
WG3588117-2	LCS		93.2		%		85-115	30-JUL-21
Ammonia as N								

Quality Control Report

Workorder: L2619475

Report Date: 05-AUG-21

Page 2 of 4

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-L-F-CL Water								
Batch	R5537382							
WG3588117-1 MB								
Ammonia as N			<0.0050		mg/L		0.005	30-JUL-21
WG3588117-4 MS		L2619475-2						
Ammonia as N			N/A	MS-B	%		-	30-JUL-21
NO2-L-IC-N-CL Water								
Batch	R5533137							
WG3586638-9 DUP		L2619475-3						
Nitrite (as N)		0.0388	0.0387		mg/L	0.3	20	28-JUL-21
WG3586638-8 LCS								
Nitrite (as N)			101.7		%		90-110	28-JUL-21
WG3586638-7 MB								
Nitrite (as N)			<0.0010		mg/L		0.001	28-JUL-21
WG3586638-10 MS		L2619475-5						
Nitrite (as N)			108.2		%		75-125	28-JUL-21
NO3-L-IC-N-CL Water								
Batch	R5533137							
WG3586638-9 DUP		L2619475-5						
Nitrate (as N)		0.661	0.660		mg/L	0.3	20	28-JUL-21
WG3586638-8 LCS								
Nitrate (as N)			103.0		%		90-110	28-JUL-21
WG3586638-7 MB								
Nitrate (as N)			<0.0050		mg/L		0.005	28-JUL-21
WG3586638-10 MS		L2619475-5						
Nitrate (as N)			106.6		%		75-125	28-JUL-21
PH/EC/ALK-CL Water								
Batch	R5544753							
WG3590813-7 DUP		L2619475-5						
pH		7.45	7.47	J	pH	0.02	0.2	04-AUG-21
Conductivity (EC)		1520	1530		uS/cm	0.1	10	04-AUG-21
Bicarbonate (HCO3)		710	735		mg/L	3.5	20	04-AUG-21
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	20	04-AUG-21
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	20	04-AUG-21
Alkalinity, Total (as CaCO3)		582	603		mg/L	3.5	20	04-AUG-21
WG3590813-4 LCS								
Conductivity (EC)			98.3		%		90-110	04-AUG-21
Alkalinity, Total (as CaCO3)			105.2		%		85-115	04-AUG-21
WG3590813-1 MB								

Quality Control Report

Workorder: L2619475

Report Date: 05-AUG-21

Page 3 of 4

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-CL								
Water								
Batch R5544753								
WG3590813-1 MB								
Conductivity (EC)			<2.0		uS/cm		2	04-AUG-21
Bicarbonate (HCO ₃)			<5.0		mg/L		5	04-AUG-21
Carbonate (CO ₃)			<5.0		mg/L		5	04-AUG-21
Hydroxide (OH)			<5.0		mg/L		5	04-AUG-21
Alkalinity, Total (as CaCO ₃)			<2.0		mg/L		2	04-AUG-21
SO4-L-IC-N-CL								
Water								
Batch R5533137								
WG3586638-9 DUP								
Sulfate (SO ₄)		L2619475-5 2.96	2.94		mg/L	0.6	20	28-JUL-21
WG3586638-8 LCS								
Sulfate (SO ₄)			103.1		%		85-115	28-JUL-21
WG3586638-7 MB								
Sulfate (SO ₄)			<0.050		mg/L		0.05	28-JUL-21
WG3586638-10 MS								
Sulfate (SO ₄)		L2619475-5	108.1		%		75-125	28-JUL-21
TC-MPN-CL								
Water								
Batch R5533837								
WG3587016-1 MB								
MPN - Total Coliforms			<1		MPN/100mL		1	28-JUL-21
TEMP-CL								
Water								
Batch R5544753								
WG3590813-7 DUP								
Temperature		L2619475-5 21.8	21.8		Degree C	0.0	25	04-AUG-21
TSS-L-CL								
Water								
Batch R5534796								
WG3586182-2 LCS								
Total Suspended Solids			96.3		%		85-115	29-JUL-21
WG3586182-1 MB								
Total Suspended Solids			<1.0		mg/L		1	29-JUL-21

Quality Control Report

Workorder: L2619475

Report Date: 05-AUG-21

Page 4 of 4

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.

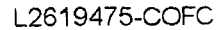
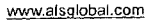
Hold Time Exceedances:

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.



COC Number: 20 -

Page 1 of 1

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

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.

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: 10-NOV-21
Report Date: 25-NOV-21 16:37 (MT)
Version: FINAL

Client Phone: 604-986-7723

Certificate of Analysis

Lab Work Order #: L2661089
Project P.O. #: NOT SUBMITTED
Job Reference: 20050 HOSMER
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

Sample ID Description Sampled Date Sampled Time Client ID		L2661089-1 Groundwater 09-NOV-21 12:00 E265104	L2661089-2 Groundwater 09-NOV-21 12:00 E265105	L2661089-3 Groundwater 09-NOV-21 12:00 E265106	L2661089-4 Groundwater 09-NOV-21 12:00 E265107 (MW6)	L2661089-5 Groundwater 09-NOV-21 12:00 E265108 (MW7)
Grouping	Analyte					
WATER						
Physical Tests	Hardness (as CaCO3) (mg/L)	392	488	362	591	811
	Temperature (Degree C)	20.6	20.1	19.9	19.9	20.0
	Total Suspended Solids (mg/L)	5.2	601	1570	2310	3610
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	367	398	325	509	569
	Ammonia as N (mg/L)	3.39	4.07	0.0150	33.2	64.3
	Bicarbonate (HCO3) (mg/L)	447	486	396	621	694
	Carbonate (CO3) (mg/L)	<5.0	<5.0	<5.0	<5.0	<5.0
	Chloride (Cl) (mg/L)	85.8	96.7	3.87	181	232
	Conductivity (EC) (uS/cm)	920	958	604	1680	2540
	Fluoride (F) (mg/L)	0.139	0.19	0.151	0.38	0.19
	Hydroxide (OH) (mg/L)	<5.0	<5.0	<5.0	<5.0	<5.0
	Nitrate and Nitrite (as N) (mg/L)	2.36	0.285	0.163	57.6	135
	Nitrate (as N) (mg/L)	2.36	0.285	0.163	57.6	135
	Nitrite (as N) (mg/L)	0.0012	<0.0050 ^{DLDS}	<0.0010	0.0288	0.0589
	pH (pH)	7.55	7.51	7.56	7.29	7.28
	Sulfate (SO4) (mg/L)	5.61	37.6	53.8	13.8	11.5
Bacteriological Tests	Coliform Bacteria - Fecal (CFU/100mL)	<1	<100 ^{DLA}	<100 ^{DLA}	<100 ^{DLA}	<100 ^{DLA}
	MPN - Total Coliforms (MPN/100mL)	<1	<10 ^{DLM}	<10 ^{DLM}	<10 ^{DLM}	<10 ^{DLM}
Dissolved Metals	Dissolved Metals Filtration Location	LAB	LAB	LAB	LAB	LAB
	Calcium (Ca)-Dissolved (mg/L)	122	147	107	194	265 ^{DLDS}
	Magnesium (Mg)-Dissolved (mg/L)	20.8	29.2	22.9	25.9	36.2 ^{DLDS}

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

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CL-L-IC-N-CL	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
F-L-IC-CL	Water	Fluoride	APHA 4110 B-Ion Chromatography
FCC-MF-CL	Water	Fecal Coliform Count-MF	APHA 9222D
This analysis is carried out using procedures adapted from APHA Method 9222 "Membrane Filter Technique for Members of the Coliform Group". Coliform bacteria is enumerated by culturing and colony counting. A known sample volume is filtered through a 0.45 micron membrane filter. The test involves an initial 24 hour incubation at 44.5 degrees C of the filter with the appropriate growth medium. This method is specific for thermotolerant bacteria (Fecal) and is used for non-turbid water with a low background bacteria level.			
HARDNESS-CALC-CL	Water	Hardness	APHA 2340 B
Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO ₃ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.			
MET-DIS-ICP-CL	Water	Dissolved Metals by ICPOES	APHA 3030B/EPA 6010D
"This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (APHA Method 3030B) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).			
N2N3-CALC-CL	Water	Nitrate+Nitrite	CALCULATION
NH3-L-F-CL	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.			
NO2-L-IC-N-CL	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-CL	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.			
PH/EC/ALK-CL	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			
SO4-L-IC-N-CL	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
TC-MPN-CL	Water	Total Coliform	APHA 9223B
This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the positive responses to a probability table. Recommended Holding Time: Sample: 1 day Reference: APHA			
TEMP-CL	Water	Temperature	APHA 2550-Thermometer
TSS-L-CL	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.

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: L2661089

Report Date: 25-NOV-21

Page 2 of 3

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-L-IC-N-CL	Water							
Batch	R5643576							
WG3657052-2 LCS								
Nitrate (as N)			101.9		%		90-110	10-NOV-21
WG3657052-1 MB								
Nitrate (as N)			<0.0050		mg/L		0.005	10-NOV-21
PH/EC/ALK-CL	Water							
Batch	R5645076							
WG3657576-5 LCS								
Conductivity (EC)			101.8		%		90-110	11-NOV-21
Alkalinity, Total (as CaCO3)			97.9		%		85-115	11-NOV-21
WG3657576-4 MB								
Conductivity (EC)			<2.0		uS/cm		2	11-NOV-21
Bicarbonate (HCO3)			<5.0		mg/L		5	11-NOV-21
Carbonate (CO3)			<5.0		mg/L		5	11-NOV-21
Hydroxide (OH)			<5.0		mg/L		5	11-NOV-21
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	11-NOV-21
SO4-L-IC-N-CL	Water							
Batch	R5643576							
WG3657052-2 LCS								
Sulfate (SO4)			103.1		%		85-115	10-NOV-21
WG3657052-1 MB								
Sulfate (SO4)			<0.050		mg/L		0.05	10-NOV-21
TC-MPN-CL	Water							
Batch	R5642780							
WG3656823-1 MB								
MPN - Total Coliforms			<1		MPN/100mL		1	10-NOV-21
TSS-L-CL	Water							
Batch	R5648777							
WG3657247-4 LCS								
Total Suspended Solids			94.3		%		85-115	13-NOV-21
WG3657247-3 MB								
Total Suspended Solids			<1.0		mg/L		1	13-NOV-21

Quality Control Report

Workorder: L2661089

Report Date: 25-NOV-21

Page 3 of 3

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.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L2661089-COFC



Report To Contact and company name below will appear on the final report		Reports / Recipients		Turnaround Time (TAT) Requested	
Company: Sperling Hansen Associates Inc.	Select Report Format: <input type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)	<input type="checkbox"/> Merge QC/QCI Reports with COA <input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> N/A		<input checked="" type="checkbox"/> Routine [R] if received by 3pm M-F - no surcharges apply	
Contact: Scott Gartwaite	<input checked="" type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked	<input type="checkbox"/> Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX		<input type="checkbox"/> 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum	
Phone: 778-471-7088				<input type="checkbox"/> 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum	
Company address below will appear on the final report				<input type="checkbox"/> 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum	
Street: 1225 East Keith Road	Email 1 or Fax: sgartwaite@sperlinghansen.com			<input type="checkbox"/> 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum	
City/Province: North Vancouver, B.C.	Email 2: chetherrington@sperlinghansen.com			<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	
Postal Code: V7J 1J3	Email 3:			Date and Time Required for all E&P TATs: dd-mm-yy hh:mm any/pm	
Invoice To: Same as Report To	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Invoice Recipients		Analysis Request	
Copy of Invoice with Report: <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			Indicate Filled (F), Preserved (P) or Filled and Preserved (FP) below	
Company:	Email 1 or Fax: chetherrington@sperlinghansen.com				
Contact:	Email 2:				

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #: 20050 Hosmer	AFE/Coat Center:	PO#	
Job #: 20050 Hosmer	Major/Minor Code:	Routing Code:	
PO / AFE:	Requisitioner:		
LSD:	Location:		
ALS Lab Work Order # (ALS use only):		ALS Contact: Dean Watt	Sampler: TM

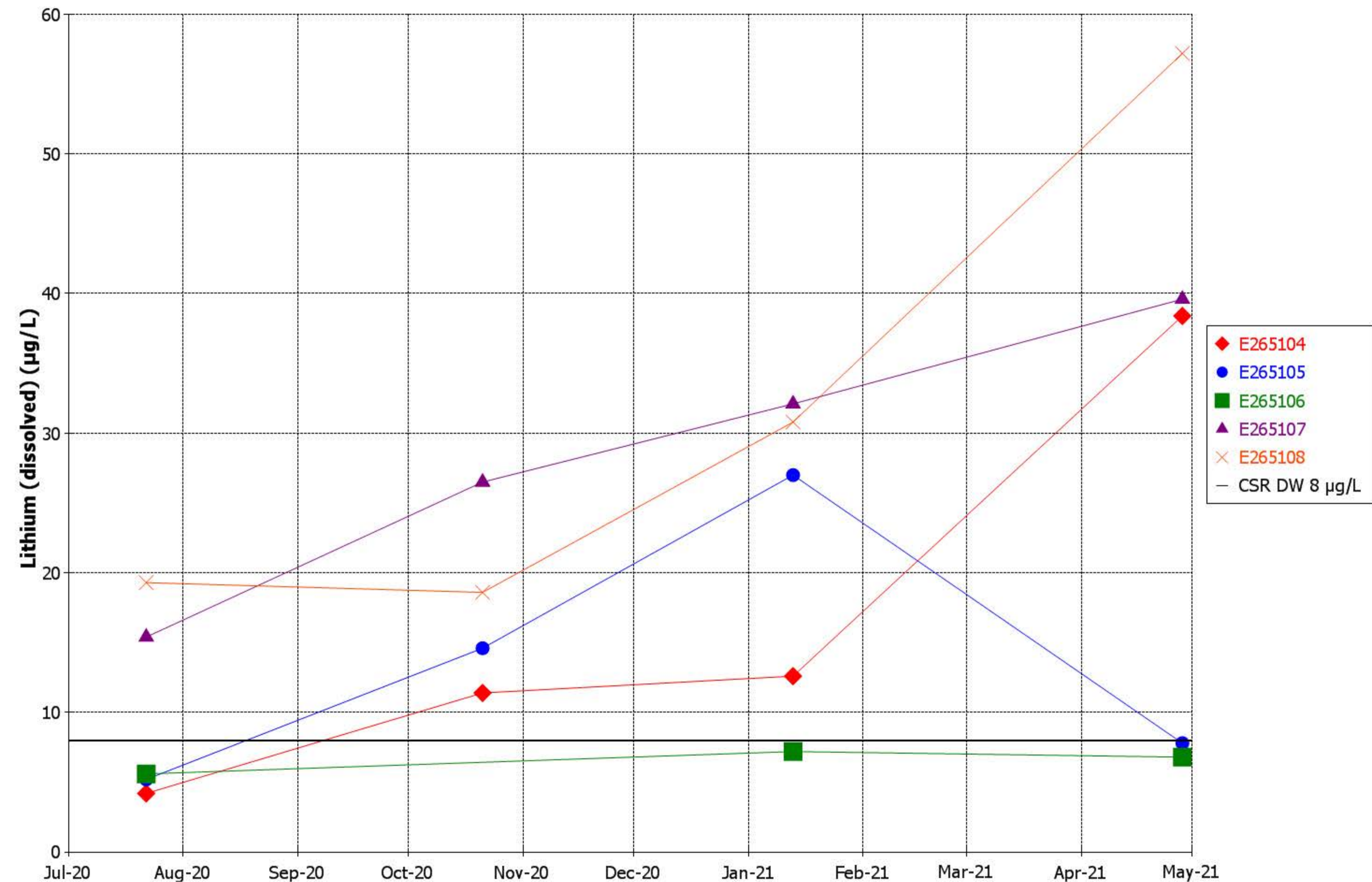
ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	temperature, conductivity, pH	Anions	Total Alkalinity	TSS	Hardness	Ammonia	fluoride, chloride, sulfate	nitrate, nitrite	Fecal and Total Coliform	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
1	E265104	09.11.21		Groundwater	3												
2	E265105			Groundwater	1												
3	E265106			Groundwater	1												
4	E265107 (MW6)			Groundwater	1												
5	E265108 (MW7)			Groundwater	1												

Drinking Water (DW) Samples (client use)	Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)
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)
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)

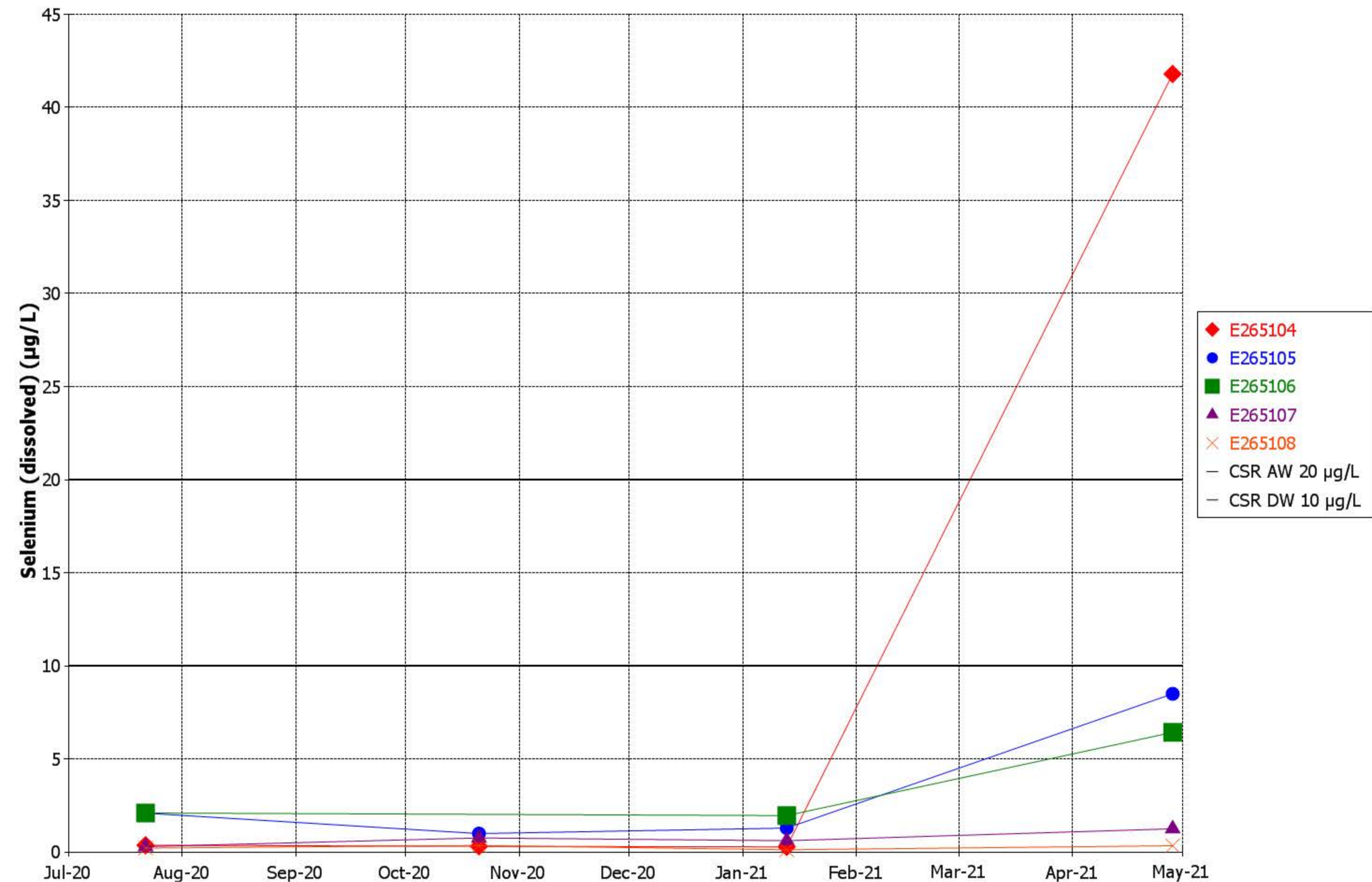
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (ALS use only)		WHITE - LABORATORY COPY		YELLOW - CLIENT COPY	
Released by:	Date:	Received by:	Date:	Time:	Received by:	Date:	Time:
REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION		WHITE - LABORATORY COPY		YELLOW - CLIENT COPY		FINAL SHIPMENT RECEPTION (ALS use only)	
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.		ALS 2020 FORM			

APPENDIX D
Trending Figures

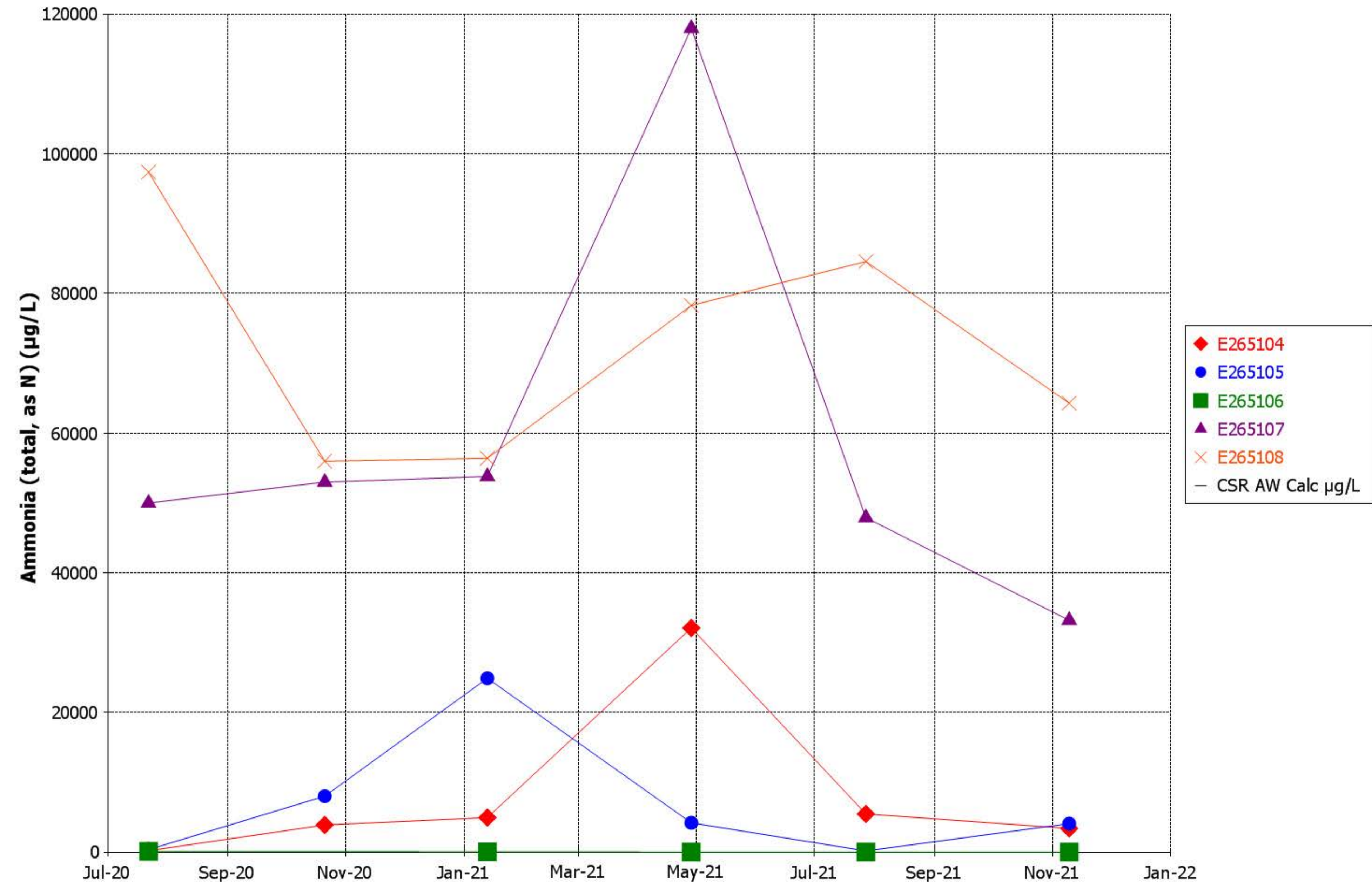
Time Series Plot For Lithium (dissolved) Hosmer Exfiltration Site



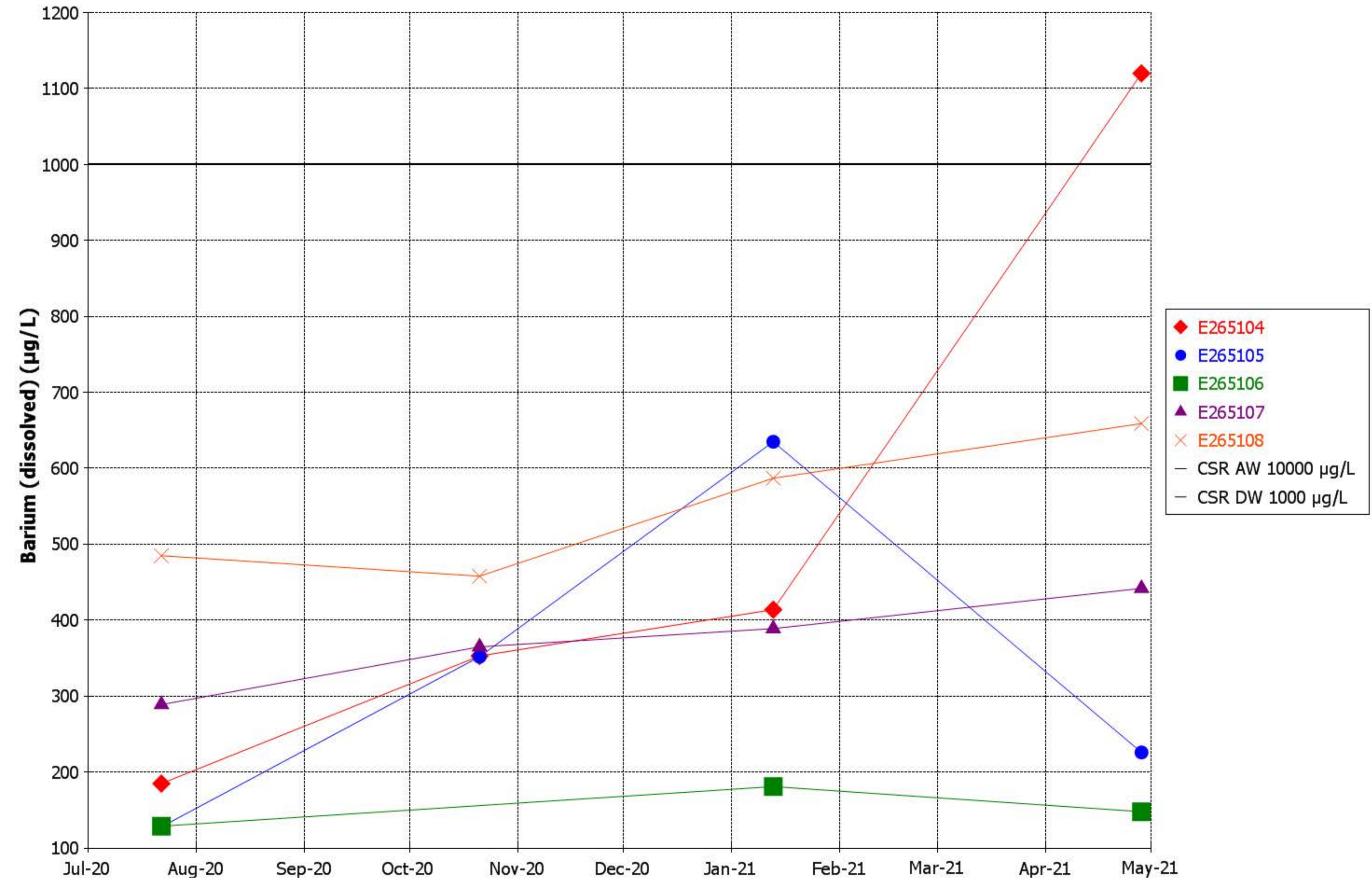
Time Series Plot For Selenium (dissolved) Hosmer Exfiltration Site



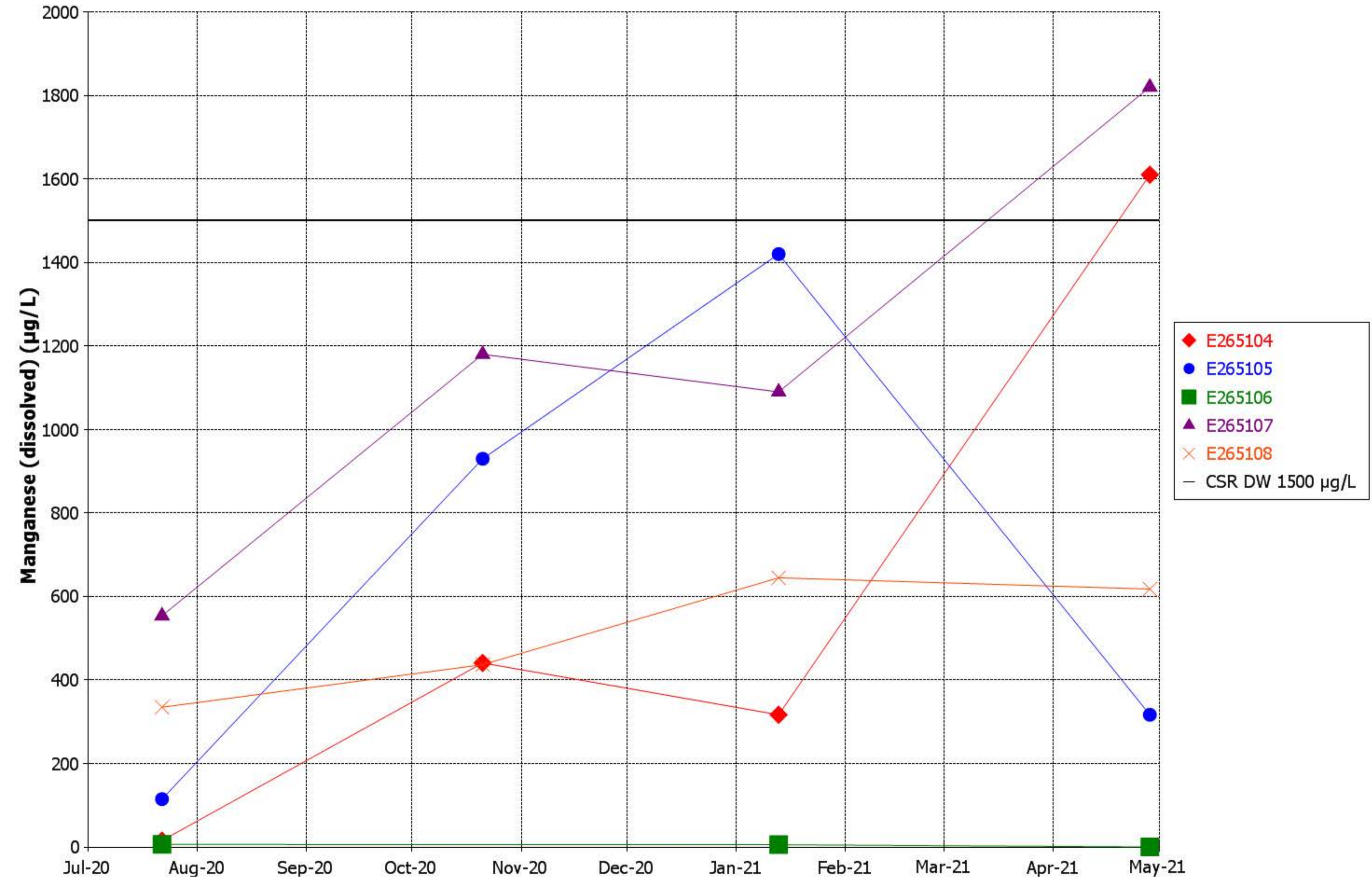
**Time Series Plot For Ammonia (total, as N)
Hosmer Exfiltration Site**



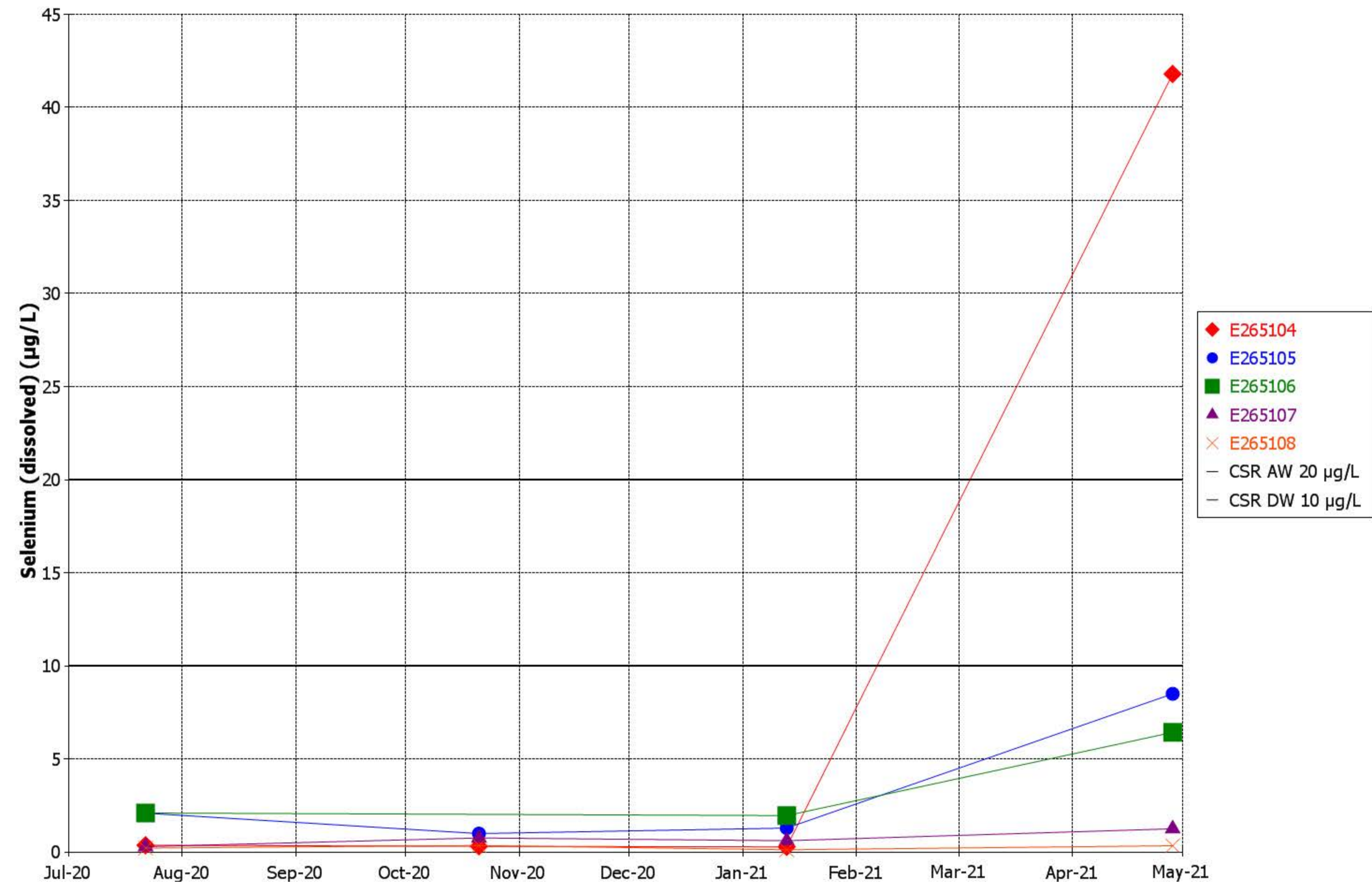
Time Series Plot For Barium (dissolved) Hosmer Exfiltration Site



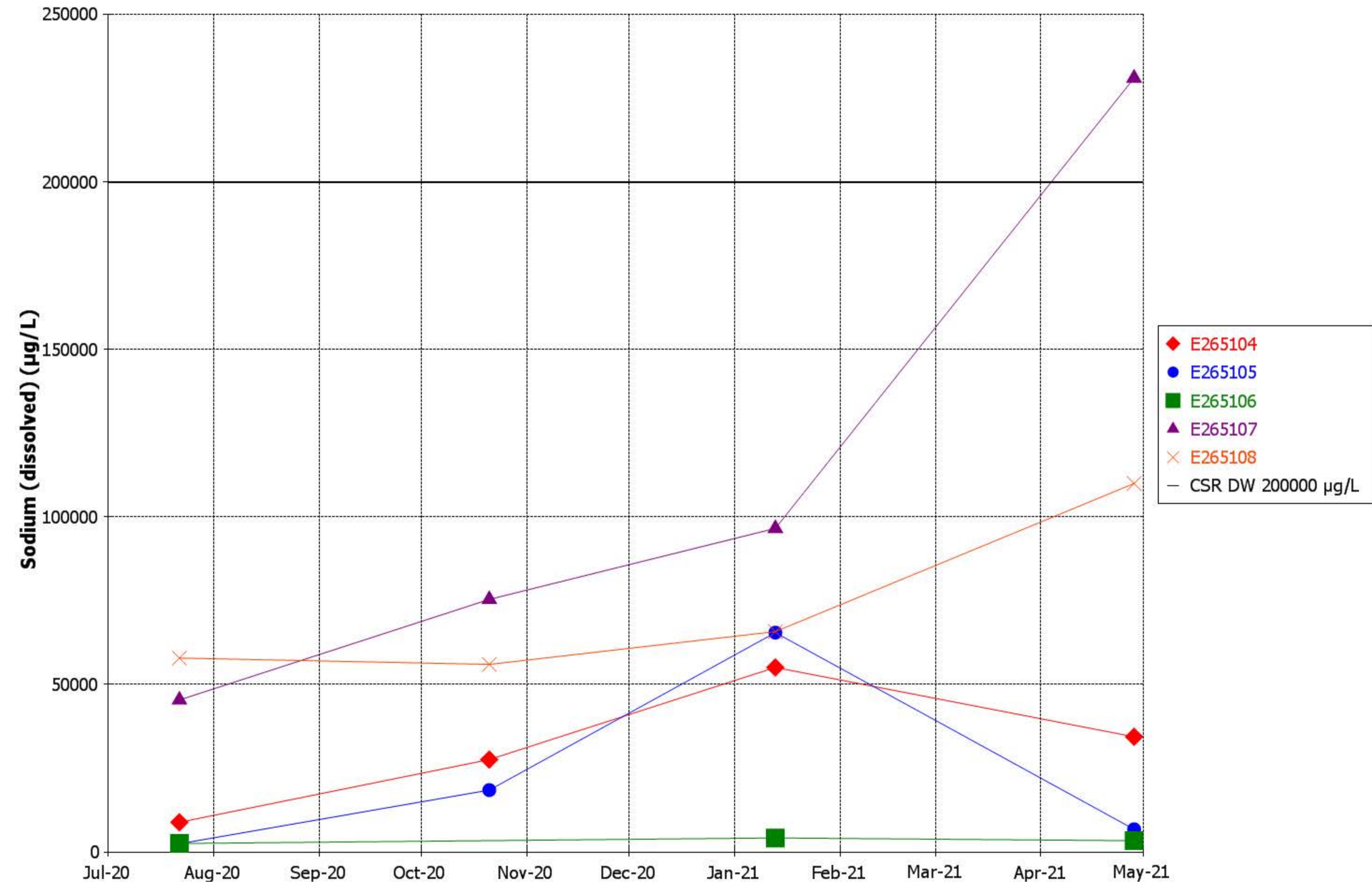
Time Series Plot For Manganese (dissolved) Hosmer Exfiltration Site



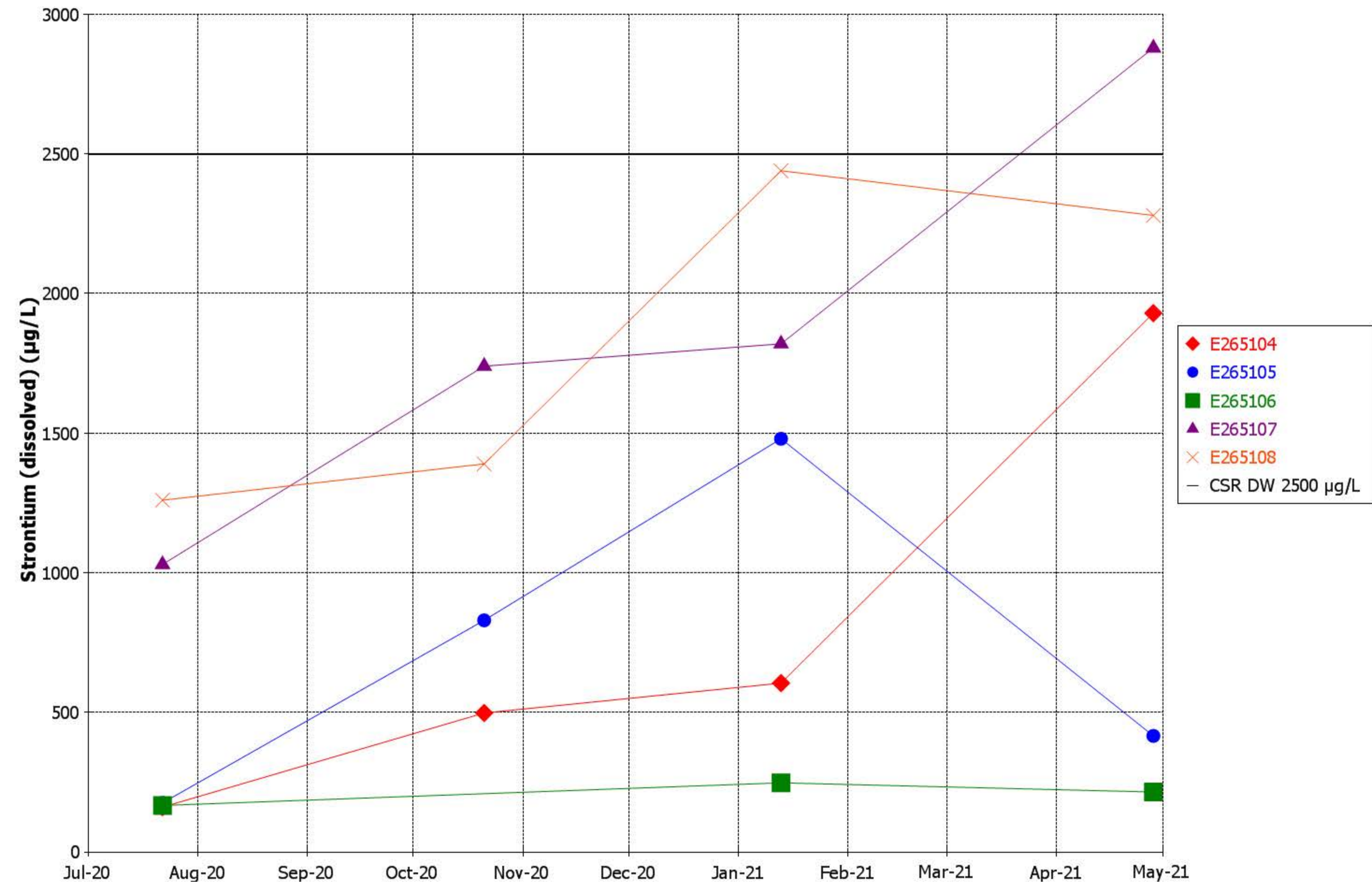
Time Series Plot For Selenium (dissolved) Hosmer Exfiltration Site



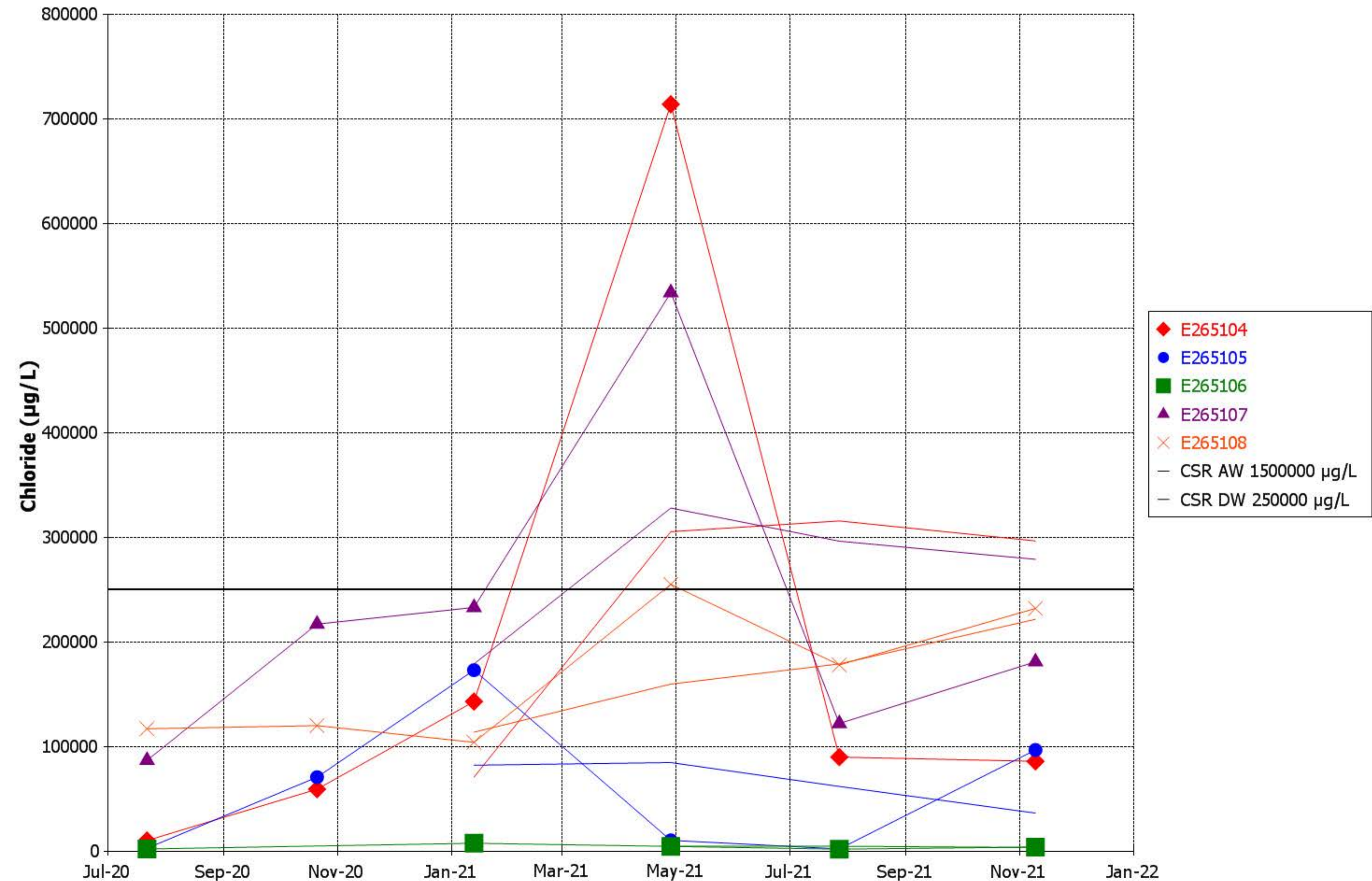
Time Series Plot For Sodium (dissolved) Hosmer Exfiltration Site



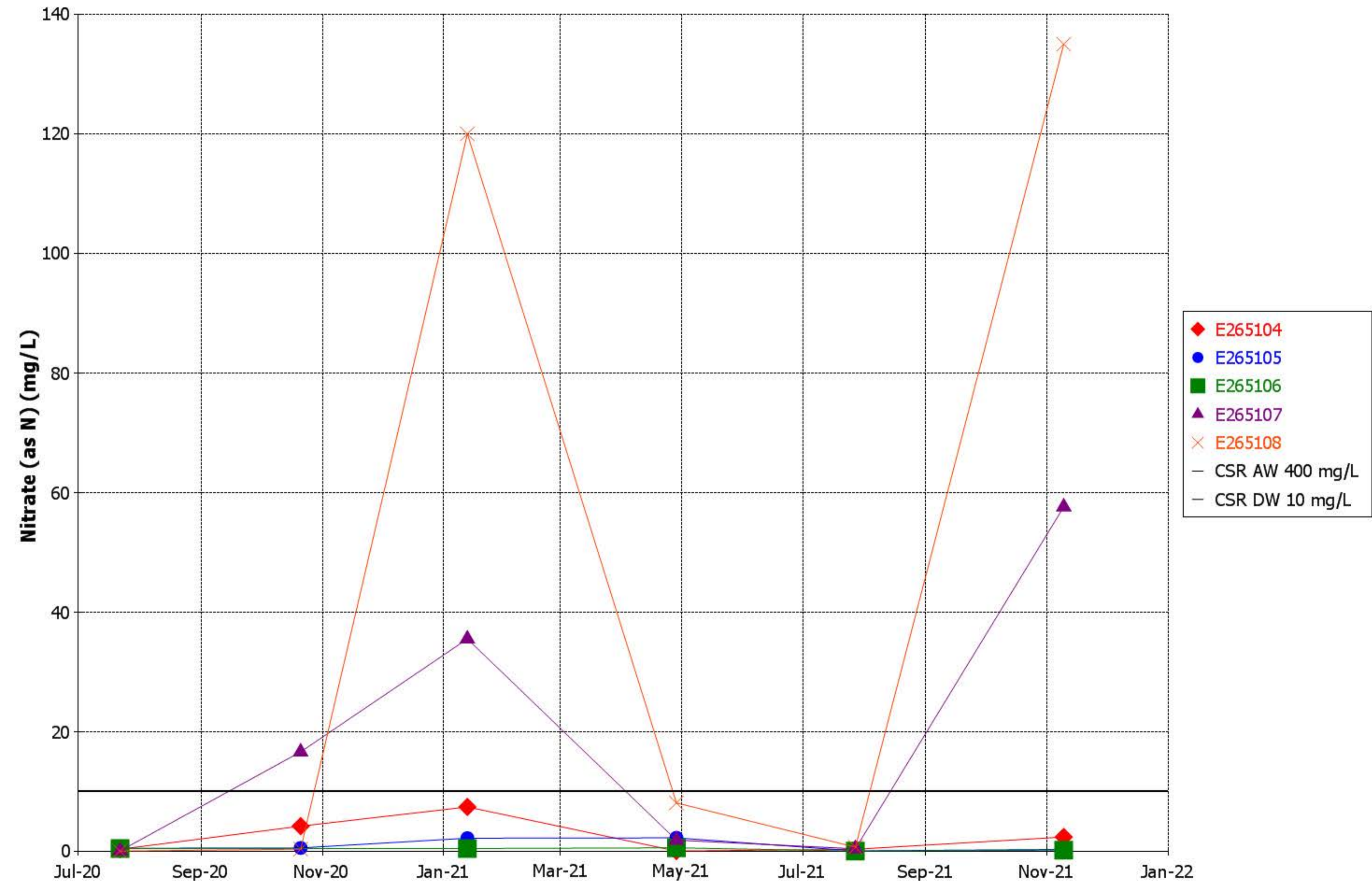
Time Series Plot For Strontium (dissolved) Hosmer Exfiltration Site



Time Series Plot For Chloride Hosmer Exfiltration Site



Time Series Plot For Nitrate (as N) Hosmer Exfiltration Site



**Time Series Plot For Nitrate + Nitrite (as N)
Hosmer Exfiltration Site**

