

Technical Memo

To : Mal Wensierski

Date : 2/1/2017

Lafarge Canada Inc.

Re. : 2016 Monitoring Summary

6509 Airport Road,

Project: Oro Pit

Mississauga, ON L4V 1S7

From : Andrew Pentney

As requested we are providing a summary of the 2016 groundwater monitoring program results for the Oro Pit for your records. Previous memos outlined the complete monitoring program requirements in detail and summarized available monitoring results, including private well surveys in the area of the pit.

The current monitoring program requirements for the Oro Pit include quarterly water level measurements and annual water quality sampling.

Extraction activities began at the Oro Pit in January 2015. The adjacent Greek Pit is well established and extraction has occurred at that site for a number of years.

Monitoring Program

The monitoring completed in 2016 constitutes the second year of measurements during Oro Pit extraction operations. Baseline conditions were established over the 2012 to 2014 period.

The site location and monitoring network is shown in **Figure 1** (attached). Existing Oro Pit monitors include locations M6, DC-1, DC-2, DC-4 and DC-5. In addition monitor OW1, at the Greek Pit is included in the program.

Based on the water table configuration, groundwater flows from the area of DC-1, and moves radially north, northeast and east across the site (north to DC-2; northeast to Greek Pit OW1; and, east to the Roehner Pit). The current extraction area is immediately north of M6, therefore locations M6 and DC-4 are upgradient of the current extraction area. Location OW1 is downgradient of the current extraction area.

Monitoring completed in 2016 at the Oro Pit included (generally) bi-monthly water level measurements at monitoring wells M6, DC-1, DC-2, DC-4, DC-5 and OW1. In addition water quality samples were obtained at M6, DC-4 and OW1 in December 2016.

Monitoring Results Summary

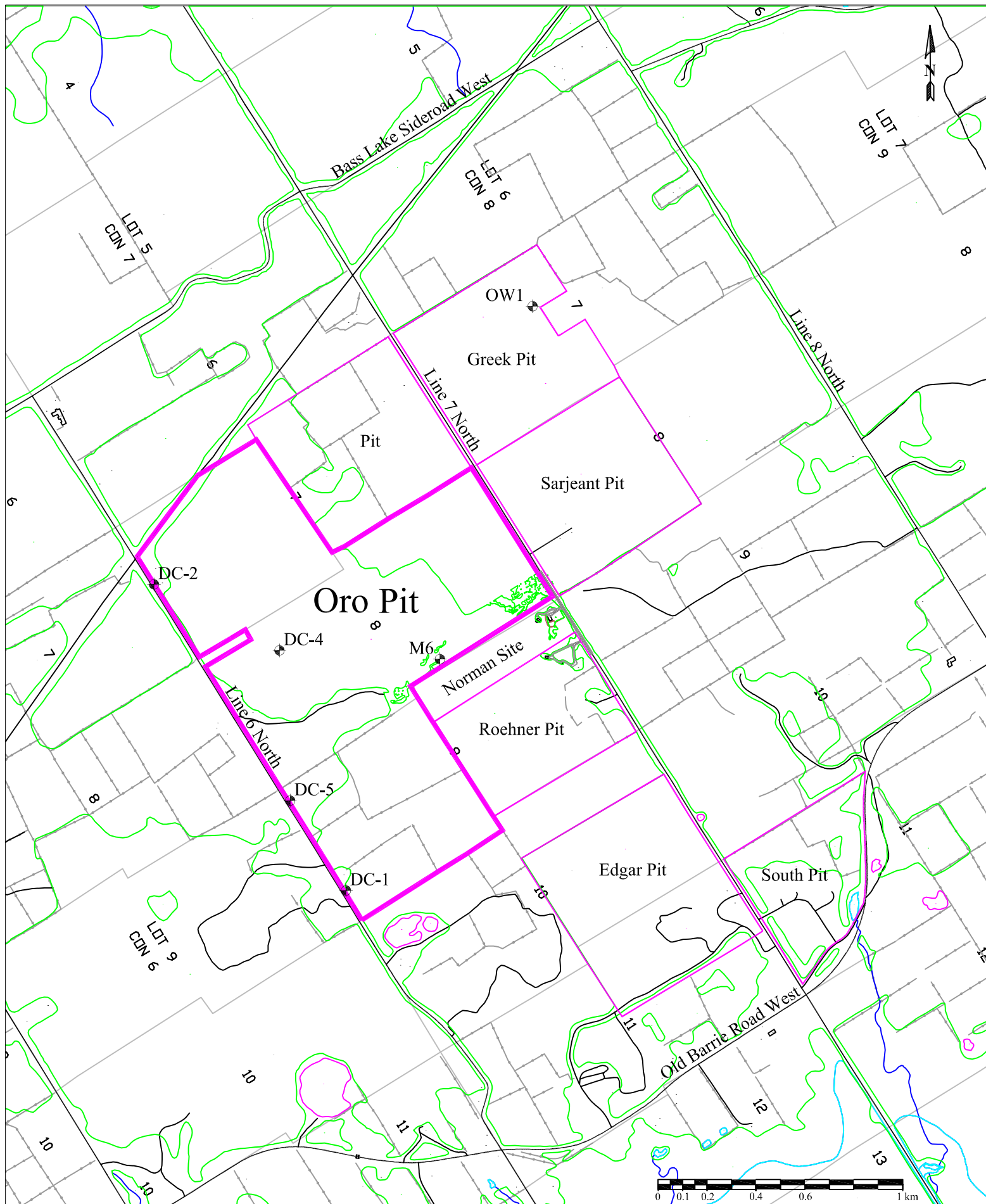
Water level monitoring results at on-site wells are summarized in the attached table and hydrograph. As shown, water level elevations and overall water table fluctuations are consistent from 2013 to 2016, and are comparable to historical (1991) results.

The December 2016 water quality sample results are attached for reference. Note that colour and turbidity results are elevated at each of the monitoring well locations (indicative of silt or clay within the sample water) due to the typical construction of these wells and the fact that they are pumped very intermittently. The colour and turbidity results at the monitoring wells do not have any implications related to water supply within the aquifer.

No significant water quality concerns are noted and no impacts due to Oro Pit or Greek Pit operations are apparent. Although chloride concentrations are slightly higher at OW1 as compared to M6 and DC-4, the results remain well below suggested drinking water criteria related to aesthetics and health. The results indicate that the groundwater quality within the water table system on-site is slightly hard, however overall meets the MOE drinking water health related guidelines. Continued monitoring is recommended, and will occur as part of the stipulated monitoring program.

Attached:

- Figure 1: Site Location
- Water Level Summary Table
- Water Level Hydrograph
- Water Quality Sampling Analysis Laboratory Report



- Pit licence boundary (approx)
- river, stream, pond
- treeline
- monitoring well location

modified from: OBM mapping, Site Plan
UNDER LICENSE, WITHOUT PREJUDICE OR ENDORSEMENT,
FROM THE QUEEN'S PRINTER OF ONTARIO, 2005

March 2014
Scale: as shown

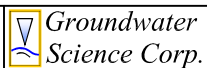


Figure 1: Site Location

Lafarge Canada Inc.
Oro Pit Monitoring Program

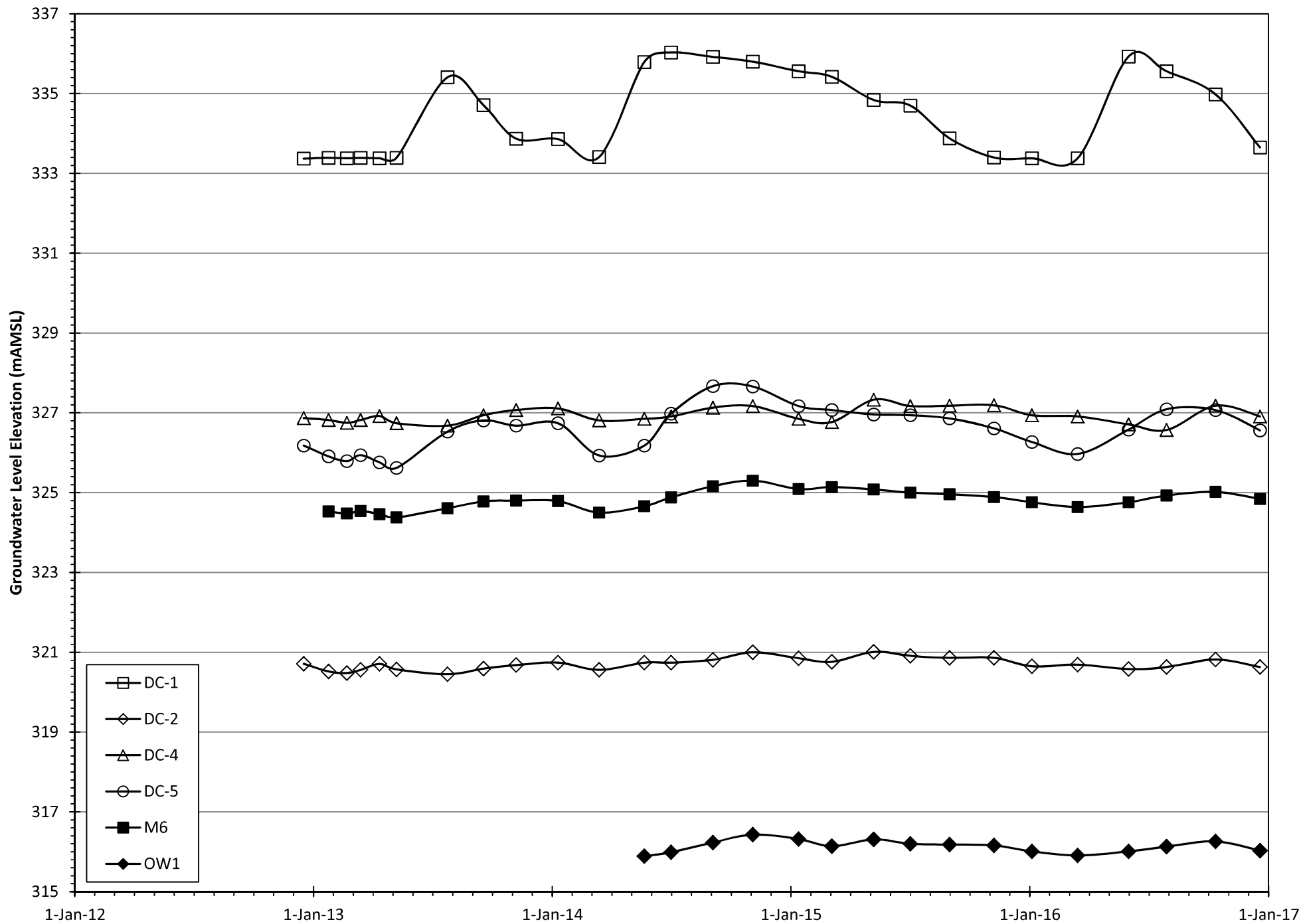
Reported Installation Elevations and Details						
Monitor:	DC-1	DC-2	DC-4	DC-5	M6	OW1
GS (mASL):	366.7	354.07	354.62	352.05	352.305	343.22
TOC (mASL):	367.45	354.57	355.66	352.64	352.95	343.63
TD (mBTOC):	34.12	36.64	30.48	30.15	31.8	33.88
SU (m):	0.75	0.5	1.04	0.59	0.645	0.41
GS = ground surface		TOC = Top of Casing		TD = total depth		SU = stick-up

Water Level Elevation - mASL						
Date	DC-1	DC-2	DC-4	DC-5	M6	OW1
3-May-91	334.56	320.22	326.22	325.94	323.81	#N/A
13-May-91	335.58	320.3	326.3	326.19	323.89	#N/A
22-Jul-91	335.72	320.26	326.46	327.22	324.22	#N/A
1-Oct-91	335.39	320.52	326.91	327.17	324.45	#N/A
14-Nov-91	#N/A	#N/A	#N/A	#N/A	#N/A	315.20
11-Dec-91	#N/A	#N/A	#N/A	#N/A	#N/A	315.00
17-Dec-12	333.37 *	320.71	326.87	326.18	#N/A	#N/A
24-Jan-13	333.39 *	320.52	326.82	325.91	324.53	#N/A
21-Feb-13	333.38 *	320.48	326.75	325.79	324.48	#N/A
14-Mar-13	333.39 *	320.56	326.82	325.94	324.54	#N/A
12-Apr-13	333.38 *	320.71	326.92	325.76	324.46	#N/A
8-May-13	333.39 *	320.57	326.74	325.62	324.38	#N/A
25-Jul-13	335.41	320.45	326.68	326.53	324.61	#N/A
18-Sep-13	334.71	320.59	326.94	326.81	324.78	#N/A
7-Nov-13	333.87	320.68	327.07	326.68	324.80	#N/A
10-Jan-14	333.86	320.74	327.11	326.74	324.79	#N/A
14-Mar-14	333.41 *	320.56	326.81	325.93	324.50	#N/A
22-May-14	335.79	320.74	326.85	326.18	324.66	315.89
2-Jul-14	336.03	320.74	326.91	326.98	324.88	315.99
4-Sep-14	335.92	320.81	327.13	327.67	325.16	316.23
4-Nov-14	335.80	321.00	327.17	327.66	325.30	316.43
13-Jan-15	335.56	320.85	326.85	327.17	325.09	316.32
5-Mar-15	335.42	320.76	326.77	327.07	325.14	316.14
8-May-15	334.84	321.01	327.33	326.96	325.08	316.31
3-Jul-15	334.70	320.91	327.17	326.94	325.00	316.20
1-Sep-15	333.88	320.86	327.18	326.86	324.96	316.18
8-Nov-15	333.40 *	320.86	327.19	326.61	324.89	316.16
5-Jan-16	333.38 *	320.65	326.94	326.27	324.76	316.01
15-Mar-16	333.38 *	320.69	326.91	325.97	324.64	315.91
1-Jun-16	335.93	320.58	326.71	326.58	324.76	316.01
29-Jul-16	335.56	320.63	326.57	327.09	324.93	316.13
12-Oct-16	334.98	320.82	327.18	327.07	325.02	316.26
19-Dec-16	333.65	320.63	326.91	326.56	324.84	316.03

mASL = metres above sea level

#N/A = not available

* = likely dry (<10 cm of water column)





GROUNDWATER SCIENCE
ATTN: ANDREW PENTNEY
328 Daleview Place
WATERLOO ON N2L 5M5

Date Received: 20-DEC-16
Report Date: 28-DEC-16 12:23 (MT)
Version: FINAL

Client Phone: 519-746-6916

Certificate of Analysis

Lab Work Order #: L1872101
Project P.O. #: NOT SUBMITTED
Job Reference: ORO PIT
C of C Numbers: 15-557399
Legal Site Desc:

Nellie Gudzak
Account Manager

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ADDRESS: 60 Northland Road, Unit 1, Waterloo, ON N2V 2B8 Canada | Phone: +1 519 886 6910 | Fax: +1 519 886 9047
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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1872101-1 GREEK OW1 Sampled By: D.NAHRGANG on 19-DEC-16 @ 12:00 Matrix: WATER							
Physical Tests							
Colour, Apparent	335	DLHC	4.0	CU		20-DEC-16	R3620938
Conductivity	395		3.0	umhos/cm		21-DEC-16	R3621999
Hardness (as CaCO3)	200		10	mg/L		22-DEC-16	
pH	8.02		0.10	pH units		21-DEC-16	R3621999
Total Dissolved Solids	322	DLDS	20	mg/L		20-DEC-16	R3621989
Turbidity	>4000		0.10	NTU		21-DEC-16	R3622299
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	235		10	mg/L		21-DEC-16	R3621687
Ammonia, Total (as N)	0.10	DLM	0.10	mg/L		22-DEC-16	R3622197
Chloride (Cl)	3.07		0.50	mg/L		21-DEC-16	R3621957
Fluoride (F)	0.030		0.020	mg/L		21-DEC-16	R3621957
Nitrate (as N)	2.10		0.020	mg/L		21-DEC-16	R3621957
Nitrite (as N)	<0.010		0.010	mg/L		21-DEC-16	R3621957
Orthophosphate-Dissolved (as P)	<0.0030		0.0030	mg/L		23-DEC-16	R3623140
Sulfate (SO4)	6.01		0.30	mg/L		21-DEC-16	R3621957
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					21-DEC-16	R3621181
Aluminum (Al)-Dissolved	<0.010		0.010	mg/L	21-DEC-16	21-DEC-16	R3621418
Antimony (Sb)-Dissolved	<0.0050		0.0050	mg/L	21-DEC-16	21-DEC-16	R3621418
Arsenic (As)-Dissolved	<0.0010		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
Barium (Ba)-Dissolved	0.042		0.010	mg/L	21-DEC-16	21-DEC-16	R3621418
Beryllium (Be)-Dissolved	<0.0010		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
Bismuth (Bi)-Dissolved	<0.0010		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
Boron (B)-Dissolved	<0.050		0.050	mg/L	21-DEC-16	21-DEC-16	R3621418
Cadmium (Cd)-Dissolved	<0.000090		0.000090	mg/L	21-DEC-16	21-DEC-16	R3621418
Calcium (Ca)-Dissolved	59.5		0.50	mg/L	21-DEC-16	21-DEC-16	R3621418
Chromium (Cr)-Dissolved	0.00095		0.00050	mg/L	21-DEC-16	21-DEC-16	R3621418
Cobalt (Co)-Dissolved	<0.00050		0.00050	mg/L	21-DEC-16	21-DEC-16	R3621418
Copper (Cu)-Dissolved	<0.0010		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
Iron (Fe)-Dissolved	<0.050		0.050	mg/L	21-DEC-16	21-DEC-16	R3621418
Lead (Pb)-Dissolved	<0.0010		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
Magnesium (Mg)-Dissolved	12.4		0.50	mg/L	21-DEC-16	21-DEC-16	R3621418
Manganese (Mn)-Dissolved	<0.0010		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
Molybdenum (Mo)-Dissolved	<0.0010		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
Nickel (Ni)-Dissolved	<0.0020		0.0020	mg/L	21-DEC-16	21-DEC-16	R3621418
Phosphorus (P)-Dissolved	<0.050		0.050	mg/L	21-DEC-16	21-DEC-16	R3621418
Potassium (K)-Dissolved	<1.0		1.0	mg/L	21-DEC-16	21-DEC-16	R3621418
Selenium (Se)-Dissolved	<0.00040		0.00040	mg/L	21-DEC-16	21-DEC-16	R3621418
Silicon (Si)-Dissolved	4.9		1.0	mg/L	21-DEC-16	21-DEC-16	R3621418
Silver (Ag)-Dissolved	<0.00010		0.00010	mg/L	21-DEC-16	21-DEC-16	R3621418
Sodium (Na)-Dissolved	2.21		0.50	mg/L	21-DEC-16	21-DEC-16	R3621418

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1872101-1 GREEK OW1 Sampled By: D.NAHRGANG on 19-DEC-16 @ 12:00 Matrix: WATER Dissolved Metals Strontium (Sr)-Dissolved Thallium (Tl)-Dissolved Tin (Sn)-Dissolved Titanium (Ti)-Dissolved Tungsten (W)-Dissolved Uranium (U)-Dissolved Vanadium (V)-Dissolved Zinc (Zn)-Dissolved Zirconium (Zr)-Dissolved Aggregate Organics Phenols (4AAP)								
		0.116		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
		<0.00030		0.00030	mg/L	21-DEC-16	21-DEC-16	R3621418
		<0.0010		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
		<0.0020		0.0020	mg/L	21-DEC-16	21-DEC-16	R3621418
		<0.010		0.010	mg/L	21-DEC-16	21-DEC-16	R3621418
		<0.0050		0.0050	mg/L	21-DEC-16	21-DEC-16	R3621418
		<0.0010		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
		0.0243		0.0030	mg/L	21-DEC-16	21-DEC-16	R3621418
		<0.0040		0.0040	mg/L	21-DEC-16	21-DEC-16	R3621418
		0.0100		0.0010	mg/L		20-DEC-16	R3621372
L1872101-2 DC-4 Sampled By: D.NAHRGANG on 19-DEC-16 @ 13:00 Matrix: WATER Physical Tests Colour, Apparent Conductivity Hardness (as CaCO3) pH Total Dissolved Solids Turbidity Anions and Nutrients Alkalinity, Total (as CaCO3) Ammonia, Total (as N) Chloride (Cl) Fluoride (F) Nitrate (as N) Nitrite (as N) Orthophosphate-Dissolved (as P) Sulfate (SO4) Dissolved Metals Dissolved Metals Filtration Location Aluminum (Al)-Dissolved Antimony (Sb)-Dissolved Arsenic (As)-Dissolved Barium (Ba)-Dissolved Beryllium (Be)-Dissolved Bismuth (Bi)-Dissolved Boron (B)-Dissolved Cadmium (Cd)-Dissolved Calcium (Ca)-Dissolved Chromium (Cr)-Dissolved								
		188		2.0	CU		20-DEC-16	R3620938
		340		3.0	umhos/cm		21-DEC-16	R3621999
		168		10	mg/L		22-DEC-16	
		8.11		0.10	pH units		21-DEC-16	R3621999
		243	DLDS	20	mg/L		20-DEC-16	R3621989
		3610		0.10	NTU		21-DEC-16	R3622299
		192		10	mg/L		21-DEC-16	R3621687
		0.241		0.020	mg/L		22-DEC-16	R3622197
		0.70		0.50	mg/L		21-DEC-16	R3621957
		0.037		0.020	mg/L		21-DEC-16	R3621957
		0.540		0.020	mg/L		21-DEC-16	R3621957
		<0.010		0.010	mg/L		21-DEC-16	R3621957
		<0.0030		0.0030	mg/L		23-DEC-16	R3623140
		13.7		0.30	mg/L		21-DEC-16	R3621957
		FIELD					21-DEC-16	R3621181
		0.017		0.010	mg/L	21-DEC-16	21-DEC-16	R3621418
		<0.0050		0.0050	mg/L	21-DEC-16	21-DEC-16	R3621418
		<0.0010		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
		0.042		0.010	mg/L	21-DEC-16	21-DEC-16	R3621418
		<0.0010		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
		<0.0010		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
		<0.050		0.050	mg/L	21-DEC-16	21-DEC-16	R3621418
		<0.000090		0.000090	mg/L	21-DEC-16	21-DEC-16	R3621418
		42.9		0.50	mg/L	21-DEC-16	21-DEC-16	R3621418
		0.00062		0.00050	mg/L	21-DEC-16	21-DEC-16	R3621418

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1872101-2 DC-4 Sampled By: D.NAHRGANG on 19-DEC-16 @ 13:00 Matrix: WATER								
Dissolved Metals								
Cobalt (Co)-Dissolved		<0.00050		0.00050	mg/L	21-DEC-16	21-DEC-16	R3621418
Copper (Cu)-Dissolved		<0.0010		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
Iron (Fe)-Dissolved		<0.050		0.050	mg/L	21-DEC-16	21-DEC-16	R3621418
Lead (Pb)-Dissolved		<0.0010		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
Magnesium (Mg)-Dissolved		14.8		0.50	mg/L	21-DEC-16	21-DEC-16	R3621418
Manganese (Mn)-Dissolved		0.0036		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
Molybdenum (Mo)-Dissolved		<0.0010		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
Nickel (Ni)-Dissolved		<0.0020		0.0020	mg/L	21-DEC-16	21-DEC-16	R3621418
Phosphorus (P)-Dissolved		<0.050		0.050	mg/L	21-DEC-16	21-DEC-16	R3621418
Potassium (K)-Dissolved		1.0		1.0	mg/L	21-DEC-16	21-DEC-16	R3621418
Selenium (Se)-Dissolved		<0.00040		0.00040	mg/L	21-DEC-16	21-DEC-16	R3621418
Silicon (Si)-Dissolved		5.1		1.0	mg/L	21-DEC-16	21-DEC-16	R3621418
Silver (Ag)-Dissolved		<0.00010		0.00010	mg/L	21-DEC-16	21-DEC-16	R3621418
Sodium (Na)-Dissolved		2.08		0.50	mg/L	21-DEC-16	21-DEC-16	R3621418
Strontium (Sr)-Dissolved		0.104		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
Thallium (Tl)-Dissolved		<0.00030		0.00030	mg/L	21-DEC-16	21-DEC-16	R3621418
Tin (Sn)-Dissolved		<0.0010		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
Titanium (Ti)-Dissolved		<0.0020		0.0020	mg/L	21-DEC-16	21-DEC-16	R3621418
Tungsten (W)-Dissolved		<0.010		0.010	mg/L	21-DEC-16	21-DEC-16	R3621418
Uranium (U)-Dissolved		<0.0050		0.0050	mg/L	21-DEC-16	21-DEC-16	R3621418
Vanadium (V)-Dissolved		<0.0010		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
Zinc (Zn)-Dissolved		<0.0030		0.0030	mg/L	21-DEC-16	21-DEC-16	R3621418
Zirconium (Zr)-Dissolved		<0.0040		0.0040	mg/L	21-DEC-16	21-DEC-16	R3621418
Aggregate Organics								
Phenols (4AAP)		0.0037		0.0010	mg/L		20-DEC-16	R3621372
L1872101-3 M6 Sampled By: D.NAHRGANG on 19-DEC-16 @ 13:45 Matrix: WATER								
Physical Tests								
Colour, Apparent		174		2.0	CU		20-DEC-16	R3620938
Conductivity		340		3.0	umhos/cm		21-DEC-16	R3621999
Hardness (as CaCO3)		170		10	mg/L		22-DEC-16	
pH		8.06		0.10	pH units		21-DEC-16	R3621999
Total Dissolved Solids		230	DLDS	20	mg/L		20-DEC-16	R3621989
Turbidity		2870		0.10	NTU		21-DEC-16	R3622299
Anions and Nutrients								
Alkalinity, Total (as CaCO3)		190		10	mg/L		21-DEC-16	R3621687
Ammonia, Total (as N)		0.303		0.020	mg/L		22-DEC-16	R3622197
Chloride (Cl)		0.56		0.50	mg/L		21-DEC-16	R3621957
Fluoride (F)		0.038		0.020	mg/L		21-DEC-16	R3621957
Nitrate (as N)		0.998		0.020	mg/L		21-DEC-16	R3621957
Nitrite (as N)		<0.010		0.010	mg/L		21-DEC-16	R3621957

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1872101-3 M6 Sampled By: D.NAHRGANG on 19-DEC-16 @ 13:45 Matrix: WATER							
Anions and Nutrients							
Orthophosphate-Dissolved (as P)	<0.0030		0.0030	mg/L		23-DEC-16	R3623140
Sulfate (SO4)	9.13		0.30	mg/L		21-DEC-16	R3621957
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					21-DEC-16	R3621181
Aluminum (Al)-Dissolved	<0.010		0.010	mg/L	21-DEC-16	21-DEC-16	R3621418
Antimony (Sb)-Dissolved	<0.0050		0.0050	mg/L	21-DEC-16	21-DEC-16	R3621418
Arsenic (As)-Dissolved	<0.0010		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
Barium (Ba)-Dissolved	0.072		0.010	mg/L	21-DEC-16	21-DEC-16	R3621418
Beryllium (Be)-Dissolved	<0.0010		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
Bismuth (Bi)-Dissolved	<0.0010		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
Boron (B)-Dissolved	<0.050		0.050	mg/L	21-DEC-16	21-DEC-16	R3621418
Cadmium (Cd)-Dissolved	<0.000090		0.000090	mg/L	21-DEC-16	21-DEC-16	R3621418
Calcium (Ca)-Dissolved	46.5		0.50	mg/L	21-DEC-16	21-DEC-16	R3621418
Chromium (Cr)-Dissolved	<0.00050		0.00050	mg/L	21-DEC-16	21-DEC-16	R3621418
Cobalt (Co)-Dissolved	<0.00050		0.00050	mg/L	21-DEC-16	21-DEC-16	R3621418
Copper (Cu)-Dissolved	<0.0010		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
Iron (Fe)-Dissolved	<0.050		0.050	mg/L	21-DEC-16	21-DEC-16	R3621418
Lead (Pb)-Dissolved	<0.0010		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
Magnesium (Mg)-Dissolved	13.2		0.50	mg/L	21-DEC-16	21-DEC-16	R3621418
Manganese (Mn)-Dissolved	0.0232		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
Molybdenum (Mo)-Dissolved	<0.0010		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
Nickel (Ni)-Dissolved	<0.0020		0.0020	mg/L	21-DEC-16	21-DEC-16	R3621418
Phosphorus (P)-Dissolved	<0.050		0.050	mg/L	21-DEC-16	21-DEC-16	R3621418
Potassium (K)-Dissolved	1.1		1.0	mg/L	21-DEC-16	21-DEC-16	R3621418
Selenium (Se)-Dissolved	<0.00040		0.00040	mg/L	21-DEC-16	21-DEC-16	R3621418
Silicon (Si)-Dissolved	5.9		1.0	mg/L	21-DEC-16	21-DEC-16	R3621418
Silver (Ag)-Dissolved	<0.00010		0.00010	mg/L	21-DEC-16	21-DEC-16	R3621418
Sodium (Na)-Dissolved	1.96		0.50	mg/L	21-DEC-16	21-DEC-16	R3621418
Strontium (Sr)-Dissolved	0.117		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
Thallium (Tl)-Dissolved	<0.00030		0.00030	mg/L	21-DEC-16	21-DEC-16	R3621418
Tin (Sn)-Dissolved	<0.0010		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
Titanium (Ti)-Dissolved	<0.0020		0.0020	mg/L	21-DEC-16	21-DEC-16	R3621418
Tungsten (W)-Dissolved	<0.010		0.010	mg/L	21-DEC-16	21-DEC-16	R3621418
Uranium (U)-Dissolved	<0.0050		0.0050	mg/L	21-DEC-16	21-DEC-16	R3621418
Vanadium (V)-Dissolved	<0.0010		0.0010	mg/L	21-DEC-16	21-DEC-16	R3621418
Zinc (Zn)-Dissolved	0.0045		0.0030	mg/L	21-DEC-16	21-DEC-16	R3621418
Zirconium (Zr)-Dissolved	<0.0040		0.0040	mg/L	21-DEC-16	21-DEC-16	R3621418
Aggregate Organics							
Phenols (4AAP)	0.0054		0.0010	mg/L		20-DEC-16	R3621372

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1872101-1, -2, -3
Matrix Spike	Boron (B)-Dissolved	MS-B	L1872101-1, -2, -3
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1872101-1, -2, -3
Matrix Spike	Cobalt (Co)-Dissolved	MS-B	L1872101-1, -2, -3
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1872101-1, -2, -3
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1872101-1, -2, -3
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1872101-1, -2, -3
Matrix Spike	Potassium (K)-Dissolved	MS-B	L1872101-1, -2, -3
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1872101-1, -2, -3
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1872101-1, -2, -3
Matrix Spike	Uranium (U)-Dissolved	MS-B	L1872101-1, -2, -3
Matrix Spike	Orthophosphate-Dissolved (as P)	MS-B	L1872101-1, -2, -3

Sample Parameter Qualifier key 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.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-WT	Water	Alkalinity, Total (as CaCO3)	EPA 310.2
CL-IC-WT	Water	Chloride by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).			
COLOUR-WT	Water	Colour	APHA 2120
Apparent Colour is measured spectrophotometrically by comparison to platinum-cobalt standards using the single wavelength method after sample decanting. Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-WT	Water	Conductivity	APHA 2510 B
Water samples can be measured directly by immersing the conductivity cell into the sample.			
F-IC-N-WT	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-WT	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.			
MET-D-CCMS-WT	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.			
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).			
NH3-WT	Water	Ammonia, Total as N	EPA 350.1
Sample is measured colorimetrically. When sample is turbid a distillation step is required, sample is distilled into a solution of boric acid and measured colorimetrically.			
NO2-IC-WT	Water	Nitrite in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-IC-WT	Water	Nitrate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
PH-WT	Water	pH	APHA 4500 H-Electrode
Water samples are analyzed directly by a calibrated pH meter.			

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011). Holdtime for samples under this regulation is 28 days

PHENOLS-4AAP-WT Water Phenol (4AAP) EPA 9066

An automated method is used to distill the sample. The distillate is then buffered to pH 9.4 which reacts with 4AAP and potassium ferricyanide to form a red complex which is measured colorimetrically.

PO4-DO-COL-WT Water Diss. Orthophosphate in Water by Colour APHA 4500-P PHOSPHORUS

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

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

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

SOLIDS-TDS-WT Water Total Dissolved Solids APHA 2540C

A well-mixed sample is filtered though glass fibres filter. A known volume of the filtrate is evaporated and dried at 105–5℃ overnight and then 180–10℃ for 1hr.

TURBIDITY-WT Water Turbidity APHA 2130 B

Sample result is based on a comparison of the intensity of the light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension under the same conditions. Sample readings are obtained from a Nephelometer.

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

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

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

15-557399

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

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 weight of sample
mg/L - unit of concentration based on volume, parts per million.

< - Less than.
D.L. - The reporting limit.
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.