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Date Received: 28-JAN-16
Report Date: 09-FEB-16 19:02 (MT)
Version: FINAL

Client Phone: 867-456-4865

Certificate of Analysis

Lab Work Order #: L1728530
Project P.O. #: NOT SUBMITTED
Job Reference: 1343-005.15
C of C Numbers: 1
Legal Site Desc:

Comments: ADDITIONAL 09-FEB-16 18:57

Brent Mack, B.Sc.
Account Manager

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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	L1728530-1 Water TRAVEL BLANK 2	L1728530-2 Water 27-JAN-16 13:55 E8	L1728530-3 Water 27-JAN-16 12:25 DUP2	L1728530-4 Water 27-JAN-16 13:55 R6
Grouping	Analyte				
WATER					
Physical Tests	Conductivity (uS/cm)	<2.0	470	470	487
	Hardness (as CaCO3) (mg/L)	<0.50	246	263	252
	pH (pH)	5.50	7.89	7.77	7.45
	Total Suspended Solids (mg/L)	<3.0	<3.0	<3.0	<3.0
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	0.0138 ^{RRV}	0.0064	0.0105	0.0118
	Nitrate (as N) (mg/L)	<0.0050	0.424	0.349	0.350
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	0.0010	<0.0010
	Phosphorus (P)-Total (mg/L)	<0.0020	<0.0020	0.0039	0.0025
	Sulfate (SO4) (mg/L)	<0.30	119	123	123
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)		4.17	4.17	4.17
Total Metals	Aluminum (Al)-Total (mg/L)	<0.0030	0.112	0.129	0.131
	Antimony (Sb)-Total (mg/L)	<0.00010	0.00014	0.00017	0.00017
	Arsenic (As)-Total (mg/L)	<0.00010	0.00022	0.00024	0.00024
	Barium (Ba)-Total (mg/L)	<0.000050	0.0745	0.0734	0.0757
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.0000050	0.0000195	0.0000527	0.0000609
	Calcium (Ca)-Total (mg/L)	<0.050	62.6	63.3	65.3
	Chromium (Cr)-Total (mg/L)	<0.00010	0.00013	0.00020	0.00020
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	0.00014	0.00014
	Copper (Cu)-Total (mg/L)	<0.00050	0.00155	0.00258	0.00353
	Iron (Fe)-Total (mg/L)	<0.010	0.040	0.057	0.050
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	0.000088	0.000127
	Lithium (Li)-Total (mg/L)	<0.0010	0.0075	0.0083	0.0087
	Magnesium (Mg)-Total (mg/L)	<0.10	21.4	22.9	23.5
	Manganese (Mn)-Total (mg/L)	<0.00010	0.0129	0.0129	0.0135
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	<0.000050	0.000516	0.000534	0.000528
	Nickel (Ni)-Total (mg/L)	<0.00050	0.00179	0.00212	0.00215
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	<0.10	1.84	1.92	1.94
	Selenium (Se)-Total (mg/L)	<0.000050	0.000474	0.000461	0.000484
Silicon (Si)-Total (mg/L)	<0.050	4.87	4.97	5.13	
Silver (Ag)-Total (mg/L)	<0.000010	0.000025	0.000020	0.000023	
Sodium (Na)-Total (mg/L)	<0.050	7.80	8.38	8.76	

* 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	L1728530-1 Water TRAVEL BLANK 2	L1728530-2 Water 27-JAN-16 13:55 E8	L1728530-3 Water 27-JAN-16 12:25 DUP2	L1728530-4 Water 27-JAN-16 13:55 R6
Grouping	Analyte				
WATER					
Total Metals	Strontium (Sr)-Total (mg/L)	<0.00020	0.333	0.344	0.352
	Sulfur (S)-Total (mg/L)	<0.50	36.6	38.3	39.8
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030	0.00035
	Uranium (U)-Total (mg/L)	<0.000010	0.00263	0.00271	0.00278
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	0.0038	0.0067	0.0072
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	0.00041	0.00039
Dissolved Metals	Dissolved Mercury Filtration Location		FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location		FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)		0.0372	0.0431	0.0415
	Antimony (Sb)-Dissolved (mg/L)		0.00012	0.00011	0.00011
	Arsenic (As)-Dissolved (mg/L)		0.00019	0.00020	0.00020
	Barium (Ba)-Dissolved (mg/L)		0.0742	0.0751	0.0737
	Beryllium (Be)-Dissolved (mg/L)		<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)		<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)		<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)		0.0000217	0.0000185	0.0000192
	Calcium (Ca)-Dissolved (mg/L)		64.1	67.0	64.0
	Chromium (Cr)-Dissolved (mg/L)		0.00012	<0.00010	0.00010
	Cobalt (Co)-Dissolved (mg/L)		<0.00010	0.00012	0.00012
	Copper (Cu)-Dissolved (mg/L)		0.00147	0.00149	0.00152
	Iron (Fe)-Dissolved (mg/L)		0.017	0.021	0.021
	Lead (Pb)-Dissolved (mg/L)		<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)		0.0078	0.0084	0.0085
	Magnesium (Mg)-Dissolved (mg/L)		21.0	23.2	22.5
	Manganese (Mn)-Dissolved (mg/L)		0.0125	0.0124	0.0125
	Mercury (Hg)-Dissolved (mg/L)		<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)		0.000469	0.000430	0.000461
	Nickel (Ni)-Dissolved (mg/L)		0.00167	0.00200	0.00198
	Phosphorus (P)-Dissolved (mg/L)		<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)		1.61	1.69	1.68
	Selenium (Se)-Dissolved (mg/L)		0.000442	0.000494	0.000428
	Silicon (Si)-Dissolved (mg/L)		4.88	5.10	4.94
	Silver (Ag)-Dissolved (mg/L)		<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)		7.76	8.42	8.50

* 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	L1728530-1 Water TRAVEL BLANK 2	L1728530-2 Water 27-JAN-16 13:55 E8	L1728530-3 Water 27-JAN-16 12:25 DUP2	L1728530-4 Water 27-JAN-16 13:55 R6
Grouping	Analyte				
WATER					
Dissolved Metals	Strontium (Sr)-Dissolved (mg/L)		0.330	0.342	0.337
	Sulfur (S)-Dissolved (mg/L)		36.6	39.7	38.3
	Thallium (Tl)-Dissolved (mg/L)		<0.000010	<0.000010	<0.000010
	Tin (Sn)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)		<0.00030	<0.00030	<0.00030
	Uranium (U)-Dissolved (mg/L)		0.00253	0.00241	0.00257
	Vanadium (V)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)		0.0038	0.0031	0.0032
	Zirconium (Zr)-Dissolved (mg/L)		<0.00030	0.00034	0.00035

* 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	Calcium (Ca)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Sulfate (SO4)	MS-B	L1728530-1, -2, -3, -4
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Dissolved Organic Carbon	MS-B	L1728530-2, -3, -4
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Sodium (Na)-Total	MS-B	L1728530-1, -2, -3, -4
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1728530-2, -3, -4
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1728530-2, -3, -4

Qualifiers for Individual Parameters Listed:

Qualifier	Description
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-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.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
EC-MAN-WR	Water	Conductivity by Meter	APHA 2510 (B)

Reference Information

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

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 µm), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

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

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

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

Water samples are filtered (0.45 µm), 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-DIS-LOW-ICP-VA Water Dissolved Metals in Water by ICPOES EPA 3005A/6010B

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 (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

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.

MET-TOT-LOW-ICP-VA Water Total Metals in Water by ICPOES EPA 3005A/6010B

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 procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

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-WR 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-WR 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.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

PH-MAN-WR Water pH by Meter APHA 4500-H+

pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 – 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.

S-DIS-ICP-VA Water Dissolved Sulfur in Water by ICPOES EPA SW-846 3005A/6010B

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 procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in

Reference Information

submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

S-TOT-ICP-VA Water Total Sulfur in Water by ICPOES EPA SW-846 3005A/6010B

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 procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

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

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

TSS-MAN-WR Water Total Suspended Solids by Gravimetric APHA 2540 D

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids are determined by filtering a sample through a glass fibre filter and drying the filter at 104 degrees celsius.

** 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
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Chain of Custody Numbers:

1

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.

