



HEMMERA ENVIROCHEM INC.
ATTN: Natasha Sandys
230 - 2237 2nd Avenue
Whitehorse YK Y1A 0K7

Date Received: 20-JUN-16
Report Date: 15-JUL-16 11:12 (MT)
Version: FINAL REV. 2

Client Phone: 867-456-4865

Certificate of Analysis

Lab Work Order #: L1785857
Project P.O. #: NOT SUBMITTED
Job Reference: 1343-005.17
C of C Numbers: 1, 2
Legal Site Desc:

Comments:

15-JUL-2016 This report replaces the previous version and contains additional analyses, as requested.

Brent Mack, B.Sc.
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
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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L1785857-1 Water 16-JUN-16 14:45 R1	L1785857-2 Water 17-JUN-16 10:30 R1	L1785857-3 Water 16-JUN-16 13:30 R2	L1785857-4 Water 17-JUN-16 10:30 R2	L1785857-5 Water 20-JUN-16 TRAVEL BLANK
Grouping	Analyte				
WATER					
Physical Tests	Conductivity (uS/cm)		712	659	<2.0
	Hardness (as CaCO3) (mg/L)	392		356	<0.50
	pH (pH)		8.17	8.22	5.18
	Total Suspended Solids (mg/L)		7.3	7.3	<3.0
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	0.0194		0.0120	0.0401 ^{RRV}
	Nitrate (as N) (mg/L)		0.119	0.0448	<0.0050
	Nitrite (as N) (mg/L)		<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Total (mg/L)	0.0106		0.0087	<0.0020
	Sulfate (SO4) (mg/L)		222	178	<0.30
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	11.6		8.99	
	Total Organic Carbon (mg/L)				<0.50
Total Metals	Aluminum (Al)-Total (mg/L)	0.175		0.109	<0.0030
	Antimony (Sb)-Total (mg/L)	0.00023		0.00047	<0.00010
	Arsenic (As)-Total (mg/L)	0.00066		0.00091	<0.00010
	Barium (Ba)-Total (mg/L)	0.0505		0.0476	<0.000050
	Beryllium (Be)-Total (mg/L)	<0.000020		<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050		<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010		0.011	<0.010
	Cadmium (Cd)-Total (mg/L)	0.0000625		0.0000203	<0.0000050
	Calcium (Ca)-Total (mg/L)	82.9		59.6	<0.050
	Chromium (Cr)-Total (mg/L)	<0.00070 ^{DLB}		<0.00070 ^{DLB}	<0.00010
	Cobalt (Co)-Total (mg/L)	0.00057		0.00022	<0.00010
	Copper (Cu)-Total (mg/L)	0.00250		0.00151	<0.00050
	Iron (Fe)-Total (mg/L)	0.503		0.436	<0.010
	Lead (Pb)-Total (mg/L)	0.000258		0.000077	<0.000050
	Lithium (Li)-Total (mg/L)	0.0037		0.0059	<0.0010
	Magnesium (Mg)-Total (mg/L)	37.3		46.7	<0.10
	Manganese (Mn)-Total (mg/L)	0.230		0.0750	<0.00010
	Mercury (Hg)-Total (mg/L)	0.0000051		<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	0.00134		0.000648	<0.000050
	Nickel (Ni)-Total (mg/L)	0.00431		0.00299	<0.00050
	Phosphorus (P)-Total (mg/L)	<0.050		<0.050	<0.050
	Potassium (K)-Total (mg/L)	0.61		0.81	<0.10
	Selenium (Se)-Total (mg/L)	0.00246		0.000448	<0.000050
	Silicon (Si)-Total (mg/L)	4.28		5.29	<0.050
	Silver (Ag)-Total (mg/L)	<0.000010		<0.000010	<0.000010

* 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	L1785857-6 Water 17-JUN-16 16:45 R3	L1785857-7 Water 18-JUN-16 11:00 R6	L1785857-8 Water 18-JUN-16 11:00 DUP-3	L1785857-9 Water 17-JUN-16 12:45 R7	L1785857-10 Water 16-JUN-16 12:45 R8	
Grouping	Analyte					
WATER						
Physical Tests	Conductivity (uS/cm)	806	189	189	182	
	Hardness (as CaCO3) (mg/L)	461	86.4	87.3	98.6	132
	pH (pH)	8.26	7.86	7.84	7.51	
	Total Suspended Solids (mg/L)	68.7	10.7	8.7	19.3	
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	0.0177	0.0082	0.0102	0.0412	<0.0050
	Nitrate (as N) (mg/L)	0.0558	0.0265	0.0269	0.0885	
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	
	Phosphorus (P)-Total (mg/L)	0.0055	0.0078	0.0075	0.0292	0.0052
	Sulfate (SO4) (mg/L)	261	31.7	31.6	31.6	
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	12.8	15.2	15.2	28.3	14.7
	Total Organic Carbon (mg/L)					
Total Metals	Aluminum (Al)-Total (mg/L)	1.93	0.149	0.156	0.470	0.0581
	Antimony (Sb)-Total (mg/L)	0.00029	0.00012	0.00012	0.00022	0.00184
	Arsenic (As)-Total (mg/L)	0.00194	0.00061	0.00060	0.00141	0.00040
	Barium (Ba)-Total (mg/L)	0.117	0.0352	0.0345	0.0778	0.0483
	Beryllium (Be)-Total (mg/L)	0.000077	<0.000020	<0.000020	0.000034	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	0.0000492	0.0000160	0.0000169	0.0000257	0.0000270
	Calcium (Ca)-Total (mg/L)	82.7	21.0	21.9	20.9	31.4
	Chromium (Cr)-Total (mg/L)	0.00425	<0.00050 ^{DLB}	<0.00050 ^{DLB}	0.00227	0.00093
	Cobalt (Co)-Total (mg/L)	0.00130	0.00024	0.00027	0.00086	<0.00010
	Copper (Cu)-Total (mg/L)	0.00551	0.00291	0.00305	0.00493	0.00221
	Iron (Fe)-Total (mg/L)	3.31	0.304	0.314	1.93	0.118
	Lead (Pb)-Total (mg/L)	0.00132	0.000063	0.000088	0.000280	<0.000050
	Lithium (Li)-Total (mg/L)	0.0057	0.0033	0.0034	<0.0010	<0.0010
	Magnesium (Mg)-Total (mg/L)	54.5	7.21	7.56	9.63	11.8
	Manganese (Mn)-Total (mg/L)	0.133	0.0253	0.0268	0.206	0.00425
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	0.00137	0.000429	0.000431	0.000529	0.000787
	Nickel (Ni)-Total (mg/L)	0.00880	0.00239	0.00252	0.00445	0.00347
	Phosphorus (P)-Total (mg/L)	0.060	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	1.20	0.87	0.91	0.21	<0.10
	Selenium (Se)-Total (mg/L)	0.000570	0.000150	0.000170	0.000290	0.000561
Silicon (Si)-Total (mg/L)	8.94	4.38	4.59	5.11	5.53	
Silver (Ag)-Total (mg/L)	0.000029	<0.000010	<0.000010	<0.000010	<0.000010	

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L1785857-11 Water 17-JUN-16 10:35 R8	L1785857-12 Water 17-JUN-16 09:50 R9	L1785857-13 Water 17-JUN-16 17:50 R11	L1785857-14 Water 17-JUN-16 14:40 SL	L1785857-15 Water 17-JUN-16 10:15 R9	
Grouping	Analyte					
WATER						
Physical Tests	Conductivity (uS/cm)	260		406	1470	528
	Hardness (as CaCO3) (mg/L)		310	214	967	
	pH (pH)	7.57		7.86	8.25	7.85
	Total Suspended Solids (mg/L)	4.7		38.0	20.7	<3.0
Anions and Nutrients	Ammonia, Total (as N) (mg/L)		0.0396			
	Nitrate (as N) (mg/L)	<0.0050		0.117	0.019	0.170
	Nitrite (as N) (mg/L)	<0.0010		<0.0010	<0.0020 ^{DLDS}	0.0011
	Phosphorus (P)-Total (mg/L)		0.0105			
	Sulfate (SO4) (mg/L)	79.1		109	669	170
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)		23.6			
	Total Organic Carbon (mg/L)					
Total Metals	Aluminum (Al)-Total (mg/L)		0.0507	0.151	0.215	
	Antimony (Sb)-Total (mg/L)		0.00023	0.00024	0.00281	
	Arsenic (As)-Total (mg/L)		0.00076	0.00061	0.0163	
	Barium (Ba)-Total (mg/L)		0.0713	0.0551	0.0298	
	Beryllium (Be)-Total (mg/L)		<0.000020	<0.000020	<0.000020	
	Bismuth (Bi)-Total (mg/L)		<0.000050	<0.000050	<0.000050	
	Boron (B)-Total (mg/L)		<0.010	<0.010	0.042	
	Cadmium (Cd)-Total (mg/L)		0.0000459	0.0000376	0.0000282	
	Calcium (Ca)-Total (mg/L)		67.2	48.2	210	
	Chromium (Cr)-Total (mg/L)		0.00089	0.00108	0.00725	
	Cobalt (Co)-Total (mg/L)		0.00047	0.00021	0.00075	
	Copper (Cu)-Total (mg/L)		0.00408	0.00280	0.00205	
	Iron (Fe)-Total (mg/L)		0.930	0.315	0.483	
	Lead (Pb)-Total (mg/L)		0.000051	0.000163	0.000244	
	Lithium (Li)-Total (mg/L)		<0.0010	<0.0010	0.0114	
	Magnesium (Mg)-Total (mg/L)		30.5	21.9	98.2	
	Manganese (Mn)-Total (mg/L)		0.300	0.0163	0.0138	
	Mercury (Hg)-Total (mg/L)		0.0000061	<0.0000050	<0.0000050	
	Molybdenum (Mo)-Total (mg/L)		0.00143	0.00109	0.00200	
	Nickel (Ni)-Total (mg/L)		0.00387	0.00307	0.0241	
	Phosphorus (P)-Total (mg/L)		<0.050	<0.050	<0.050	
	Potassium (K)-Total (mg/L)		0.54	0.54	1.40	
	Selenium (Se)-Total (mg/L)		0.00109	0.000696	0.0157	
	Silicon (Si)-Total (mg/L)		4.31	5.77	4.74	
Silver (Ag)-Total (mg/L)		<0.000010	0.000012	<0.000010		

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ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1785857-1	L1785857-2	L1785857-3	L1785857-4	L1785857-5
		Description	Water	Water	Water	Water	Water
		Sampled Date	16-JUN-16	17-JUN-16	16-JUN-16	17-JUN-16	20-JUN-16
		Sampled Time	14:45	10:30	13:30	10:30	
		Client ID	R1	R1	R2	R2	TRAVEL BLANK
Grouping	Analyte						
WATER							
Total Metals	Sodium (Na)-Total (mg/L)		3.34		2.89		<0.050
	Strontium (Sr)-Total (mg/L)		0.381		0.312		<0.00020
	Sulfur (S)-Total (mg/L)		71.4		59.3		<0.50
	Thallium (Tl)-Total (mg/L)		0.000010		<0.000010		<0.000010
	Tin (Sn)-Total (mg/L)		<0.00010		<0.00010		<0.00010
	Titanium (Ti)-Total (mg/L)		0.00438		0.00318		<0.00030
	Uranium (U)-Total (mg/L)		0.00259		0.00390		<0.000010
	Vanadium (V)-Total (mg/L)		0.00060		0.00063		<0.00050
	Zinc (Zn)-Total (mg/L)		0.0036		<0.0030		<0.0030
	Zirconium (Zr)-Total (mg/L)		0.00056		0.00038		<0.00030
Dissolved Metals	Dissolved Mercury Filtration Location		FIELD		FIELD		
	Dissolved Metals Filtration Location		FIELD		FIELD		
	Aluminum (Al)-Dissolved (mg/L)		0.0214		0.0244		
	Antimony (Sb)-Dissolved (mg/L)		0.00023		0.00045		
	Arsenic (As)-Dissolved (mg/L)		0.00054		0.00086		
	Barium (Ba)-Dissolved (mg/L)		0.0518		0.0506		
	Beryllium (Be)-Dissolved (mg/L)		<0.000020		<0.000020		
	Bismuth (Bi)-Dissolved (mg/L)		<0.000050		<0.000050		
	Boron (B)-Dissolved (mg/L)		<0.010		0.010		
	Cadmium (Cd)-Dissolved (mg/L)		0.0000607		0.0000180		
	Calcium (Ca)-Dissolved (mg/L)		89.7		63.0		
	Chromium (Cr)-Dissolved (mg/L)		0.00023		0.00050		
	Cobalt (Co)-Dissolved (mg/L)		0.00044		0.00017		
	Copper (Cu)-Dissolved (mg/L)		0.00213		0.00133		
	Iron (Fe)-Dissolved (mg/L)		0.212		0.277		
	Lead (Pb)-Dissolved (mg/L)		<0.000050		<0.000050		
	Lithium (Li)-Dissolved (mg/L)		0.0037		0.0059		
	Magnesium (Mg)-Dissolved (mg/L)		40.8		48.3		
	Manganese (Mn)-Dissolved (mg/L)		0.231		0.0731		
	Mercury (Hg)-Dissolved (mg/L)		<0.0000050		<0.0000050		
	Molybdenum (Mo)-Dissolved (mg/L)		0.00130		0.000606		
	Nickel (Ni)-Dissolved (mg/L)		0.00407		0.00302		
	Phosphorus (P)-Dissolved (mg/L)		<0.050		<0.050		
	Potassium (K)-Dissolved (mg/L)		0.63		0.83		
	Selenium (Se)-Dissolved (mg/L)		0.00256		0.000428		
	Silicon (Si)-Dissolved (mg/L)		4.38		5.33		
	Silver (Ag)-Dissolved (mg/L)		<0.000010		<0.000010		

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L1785857-6	L1785857-7	L1785857-8	L1785857-9	L1785857-10
					Water	Water	Water	Water	Water
		17-JUN-16	16:45	R3	17-JUN-16	18-JUN-16	18-JUN-16	17-JUN-16	16-JUN-16
					16:45	11:00	11:00	12:45	12:45
					R3	R6	DUP-3	R7	R8
Grouping	Analyte								
WATER									
Total Metals	Sodium (Na)-Total (mg/L)	3.97	3.51	3.69	1.58	3.83			
	Strontium (Sr)-Total (mg/L)	0.386	0.123	0.124	0.0648	0.120			
	Sulfur (S)-Total (mg/L)	87.4	11.1	11.2	10.9	27.6			
	Thallium (Tl)-Total (mg/L)	0.000032	<0.000010	<0.000010	<0.000010	<0.000010			
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010			
	Titanium (Ti)-Total (mg/L)	0.0515	0.00296	0.00280	0.0133	0.00107			
	Uranium (U)-Total (mg/L)	0.00582	0.000786	0.000761	0.000103	0.000052			
	Vanadium (V)-Total (mg/L)	0.00599	0.00088	0.00093	0.00226	<0.00050			
	Zinc (Zn)-Total (mg/L)	0.0115	<0.0030	<0.0030	0.0031	<0.0030			
	Zirconium (Zr)-Total (mg/L)	0.00085	0.00069	0.00070	0.00090	0.00047			
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)	0.0251	0.0997	0.101	0.107	0.0296			
	Antimony (Sb)-Dissolved (mg/L)	0.00019	0.00012	0.00012	0.00021	0.00188			
	Arsenic (As)-Dissolved (mg/L)	0.00060	0.00055	0.00056	0.00126	0.00033			
	Barium (Ba)-Dissolved (mg/L)	0.0566	0.0346	0.0348	0.0732	0.0476			
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	0.000024	<0.000020			
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050			
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010			
	Cadmium (Cd)-Dissolved (mg/L)	0.0000068	0.0000143	0.0000130	0.0000093	0.0000254			
	Calcium (Ca)-Dissolved (mg/L)	89.3	22.1	22.3	22.5	32.7			
	Chromium (Cr)-Dissolved (mg/L)	0.00044	0.00037	0.00040	0.00147	0.00070			
	Cobalt (Co)-Dissolved (mg/L)	0.00025	0.00021	0.00021	0.00068	<0.00010			
	Copper (Cu)-Dissolved (mg/L)	0.00167	0.00287	0.00291	0.00454	0.00211			
	Iron (Fe)-Dissolved (mg/L)	0.143	0.217	0.207	1.36	0.057			
	Lead (Pb)-Dissolved (mg/L)	<0.000050	0.000051	<0.000050	0.000057	<0.000050			
	Lithium (Li)-Dissolved (mg/L)	0.0042	0.0035	0.0035	<0.0010	<0.0010			
	Magnesium (Mg)-Dissolved (mg/L)	57.7	7.60	7.71	10.3	12.2			
	Manganese (Mn)-Dissolved (mg/L)	0.0840	0.0235	0.0239	0.218	0.00336			
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050			
	Molybdenum (Mo)-Dissolved (mg/L)	0.00121	0.000397	0.000384	0.000522	0.000726			
	Nickel (Ni)-Dissolved (mg/L)	0.00309	0.00242	0.00239	0.00422	0.00336			
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050			
	Potassium (K)-Dissolved (mg/L)	0.89	0.95	0.97	0.20	<0.10			
	Selenium (Se)-Dissolved (mg/L)	0.000471	0.000161	0.000179	0.000317	0.000518			
	Silicon (Si)-Dissolved (mg/L)	5.71	4.45	4.50	4.77	5.57			
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010			

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L1785857-11 Water 17-JUN-16 10:35 R8	L1785857-12 Water 17-JUN-16 09:50 R9	L1785857-13 Water 17-JUN-16 17:50 R11	L1785857-14 Water 17-JUN-16 14:40 SL	L1785857-15 Water 17-JUN-16 10:15 R9
Grouping	Analyte				
WATER					
Total Metals	Sodium (Na)-Total (mg/L)	2.66	5.80	2.42	
	Strontium (Sr)-Total (mg/L)	0.246	0.213	0.949	
	Sulfur (S)-Total (mg/L)	61.1	38.8	227	
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	0.000025	
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Titanium (Ti)-Total (mg/L)	0.00165	0.00431	0.00486	
	Uranium (U)-Total (mg/L)	0.000955	0.00112	0.00305	
	Vanadium (V)-Total (mg/L)	0.00054	0.00079	0.00075	
	Zinc (Zn)-Total (mg/L)	<0.0030	0.0047	0.0034	
	Zirconium (Zr)-Total (mg/L)	0.00098	0.00078	<0.00030	
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	
	Aluminum (Al)-Dissolved (mg/L)	0.0431	0.0374	0.0020	
	Antimony (Sb)-Dissolved (mg/L)	0.00021	0.00022	0.00270	
	Arsenic (As)-Dissolved (mg/L)	0.00081	0.00049	0.0168	
	Barium (Ba)-Dissolved (mg/L)	0.0731	0.0541	0.0288	
	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	0.041	
	Cadmium (Cd)-Dissolved (mg/L)	0.0000367	0.0000193	0.0000187	
	Calcium (Ca)-Dissolved (mg/L)	71.6	49.2	220	
	Chromium (Cr)-Dissolved (mg/L)	0.00078	0.00081	0.00124	
	Cobalt (Co)-Dissolved (mg/L)	0.00047	0.00012	0.00014	
	Copper (Cu)-Dissolved (mg/L)	0.00406	0.00239	0.00104	
	Iron (Fe)-Dissolved (mg/L)	0.884	0.111	<0.010	
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010	0.0110	
	Magnesium (Mg)-Dissolved (mg/L)	31.9	22.2	101	
	Manganese (Mn)-Dissolved (mg/L)	0.310	0.0102	0.00527	
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	
	Molybdenum (Mo)-Dissolved (mg/L)	0.00133	0.00100	0.00184	
	Nickel (Ni)-Dissolved (mg/L)	0.00381	0.00279	0.0156	
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	
	Potassium (K)-Dissolved (mg/L)	0.59	0.52	1.43	
	Selenium (Se)-Dissolved (mg/L)	0.00112	0.000692	0.0163	
	Silicon (Si)-Dissolved (mg/L)	4.51	5.59	4.13	
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	

* 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	L1785857-1	L1785857-2	L1785857-3	L1785857-4	L1785857-5
					Water	Water	Water	Water	Water
		16-JUN-16	14:45	R1	16-JUN-16	17-JUN-16	16-JUN-16	17-JUN-16	20-JUN-16
					R1	R1	R2	R2	TRAVEL BLANK
Grouping	Analyte								
WATER									
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)		3.56				3.01		
	Strontium (Sr)-Dissolved (mg/L)		0.401				0.318		
	Sulfur (S)-Dissolved (mg/L)		75.0				59.0		
	Thallium (Tl)-Dissolved (mg/L)		<0.000010				<0.000010		
	Tin (Sn)-Dissolved (mg/L)		<0.00010				<0.00010		
	Titanium (Ti)-Dissolved (mg/L)		0.00033				0.00038		
	Uranium (U)-Dissolved (mg/L)		0.00263				0.00387		
	Vanadium (V)-Dissolved (mg/L)		<0.00050				<0.00050		
	Zinc (Zn)-Dissolved (mg/L)		0.0023				<0.0010		
	Zirconium (Zr)-Dissolved (mg/L)		0.00063				0.00042		
Speciated Metals	Chromium (III)-Dissolved (mg/L)								
	Chromium (III)-Total (mg/L)								
	Hexavalent Chromium (mg/L)								
	Hexavalent Chromium-Dissolved (mg/L)								

* 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	L1785857-6	L1785857-7	L1785857-8	L1785857-9	L1785857-10
					Water	Water	Water	Water	Water
		17-JUN-16	16:45	R3	17-JUN-16	18-JUN-16	18-JUN-16	17-JUN-16	16-JUN-16
					16:45	11:00	11:00	12:45	12:45
					R3	R6	DUP-3	R7	R8
Grouping	Analyte								
WATER									
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)		4.01	3.70	3.69	1.70	3.90		
	Strontium (Sr)-Dissolved (mg/L)		0.397	0.124	0.123	0.0674	0.121		
	Sulfur (S)-Dissolved (mg/L)		91.8	11.2	11.2	11.4	27.8		
	Thallium (Tl)-Dissolved (mg/L)		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010	<0.00010	0.00021		
	Titanium (Ti)-Dissolved (mg/L)		0.00041	0.00102	0.00098	0.00246	0.00043		
	Uranium (U)-Dissolved (mg/L)		0.00571	0.000730	0.000731	0.000084	0.000043		
	Vanadium (V)-Dissolved (mg/L)		0.00063	0.00072	0.00072	0.00115	<0.00050		
	Zinc (Zn)-Dissolved (mg/L)		0.0013	0.0077	0.0068	0.0017	0.0024		
	Zirconium (Zr)-Dissolved (mg/L)		0.00053	0.00072	0.00073	0.00115	0.00049		
Speciated Metals	Chromium (III)-Dissolved (mg/L)					0.00147			
	Chromium (III)-Total (mg/L)		0.00325			0.00127			
	Hexavalent Chromium (mg/L)		0.0010			0.0010			
	Hexavalent Chromium-Dissolved (mg/L)					<0.0010			

* 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	L1785857-11 Water 17-JUN-16 10:35 R8	L1785857-12 Water 17-JUN-16 09:50 R9	L1785857-13 Water 17-JUN-16 17:50 R11	L1785857-14 Water 17-JUN-16 14:40 SL	L1785857-15 Water 17-JUN-16 10:15 R9
Grouping	Analyte					
WATER						
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)		2.70	5.83	2.39	
	Strontium (Sr)-Dissolved (mg/L)		0.243	0.212	0.946	
	Sulfur (S)-Dissolved (mg/L)		61.3	38.3	230	
	Thallium (Tl)-Dissolved (mg/L)		<0.000010	<0.000010	0.000016	
	Tin (Sn)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010	
	Titanium (Ti)-Dissolved (mg/L)		0.00124	0.00060	<0.00030	
	Uranium (U)-Dissolved (mg/L)		0.000926	0.00107	0.00299	
	Vanadium (V)-Dissolved (mg/L)		0.00051	<0.00050	<0.00050	
	Zinc (Zn)-Dissolved (mg/L)		0.0015	0.0033	0.0021	
	Zirconium (Zr)-Dissolved (mg/L)		0.00104	0.00080	<0.00030	
Speciated Metals	Chromium (III)-Dissolved (mg/L)				<0.00042	
	Chromium (III)-Total (mg/L)			<0.00072	0.00535	
	Hexavalent Chromium (mg/L)			0.0010	0.0019	
	Hexavalent Chromium-Dissolved (mg/L)				0.0016	

* 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)
Duplicate	Chromium (Cr)-Total	DLB	L1785857-1, -10, -12, -13, -14, -3, -5, -6, -7, -8, -9
Method Blank	Chromium (Cr)-Total	MB-LOR	L1785857-1, -10, -12, -13, -14, -3, -5, -6, -7, -8, -9
Matrix Spike	Sulfate (SO ₄)	MS-B	L1785857-11, -13, -14, -15, -2, -4, -5, -6, -7, -8, -9
Matrix Spike	Phosphorus (P)-Total	MS-B	L1785857-1, -10, -12, -3, -5, -6, -7, -8, -9
Matrix Spike	Manganese (Mn)-Total	MS-B	L1785857-1, -10, -12, -13, -14, -3, -5, -6, -7, -8, -9
Matrix Spike	Sodium (Na)-Total	MS-B	L1785857-1, -10, -12, -13, -14, -3, -5, -6, -7, -8, -9
Matrix Spike	Strontium (Sr)-Total	MS-B	L1785857-1, -10, -12, -13, -14, -3, -5, -6, -7, -8, -9
Matrix Spike	Dissolved Organic Carbon	MS-B	L1785857-12, -9

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLB	Detection Limit Raised. Analyte detected at comparable level in Method Blank.
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.
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.	
CARBONS-TOC-VA	Water	Total 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)".	
CR-CR3-DIS-CALC-ED	Water	Dissolved Trivalent Chromium in Water	CALCULATION
		Chromium (III)-Dissolved is calculated as the difference between the dissolved chromium and the dissolved hexavalent chromium (Cr(VI)) results.	
CR-CR3-TOT-CALC-ED	Water	Total Trivalent Chromium in Water	CALCULATION
		Chromium (III)-Total is calculated as the difference between the total chromium and the hexavalent chromium (Cr(VI)) results.	
CR-CR6-ED	Water	Chromium, Hexavalent (Cr +6)	APHA 3500-Cr C (Ion Chromatography)
		This analysis is carried out using procedures adapted from method 3500-Cr C in "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from Method 1636 published by the United States Environmental Protection Agency (EPA). The procedure involves analysis for chromium (VI) by ion chromatography using diphenylcarbazide in a sulphuric acid solution.	
		Results are based on an un-filtered, field-preserved sample.	
CR6-D-IC-ED	Water	Chromium, Dissolved Hexavalent (Cr +6)	APHA 3500-Cr C (Ion Chromatography)
		This analysis is carried out using procedures adapted from method 3500-Cr C in "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from Method 1636 published by the United States Environmental Protection Agency (EPA). The procedure involves analysis for chromium (VI) by ion chromatography using diphenylcarbazide in a sulphuric acid solution.	
		Results are based on a field-filtered, field-preserved sample.	
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.	

Reference Information

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 CaCO ₃ 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.			
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-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-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.			
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.			
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			

Reference Information

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.

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
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA
WR	ALS ENVIRONMENTAL - WHITEHORSE, YUKON, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

1 2

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.



Contact: Brent Mack
Company: ALS Environmental
Address: 8081 Lougheed HWY, Suite 100
Burnaby, BC V5A1W9

REFERENCE DATA

Project / Location: L1785857

PO Number: L1785857

ALS Work Order: 1606852

TEM Water Narrative: Analysis performed on FEI Tecnai TEM with integrated EDXA capabilities. Morphology, EDXA, and SAED measurements used to determine fiber species. Representative EDXA spectra of each asbestos type detected included. Compliance samples must be received and filtered within 48 hours of collection. Collection is performed outside ALS and is the responsibility of the client. Samples disposed after 60 days. TEM grids archived 3 years. Results apply only to portions analyzed.

TEM Water Methods: "EPA 100.2" refers to drinking water samples filtered on 47mm, 0.22µm pore MCE filters. "EPA 100.1" refers to drinking water samples filtered on 47mm, 0.1µm pore Polycarbonate filters. No standard method for asbestos in nonpotable water exists. All TEM waters (potable and nonpotable) analyzed at >10,000x magnification for asbestos fibers >10µm long. Whenever possible, sufficient volume is analyzed to yield an AS of <0.20 MFL based on the detection of 1 confirmed asbestos fiber in the total area analyzed. However, the volume analyzed is dependent upon a filter loading of <25% particulate. Samples containing excessive suspended solids may not reach the recommended AS of <0.20 MFL. In any case, a minimum of 4 and a maximum of 10 openings are analyzed regardless of the AS reached or asbestos concentration detected. ALS will report results directly to state of origin only when;

- a) the Chain of Custody clearly states "drinking water for state compliance",
- b) the appropriate state drinking water form is submitted with the samples,
- c) the state form is completely filled out by the client prior to submittal, and
- d) the address to which the form is to be sent is provided.

NOTES: NA=Not Applicable, ND=None Detected, AS=Analytical Sensitivity, MFL=Millions of Fibers per Liter. [†] Act-Tremolite concentrations include Actinolite as well as the Libby Amphiboles; Tremolite, Winchite, & Richterite.

OH Lab ID: #4077, Ohio Analysts; P. Johnson #2268, A. Sohn #3431

PA Lab ID: #68-01320, Cert. #003

NELAC accredited through New York ELAP, LAB #11371

TEM ANALYSIS DATA

EDXA Resolution (eV): <175

Accelerating Voltage (keV): 100

Prep Start Date: 6/27/2016

Calibration Constant (µm/cm): 0.74

Camera Constant (mm-Å): 129.25

Analysis Start Date: 6/28/2016

Pamela Johnson

Pamela Johnson
ALS TEM Analyst

Shawn Smythe

Shawn Smythe
ALS Project Manager

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IDENTIFICATION

Client Sample ID:	L1785857-2 R1	L1785857-6 R3
ALS Sample ID:	1606852-01	1606852-02
Method:	EPA 100.2	EPA 100.2
Date of Collection:	6/17/2016	6/17/2016
Time of Collection:	9:56	9:56

FILTRATION & ANALYSIS

Date of Filtration:	6/23/2016	6/23/2016
Time of Filtration:	15:35	15:35
Volume Filtered (L):	0.01	0.005
Openings Analyzed:	10	10
Avg. Opening Area (mm ²):	0.011	0.011
AS (MFL):	0.98	1.95

ASBESTOS COUNT

Chrysotile:	0	0
Amosite:	0	0
Crocidolite:	0	0
Act-Tremolite [†] :	0	0
Anthophyllite:	0	0
Total Asbestos:	0	0

ASBESTOS CONCENTRATION (MFL)

Chrysotile:	<AS	<AS
Amosite:	<AS	<AS
Crocidolite:	<AS	<AS
Act-Tremolite [†] :	<AS	<AS
Anthophyllite:	<AS	<AS
Total Asbestos:	<AS	<AS

NOTES

Samples L1785857-2 R1 and L1785857-6 R3 were received past the method hold time of 48 hours from time and date of sample collection written on sample bottle labels.

EDXA SPECTRA

NOTE: Spurious peaks may originate from low background sample holder, column pole pieces, TEM grids, prep solutions or matrix materials.

NONE: No asbestos detected.

PHOTOMICROGRAPHS

Collected using Gatan Digital Micrograph.

NONE: No asbestos detected.

