



GOVERNMENT OF YUKON - EMR
ATTN: Emilie Hamm, Project Officer
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Date Received: 25-NOV-16
Report Date: 30-NOV-16 16:13 (MT)
Version: FINAL

Client Phone: 867-667-8712

Certificate of Analysis

Lab Work Order #: L1862562
Project P.O. #: NOT SUBMITTED
Job Reference: MOUNT NANSEN
C of C Numbers:
Legal Site Desc:

Can Dang
Senior Account Manager

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1862562-1			
		Surface			
		25-NOV-16			
		BIOASSAY WATER (BW)			
Grouping	Analyte				
WATER					
Physical Tests	Conductivity (uS/cm)	1560			
	Hardness (as CaCO3) (mg/L)	829			
	pH (pH)	7.53			
	Total Suspended Solids (mg/L)	30.8			
	TDS (Calculated) (mg/L)	1210			
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	283			
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0			
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0			
	Alkalinity, Total (as CaCO3) (mg/L)	283			
	Ammonia, Total (as N) (mg/L)	5.64			
	Bromide (Br) (mg/L)	<0.25 ^{DLDS}			
	Chloride (Cl) (mg/L)	<2.5 ^{DLDS}			
	Fluoride (F) (mg/L)	<0.10 ^{DLDS}			
	Nitrate (as N) (mg/L)	1.00			
	Nitrite (as N) (mg/L)	0.0225			
	Sulfate (SO4) (mg/L)	674			
	Anion Sum (meq/L)	19.8			
	Cation Sum (meq/L)	19.1			
	Cation - Anion Balance (%)	-1.6			
	Cyanides	Cyanide, Weak Acid Diss (mg/L)	0.0063 ^{RRV}		
Cyanide, Total (mg/L)		0.0211			
Cyanate (mg/L)		<0.20			
Thiocyanate (SCN) (mg/L)		5.99			
Total Metals	Aluminum (Al)-Total (mg/L)	0.0161			
	Antimony (Sb)-Total (mg/L)	0.00048			
	Arsenic (As)-Total (mg/L)	0.0385			
	Barium (Ba)-Total (mg/L)	0.0576			
	Beryllium (Be)-Total (mg/L)	<0.000020			
	Bismuth (Bi)-Total (mg/L)	<0.000050			
	Boron (B)-Total (mg/L)	0.056			
	Cadmium (Cd)-Total (mg/L)	0.000336			
	Calcium (Ca)-Total (mg/L)	253			
	Chromium (Cr)-Total (mg/L)	0.00051			
	Cobalt (Co)-Total (mg/L)	0.00821			
	Copper (Cu)-Total (mg/L)	0.00232			
	Iron (Fe)-Total (mg/L)	11.9			
	Lead (Pb)-Total (mg/L)	<0.000050			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	Sample ID	Description	Sampled Date	Sampled Time	Client ID
		L1862562-1	Surface	25-NOV-16		BIOASSAY WATER (BW)
WATER						
Total Metals	Lithium (Li)-Total (mg/L)	0.0013				
	Magnesium (Mg)-Total (mg/L)	47.9				
	Manganese (Mn)-Total (mg/L)	5.96				
	Mercury (Hg)-Total (mg/L)	<0.0000050				
	Molybdenum (Mo)-Total (mg/L)	0.00101				
	Nickel (Ni)-Total (mg/L)	0.00309				
	Phosphorus (P)-Total (mg/L)	<0.050				
	Potassium (K)-Total (mg/L)	6.24				
	Selenium (Se)-Total (mg/L)	0.000328				
	Silicon (Si)-Total (mg/L)	8.26				
	Silver (Ag)-Total (mg/L)	0.000023				
	Sodium (Na)-Total (mg/L)	38.8				
	Strontium (Sr)-Total (mg/L)	0.724				
	Sulfur (S)-Total (mg/L)	256				
	Thallium (Tl)-Total (mg/L)	<0.000010				
	Tin (Sn)-Total (mg/L)	<0.00010				
	Titanium (Ti)-Total (mg/L)	0.00098				
	Uranium (U)-Total (mg/L)	0.00185				
	Vanadium (V)-Total (mg/L)	0.00178				
	Zinc (Zn)-Total (mg/L)	0.0182				
	Zirconium (Zr)-Total (mg/L)	0.00064				
Dissolved Metals	Dissolved Mercury Filtration Location	LAB				
	Dissolved Metals Filtration Location	LAB				
	Aluminum (Al)-Dissolved (mg/L)	0.0030				
	Antimony (Sb)-Dissolved (mg/L)	0.00040				
	Arsenic (As)-Dissolved (mg/L)	0.00235				
	Barium (Ba)-Dissolved (mg/L)	0.0547				
	Beryllium (Be)-Dissolved (mg/L)	<0.000020				
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050				
	Boron (B)-Dissolved (mg/L)	0.053				
	Cadmium (Cd)-Dissolved (mg/L)	0.000209				
	Calcium (Ca)-Dissolved (mg/L)	249				
	Chromium (Cr)-Dissolved (mg/L)	0.00014				
	Cobalt (Co)-Dissolved (mg/L)	0.00813				
	Copper (Cu)-Dissolved (mg/L)	0.00185				
	Iron (Fe)-Dissolved (mg/L)	0.113				
	Lead (Pb)-Dissolved (mg/L)	<0.000050				

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	Sample ID	Description	Sampled Date	Sampled Time	Client ID
		L1862562-1	Surface	25-NOV-16		BIOASSAY WATER (BW)
WATER						
Dissolved Metals	Lithium (Li)-Dissolved (mg/L)	0.0010				
	Magnesium (Mg)-Dissolved (mg/L)	50.2				
	Manganese (Mn)-Dissolved (mg/L)	6.20				
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050				
	Molybdenum (Mo)-Dissolved (mg/L)	0.000904				
	Nickel (Ni)-Dissolved (mg/L)	0.00291				
	Phosphorus (P)-Dissolved (mg/L)	<0.050				
	Potassium (K)-Dissolved (mg/L)	6.68				
	Selenium (Se)-Dissolved (mg/L)	0.000298				
	Silicon (Si)-Dissolved (mg/L)	7.30				
	Silver (Ag)-Dissolved (mg/L)	<0.000010				
	Sodium (Na)-Dissolved (mg/L)	40.5				
	Strontium (Sr)-Dissolved (mg/L)	0.704				
	Sulfur (S)-Dissolved (mg/L)	232				
	Thallium (Tl)-Dissolved (mg/L)	<0.000010				
	Tin (Sn)-Dissolved (mg/L)	<0.00010				
	Titanium (Ti)-Dissolved (mg/L)	<0.00030				
	Uranium (U)-Dissolved (mg/L)	0.00175				
	Vanadium (V)-Dissolved (mg/L)	<0.00050				
	Zinc (Zn)-Dissolved (mg/L)	0.0109				
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030				

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

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
WSMT	Water sample(s) for total mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Arsenic (As)-Dissolved	MS-B	L1862562-1
Matrix Spike	Boron (B)-Dissolved	MS-B	L1862562-1
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1862562-1
Matrix Spike	Cobalt (Co)-Dissolved	MS-B	L1862562-1
Matrix Spike	Copper (Cu)-Dissolved	MS-B	L1862562-1
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1862562-1
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1862562-1
Matrix Spike	Nickel (Ni)-Dissolved	MS-B	L1862562-1
Matrix Spike	Phosphorus (P)-Dissolved	MS-B	L1862562-1
Matrix Spike	Potassium (K)-Dissolved	MS-B	L1862562-1
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1862562-1
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1862562-1
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1862562-1
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1862562-1
Matrix Spike	Nitrate (as N)	MS-B	L1862562-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
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**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
BE-D-L-CCMS-VA	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.			
BE-T-L-CCMS-VA	Water	Total Be (Low) in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CN-CNO-WT	Water	Cyanate	APHA 4500-CN-L
This analysis is carried out using procedures adapted from APHA method 4500-CN "Cyanide". Cyanate is determined by the Cyanate hydrolysis method using an ammonia selective electrode			
CN-SCN-VA	Water	Thiocyanate by Colour	APHA 4500-CN CYANIDE
This analysis is carried out using procedures adapted from APHA Method 4500-CN- M "Thiocyanate" Thiocyanate is determined by the ferric nitrate colourimetric method.			
CN-T-CFA-VA	Water	Total Cyanide in water by CFA	ISO 14403:2002

Reference Information

This analysis is carried out using procedures adapted from ISO Method 14403:2002 "Determination of Total Cyanide using Flow Analysis (FIA and CFA)". Total or strong acid dissociable (SAD) cyanide is determined by in-line UV digestion along with sample distillation and final determination by colourimetric analysis. Method Limitation: This method is susceptible to interference from thiocyanate (SCN). If SCN is present in the sample, there could be a positive interference with this method, but it would be less than 1% and could be as low as zero.

CN-WAD-CFA-VA Water Weak Acid Diss. Cyanide in water by CFA APHA 4500-CN CYANIDE

This analysis is carried out using procedures adapted from APHA Method 4500-CN I. "Weak Acid Dissociable Cyanide". Weak Acid Dissociable (WAD) cyanide is determined by in-line sample distillation with final determination by colourimetric analysis.

EC-PCT-VA Water Conductivity (Automated) APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

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

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

HARDNESS-CALC-VA Water Hardness APHA 2340B

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

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

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

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

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

IONBALANCE-VA Water Ion Balance Calculation APHA 1030E

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

$$\text{Ion Balance (\%)} = \frac{[\text{Cation Sum} - \text{Anion Sum}]}{[\text{Cation Sum} + \text{Anion Sum}]}$$

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

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

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

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

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

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

NH3-F-VA Water Ammonia in Water by Fluorescence APHA 4500 NH₃-NITROGEN (AMMONIA)

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.

NH3-F-VA Water Ammonia in Water by Fluorescence 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-VA Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

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

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

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

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

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

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

Reference Information

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

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

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

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

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

TDS-CALC-VA Water TDS (Calculated) APHA 1030E (20TH EDITION)

This analysis is carried out using procedures adapted from APHA 1030E "Checking Correctness of Analyses". The Total Dissolved Solids result is calculated from measured concentrations of anions and cations in the sample.

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

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

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

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

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

Chain of Custody Numbers:

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.



Chain of Custody / Analytical Request Form
 Canada Toll Free: 1 800 668 9878
 www.alsglobal.com

COC # _____

Page 1 of 1

Report To	Report Format / Distribution	Service Requested (Rush for routine analysis subject to availability)
Company: YG-EMR- Assessment and Abandoned Mines (AAM)	<input checked="" type="checkbox"/> Standard <input type="checkbox"/> Other	<input type="radio"/> Regular (Standard Turnaround Times - Business Days)
Contact: Emilie Hamm, Project Officer	<input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> Excel <input type="checkbox"/> Digital <input type="checkbox"/> Fax	<input checked="" type="radio"/> Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address: 2C - 4114 4th Avenue, Whitehorse, YT, Y1A 4N7 Box 2703 (K-419), Whitehorse, YT, Y1A 2C6	Email 1: emilie_hamm@gov.yk.ca	<input type="radio"/> Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
Phone: 867-667-8712 Fax: 867-456-6780	Email 2: erik_pit@gov.yk.ca	<input type="radio"/> Same Day or Weekend Emergency - Contact ALS to Confirm TAT
	Email 3:	Analysis Request

Invoice To Same as Report ? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Client / Project Information	Please indicate below Filtered, Preserved or both (F, P, F/P)										
Hardcopy of Invoice with Report? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Job #: Mount Nansen	P	F/P	P	F/P	P	P					Number of Containers
Company:	PO / AFE:											
Contact: aam-admin@gov.yk.ca	LSD:											
Address:												
Phone: Fax:	Quote #:											
Lab Work Order # (lab use only)	ALS Contact: Brent Makelki											

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	General Chemistry	Total Metals	Dissolved Metals	Total Mercury	Dissolved Mercury	Ammonia	Cyanide													
	Bioassay Water (BW)	25-Nov-16		Surface Water	X	X	X	X	X	X	X													7



L1862562-COFC

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

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 provided on a separate Excel tab.
 Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)				
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF	
	25-Nov-16		Logan	Nov 25	8:30	°C					