

Whitehorse YK Y1A 0K7

HEMMERA ENVIROCHEM INC. Date Received: 26-JAN-16

ATTN: Natasha Sandys Report Date: 24-FEB-16 11:36 (MT)

230 - 2237 2nd Avenue Version: FINAL REV. 2

Client Phone: 867-456-4865

Certificate of Analysis

Lab Work Order #: L1727085

Project P.O. #: NOT SUBMITTED

Job Reference: 1343-005.15

C of C Numbers: 1

Legal Site Desc:

Comments:

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

Brent Mack, B.Sc. Account Manager

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	Sample ID Description Sampled Date Sampled Time Client ID	L1727085-1 Water 23-JAN-16 10:45 DUP 1	L1727085-2 Water 23-JAN-16 10:48 E3	L1727085-3 Water 23-JAN-16 14:50 E4	L1727085-4 Water 24-JAN-16 14:35 GWCC-2	L1727085-5 Water 23-JAN-16 13:15 E1(H)
Grouping	Analyte	-				
WATER						
Physical Tests	Conductivity (uS/cm)	1010	1050	1350	1950	616
	Hardness (as CaCO3) (mg/L)	722	719	898	1400	367
	pH (pH)	8.05	8.05	7.37	7.66	7.70
	Total Suspended Solids (mg/L)	<3.0	<3.0	<3.0	<3.0	<3.0
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	0.0304	<0.0050	0.0054
	Nitrate (as N) (mg/L)	0.429	0.439	0.145	0.425	0.186
	Nitrite (as N) (mg/L)	<0.0020	<0.0020	<0.0020	<0.0050	<0.0010
	Phosphorus (P)-Total (mg/L)	0.0051	0.0070	<0.0020	<0.0020	0.0100
	Sulfate (SO4) (mg/L)	390	397	627	1180	203
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	6.56	6.79	8.02	7.31	15.7
Total Metals	Aluminum (Al)-Total (mg/L)	0.0054	0.0062	0.0045	0.0230	0.0307
	Antimony (Sb)-Total (mg/L)	0.00190	0.00173	0.00043	0.00093	0.00029
	Arsenic (As)-Total (mg/L)	0.00191	0.00178	0.00095	0.00145	0.00063
	Barium (Ba)-Total (mg/L)	0.0874	0.0797	0.0630	0.0225	0.0605
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	0.341	0.310	0.127	0.092	0.011
	Cadmium (Cd)-Total (mg/L)	0.0000145	0.0000125	0.0000678	0.000159	0.0000386
	Calcium (Ca)-Total (mg/L)	95.4	91.7	139	194	77.4
	Chromium (Cr)-Total (mg/L)	0.00127	0.00119	0.00067	0.00428	0.00047
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	0.00210	0.00019	0.00040
	Copper (Cu)-Total (mg/L)	0.00098	0.00090	0.00091	0.00122	0.00234
	Iron (Fe)-Total (mg/L)	0.010	0.010	0.357	0.082	0.187
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	0.0140	0.0124	0.0310	0.0136	0.0034
	Magnesium (Mg)-Total (mg/L)	116	111	137	231	40.9
	Manganese (Mn)-Total (mg/L)	0.00774	0.00717	0.404	0.00160	0.277
	Mercury (Hg)-Total (mg/L)	<0.000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	0.00194	0.00182	0.00186	0.00283	0.00131
	Nickel (Ni)-Total (mg/L)	0.0258	0.0240	0.0345	0.0476	0.00465
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	1.63	1.57	2.02	2.17	0.89
	Selenium (Se)-Total (mg/L)	0.00105	0.000946	0.00100	0.00379	0.00165
	Silicon (Si)-Total (mg/L)	6.32	6.02	5.77	5.06	5.23
	Silver (Ag)-Total (mg/L)	<0.000010	<0.00010	0.000024	<0.00010	<0.000010
	Sodium (Na)-Total (mg/L)	7.56	7.03	10.8	8.06	3.39

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

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	Sample ID Description Sampled Date Sampled Time Client ID	L1727085-6 Water 23-JAN-16 11:45 E2	L1727085-7 Water 24-JAN-16 13:35 GWCC-1	L1727085-8 Water 24-JAN-16 15:10 GWCC-4	
Grouping	Analyte	-			
WATER					
Physical Tests	Conductivity (uS/cm)	1450	2410	1060	
	Hardness (as CaCO3) (mg/L)	961	1880	683	
	pH (pH)	7.65	7.56	7.64	
	Total Suspended Solids (mg/L)	<3.0	<3.0	<3.0	
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	0.0470	<0.0050	<0.0050	
	Nitrate (as N) (mg/L)	0.180	0.523 HTD	0.187	
	Nitrite (as N) (mg/L)	<0.0050	<0.010	<0.0020	
	Phosphorus (P)-Total (mg/L)	0.0034	<0.0020	<0.0020	
	Sulfate (SO4) (mg/L)	763	1660	470	
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	7.77	5.09	8.75	
Total Metals	Aluminum (Al)-Total (mg/L)	0.0035	<0.0060	<0.0030	
	Antimony (Sb)-Total (mg/L)	0.00064	0.00109	0.00061	
	Arsenic (As)-Total (mg/L)	0.00254	0.00199	0.00120	
	Barium (Ba)-Total (mg/L)	0.0544	0.0196 DLA	0.0389	
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000040	<0.000020	
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.00010	<0.000050	
	Boron (B)-Total (mg/L)	0.145	0.313	0.036	
	Cadmium (Cd)-Total (mg/L)	0.0000727	0.000202	0.0000556	
	Calcium (Ca)-Total (mg/L)	144	214	120	
	Chromium (Cr)-Total (mg/L)	0.00088	0.00257	0.00060	
	Cobalt (Co)-Total (mg/L)	0.00323	<0.00020	<0.00010	
	Copper (Cu)-Total (mg/L)	0.00069	<0.0010	0.00090	
	Iron (Fe)-Total (mg/L)	0.991	<0.010	0.010	
	Lead (Pb)-Total (mg/L)	<0.000050	<0.00010	<0.000050	
	Lithium (Li)-Total (mg/L)	0.0286	0.101	0.0063	
	Magnesium (Mg)-Total (mg/L)	152	336	94.3	
	Manganese (Mn)-Total (mg/L)	0.314	0.00021	0.00023	
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	
	Molybdenum (Mo)-Total (mg/L)	0.00258	0.00284	0.00207	
	Nickel (Ni)-Total (mg/L)	0.0464	0.0762	0.0328	
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	
	Potassium (K)-Total (mg/L)	2.17	3.97	1.23	
	Selenium (Se)-Total (mg/L)	0.00179	0.00466	0.00227	
	Silicon (Si)-Total (mg/L)	5.89	6.11	5.08	
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000020	<0.000010	
	Sodium (Na)-Total (mg/L)	9.69	21.5	4.24	

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	Sample ID Description Sampled Date Sampled Time Client ID	L1727085-1 Water 23-JAN-16 10:45 DUP 1	L1727085-2 Water 23-JAN-16 10:48 E3	L1727085-3 Water 23-JAN-16 14:50 E4	L1727085-4 Water 24-JAN-16 14:35 GWCC-2	L1727085-5 Water 23-JAN-16 13:15 E1(H)
Grouping	Analyte	•				
WATER						
Total Metals	Strontium (Sr)-Total (mg/L)	0.658	0.604	1.05	1.08	0.355
	Sulfur (S)-Total (mg/L)	127	122	201	377	65.9
	Thallium (TI)-Total (mg/L)	<0.00010	<0.000010	0.000013	0.000054	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.0012	0.00058
	Uranium (U)-Total (mg/L)	0.00414	0.00376	0.00457	0.00456	0.00260
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	0.0053	<0.0030
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	0.00173	0.00034	0.00073
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)	0.0022	0.0024	0.0022	0.0017	0.0222
	Antimony (Sb)-Dissolved (mg/L)	0.00188	0.00185	0.00041	0.00090	0.00031
	Arsenic (As)-Dissolved (mg/L)	0.00186	0.00182	0.00060	0.00130	0.00061
	Barium (Ba)-Dissolved (mg/L)	0.0825	0.0847	0.0619	0.0222	0.0573
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	0.321	0.311	0.116	0.084	0.010
	Cadmium (Cd)-Dissolved (mg/L)	0.0000136	0.0000118	0.0000685	0.000133	0.0000396
	Calcium (Ca)-Dissolved (mg/L)	98.4	98.4	139	193	79.1
	Chromium (Cr)-Dissolved (mg/L)	0.00118	0.00116	0.00044	0.00140	0.00042
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	0.00199	<0.00010	0.00036
	Copper (Cu)-Dissolved (mg/L)	0.00088	0.00088	0.00079	0.00100	0.00224
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	0.123	<0.010	0.169
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.0132	0.0128	0.0301	0.0126	0.0038
	Magnesium (Mg)-Dissolved (mg/L)	116	115	134	222	41.2
	Manganese (Mn)-Dissolved (mg/L)	0.00715	0.00724	0.395	0.00019	0.256
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.00183	0.00183	0.00175	0.00273	0.00129
	Nickel (Ni)-Dissolved (mg/L)	0.0247	0.0247	0.0332	0.0427	0.00454
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	1.48	1.51	1.77	1.96	0.85
	Selenium (Se)-Dissolved (mg/L)	0.00107	0.00101	0.000988	0.00374	0.00134
	Silicon (Si)-Dissolved (mg/L)	6.35	6.34	5.62	4.88	5.23
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	7.21	7.29	10.4	7.71	3.35

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

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	Sample ID Description Sampled Date Sampled Time Client ID	L1727085-6 Water 23-JAN-16 11:45 E2	L1727085-7 Water 24-JAN-16 13:35 GWCC-1	L1727085-8 Water 24-JAN-16 15:10 GWCC-4	
Grouping	Analyte				
WATER					
Total Metals	Strontium (Sr)-Total (mg/L)	1.07	2.18	0.515	
	Sulfur (S)-Total (mg/L)	236	524	154	
	Thallium (TI)-Total (mg/L)	0.000033	0.000078	0.000041	
	Tin (Sn)-Total (mg/L)	<0.00010	OLA <0.00020	<0.00010	
	Titanium (Ti)-Total (mg/L)	<0.00030	O.00060	<0.00030	
	Uranium (U)-Total (mg/L)	0.00410	0.00785	0.00193	
	Vanadium (V)-Total (mg/L)	<0.00050	O.0010	<0.00050	
	Zinc (Zn)-Total (mg/L)	<0.0030	0.0071	<0.0030	
	Zirconium (Zr)-Total (mg/L)	0.00041	<0.00060	<0.00030	
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	
	Aluminum (Al)-Dissolved (mg/L)	0.0022	OLA <0.0020	0.0012	
	Antimony (Sb)-Dissolved (mg/L)	0.00061	0.00105	0.00067	
	Arsenic (As)-Dissolved (mg/L)	0.00229	0.00203	0.00124	
	Barium (Ba)-Dissolved (mg/L)	0.0543	0.0200	0.0382	
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	O.000040	<0.000020	
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	OLA <0.00010	<0.000050	
	Boron (B)-Dissolved (mg/L)	0.146	0.281	0.036	
	Cadmium (Cd)-Dissolved (mg/L)	0.0000609	0.000198	0.0000531	
	Calcium (Ca)-Dissolved (mg/L)	140	216	121	
	Chromium (Cr)-Dissolved (mg/L)	0.00053	0.00242	0.00047	
	Cobalt (Co)-Dissolved (mg/L)	0.00320	<0.00020	<0.00010	
	Copper (Cu)-Dissolved (mg/L)	0.00058	0.00077	0.00086	
	Iron (Fe)-Dissolved (mg/L)	0.735	<0.010	<0.010	
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.00010	<0.000050	
	Lithium (Li)-Dissolved (mg/L)	0.0263	0.0938	0.0069	
	Magnesium (Mg)-Dissolved (mg/L)	148	327	92.3	
	Manganese (Mn)-Dissolved (mg/L)	0.319	<0.00020	<0.00010	
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	
	Molybdenum (Mo)-Dissolved (mg/L)	0.00245	0.00269	0.00214	
	Nickel (Ni)-Dissolved (mg/L)	0.0446	0.0742	0.0320	
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	
	Potassium (K)-Dissolved (mg/L)	1.93	3.47	1.17	
	Selenium (Se)-Dissolved (mg/L)	0.00163	0.00470	0.00238	
	Silicon (Si)-Dissolved (mg/L)	5.82	5.96	4.94	
	Silver (Ag)-Dissolved (mg/L)	<0.000010	O.000020	<0.000010	
	Sodium (Na)-Dissolved (mg/L)	9.18	20.1	4.05	

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

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	Sample ID Description Sampled Date Sampled Time Client ID	L1727085-1 Water 23-JAN-16 10:45 DUP 1	L1727085-2 Water 23-JAN-16 10:48 E3	L1727085-3 Water 23-JAN-16 14:50 E4	L1727085-4 Water 24-JAN-16 14:35 GWCC-2	L1727085-5 Water 23-JAN-16 13:15 E1(H)
Grouping	Analyte					
WATER						
Dissolved Metals	Strontium (Sr)-Dissolved (mg/L)	0.633	0.632	1.02	1.07	0.374
	Sulfur (S)-Dissolved (mg/L)	127	126	195	358	65.6
	Thallium (TI)-Dissolved (mg/L)	<0.000010	<0.00010	0.000011	0.000049	<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	0.00039
	Uranium (U)-Dissolved (mg/L)	0.00400	0.00391	0.00428	0.00443	0.00263
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	0.0019	0.0048	0.0021
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	0.00160	<0.00030	0.00078
Speciated Metals	Chromium (III)-Dissolved (mg/L)		<0.00042		<0.00043	
	Chromium (III)-Total (mg/L)		<0.00072		0.00258	
	Hexavalent Chromium (mg/L)		0.0014		0.0017	
	Hexavalent Chromium-Dissolved (mg/L)		0.0012		0.0017	

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID L1727085-6 L1727085-7 L1727085-8 Description Water Water Water 24-JAN-16 23-JAN-16 24-JAN-16 Sampled Date 11:45 13:35 15:10 Sampled Time E2 GWCC-1 GWCC-4 Client ID Grouping **Analyte WATER** Strontium (Sr)-Dissolved (mg/L) **Dissolved Metals** 1.02 2.10 0.578 Sulfur (S)-Dissolved (mg/L) 504 223 149 Thallium (TI)-Dissolved (mg/L) 0.000076 0.000032 0.000045 Tin (Sn)-Dissolved (mg/L) <0.00020 < 0.00010 < 0.00010 <0.00060 Titanium (Ti)-Dissolved (mg/L) < 0.00030 < 0.00030 Uranium (U)-Dissolved (mg/L) 0.00377 0.00212 0.00744 Vanadium (V)-Dissolved (mg/L) <0.0010 < 0.00050 <0.00050 Zinc (Zn)-Dissolved (mg/L) 0.0020 0.0016 0.0065 Zirconium (Zr)-Dissolved (mg/L) 0.00038 <0.00060 < 0.00030 Chromium (III)-Dissolved (mg/L) **Speciated Metals** < 0.00047 Chromium (III)-Total (mg/L) < 0.00078 Hexavalent Chromium (mg/L) 0.0026 Hexavalent Chromium-Dissolved (mg/L) 0.0025

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

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Reference Information

QC Samples with Qualifiers & Comments:

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QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)							
Matrix Spike	Dissolved Organic Carbon	MS-B	L1727085-1, -2, -3, -4, -6, -7, -8							
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1727085-1, -2, -3, -4, -5, -6, -7, -8							
Matrix Spike	Boron (B)-Dissolved	MS-B	L1727085-1, -2, -3, -4, -5, -6, -7, -8							
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1727085-1, -2, -3, -4, -5, -6, -7, -8							
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1727085-1, -2, -3, -4, -5, -6, -7, -8							
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1727085-1, -2, -3, -4, -5, -6, -7, -8							
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1727085-1, -2, -3, -4, -5, -6, -7, -8							
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1727085-1, -2, -3, -4, -5, -6, -7, -8							

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
DLM	Detection Limit Adjusted due to sample matrix effects.
HTD	Hold time exceeded for re-analysis or dilution, but initial testing was conducted within hold time.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BE-D-L-CCMS-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.

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-MAN-WR Water Conductivity by Meter APHA 2510 (B)

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)

Reference Information

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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

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 $20 - 5^{\circ}$ 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 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

Reference Information

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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

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.

Environmental

Chain of Custody (COC) / Analytical Request Form

1 of 1

COC Number: 1

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Canada Toll Free: 1 800 668 9878

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