



CERTIFICATE OF ANALYSIS

REPORTED TO	Yukon Government - Department of Education 1000 Lewes Blvd. Whitehorse, YT Y1A 6N2	WORK ORDER	8080455
ATTENTION	Miles Hume	RECEIVED / TEMP REPORTED	2018-08-04 09:00 / 13°C 2018-08-21 11:17
PO NUMBER		COC NUMBER	B65352
PROJECT	Department of Education 2018 Water Testing Program		
PROJECT INFO	Contract No. C00044694 - Klaune		

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO 17025:2005 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks



You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

We've Got Chemistry



It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

Ahead of the Curve



Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

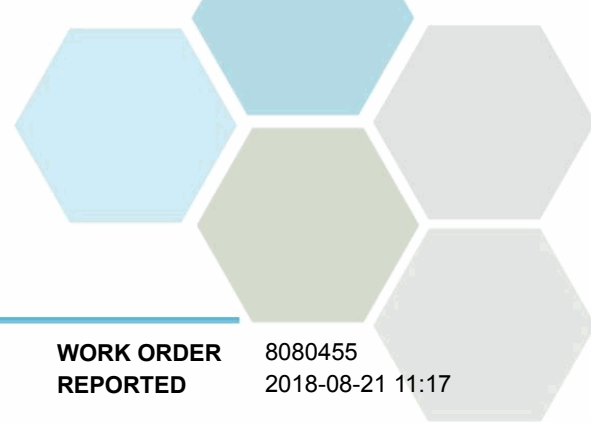
If you have any questions or concerns, please contact me at machan@caro.ca

Authorized By:

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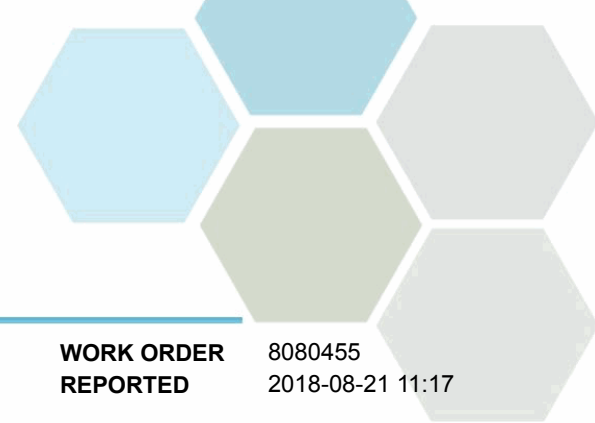


TEST RESULTS

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Analyte	Result	RL	Units	Analyzed	Qualifier
BS1 (8080455-01) Matrix: Water Sampled: 2018-07-31 10:30					
<i>Total Metals</i>					
Lead, total	1.99	0.20	µg/L	2018-08-11	
BS2 (8080455-02) Matrix: Water Sampled: 2018-07-31 10:30					
<i>Total Metals</i>					
Lead, total	10.2	0.20	µg/L	2018-08-11	
BS3 (8080455-03) Matrix: Water Sampled: 2018-07-31 10:30					
<i>Total Metals</i>					
Lead, total	10.7	0.20	µg/L	2018-08-11	
BS4 (8080455-04) Matrix: Water Sampled: 2018-07-31 10:30					
<i>Total Metals</i>					
Lead, total	5.94	0.20	µg/L	2018-08-11	
KS1 (8080455-05) Matrix: Water Sampled: 2018-07-31 10:30					
<i>Total Metals</i>					
Lead, total	1.80	0.20	µg/L	2018-08-11	
DF1 (8080455-06) Matrix: Water Sampled: 2018-07-31 10:30					
<i>Total Metals</i>					
Lead, total	2.13	0.20	µg/L	2018-08-11	
BS5 (8080455-07) Matrix: Water Sampled: 2018-07-31 10:30					
<i>Total Metals</i>					
Lead, total	1.14	0.20	µg/L	2018-08-11	
KS2 (8080455-08) Matrix: Water Sampled: 2018-07-31 10:30					
<i>Total Metals</i>					
Lead, total	8.33	0.20	µg/L	2018-08-11	
KLS (8080455-09) Matrix: Water Sampled: 2018-07-31 10:30					
<i>Anions</i>					

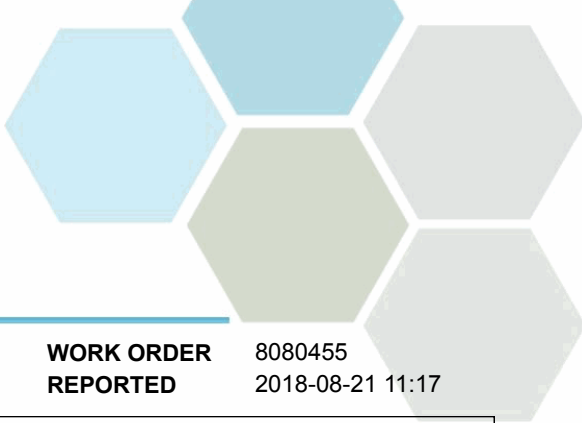


TEST RESULTS

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Analyte	Result	RL	Units	Analyzed	Qualifier
KLS (8080455-09) Matrix: Water Sampled: 2018-07-31 10:30, Continued					
<i>Anions, Continued</i>					
Chloride	0.81	0.10	mg/L	2018-08-10	
Fluoride	0.23	0.10	mg/L	2018-08-10	
Nitrate (as N)	< 0.100	0.010	mg/L	2018-08-14	
Nitrite (as N)	< 0.010	0.010	mg/L	2018-08-10	
Sulfate	181	1.0	mg/L	2018-08-14	
<i>General Parameters</i>					
Alkalinity, Total (as CaCO ₃)	41.9	1.0	mg/L	2018-08-16	HT1
Alkalinity, Phenolphthalein (as CaCO ₃)	< 1.0	1.0	mg/L	2018-08-16	HT1
Alkalinity, Bicarbonate (as CaCO ₃)	41.9	1.0	mg/L	2018-08-16	HT1
Alkalinity, Carbonate (as CaCO ₃)	< 1.0	1.0	mg/L	2018-08-16	HT1
Alkalinity, Hydroxide (as CaCO ₃)	< 1.0	1.0	mg/L	2018-08-16	HT1
Colour, True	< 5.0	5.0	CU	2018-08-09	HT1
Conductivity (EC)	703	2.0	µS/cm	2018-08-16	
pH	6.90	0.10	pH units	2018-08-16	HT2
Turbidity	1.74	0.10	NTU	2018-08-09	HT1
<i>Calculated Parameters</i>					
Hardness, Total (as CaCO ₃)	315	0.500	mg/L	N/A	
Solids, Total Dissolved	< 10	10	mg/L	2018-08-21	
<i>Total Metals</i>					
Aluminum, total	7.8	5.0	µg/L	2018-08-11	
Antimony, total	< 0.20	0.20	µg/L	2018-08-11	
Arsenic, total	7.94	0.50	µg/L	2018-08-11	
Barium, total	26.1	5.0	µg/L	2018-08-11	
Boron, total	1210	5.0	µg/L	2018-08-11	
Cadmium, total	< 0.010	0.010	µg/L	2018-08-11	
Calcium, total	39600	200	µg/L	2018-08-11	
Chromium, total	< 0.50	0.50	µg/L	2018-08-11	
Copper, total	20.7	0.40	µg/L	2018-08-11	
Iron, total	696	10	µg/L	2018-08-11	
Lead, total	1.64	0.20	µg/L	2018-08-11	
Magnesium, total	52400	10	µg/L	2018-08-11	
Manganese, total	36.0	0.20	µg/L	2018-08-11	
Mercury, total	< 0.010	0.010	µg/L	2018-08-09	
Potassium, total	4730	100	µg/L	2018-08-11	
Selenium, total	< 0.50	0.50	µg/L	2018-08-11	
Sodium, total	23100	100	µg/L	2018-08-11	
Uranium, total	1.30	0.020	µg/L	2018-08-11	
Zinc, total	37.4	4.0	µg/L	2018-08-11	



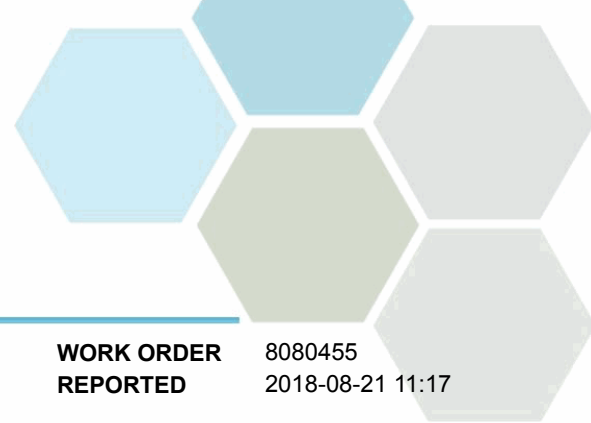
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Sample Qualifiers:

- HT1 The sample was prepared and/or analyzed past the recommended holding time.
- HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.



APPENDIX 1: SUPPORTING INFORMATION

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Analysis Description	Method Ref.	Technique	Location
Alkalinity in Water	SM 2320 B* (2011)	Titration with H ₂ SO ₄	Kelowna
Anions in Water	SM 4110 B (2011)	Ion Chromatography	Kelowna
Colour, True in Water	SM 2120 C (2011)	Spectrophotometry (456 nm)	Kelowna
Conductivity in Water	SM 2510 B (2011)	Conductivity Meter	Kelowna
Hardness in Water	SM 2340 B* (2011)	Calculation: 2.497 [total Ca] + 4.118 [total Mg] (Est)	N/A
Mercury, total in Water	EPA 245.7*	BrCl ₂ Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	Richmond
pH in Water	SM 4500-H+ B (2011)	Electrometry	Kelowna
Solids, Total Dissolved in Water	SM 1030 E (2011)	Calculation: $100 \times \frac{([\text{Cations}] - [\text{Anions}])}{([\text{Cations}] + [\text{Anions}])}$	N/A
Total Metals in Water	EPA 200.2* / EPA 6020B	HNO ₃ +HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	Richmond
Turbidity in Water	SM 2130 B (2011)	Nephelometry	Kelowna

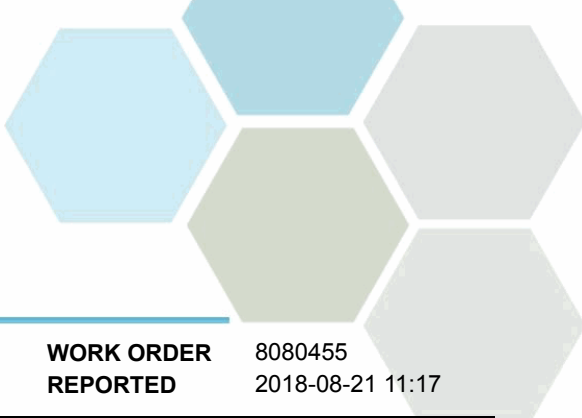
Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Glossary of Terms:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
CU	Colour Units (referenced against a platinum cobalt standard)
mg/L	Milligrams per litre
NTU	Nephelometric Turbidity Units
pH units	pH < 7 = acidic, pH > 7 = basic
µg/L	Micrograms per litre
µS/cm	Microsiemens per centimetre
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

General Comments:

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued unless otherwise agreed to in writing.



APPENDIX 2: QUALITY CONTROL RESULTS

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The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk):** A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup):** An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS):** A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS):** A second aliquot of sample is fortified with with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM):** A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
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Anions, Batch B8H0684

Blank (B8H0684-BLK1)			Prepared: 2018-08-10, Analyzed: 2018-08-10						
Chloride	< 0.10	0.10 mg/L							
Fluoride	< 0.10	0.10 mg/L							
Nitrate (as N)	< 0.010	0.010 mg/L							
Nitrite (as N)	< 0.010	0.010 mg/L							
Sulfate	< 1.0	1.0 mg/L							

LCS (B8H0684-BS1)			Prepared: 2018-08-10, Analyzed: 2018-08-10						
Chloride	16.3	0.10 mg/L	16.0		102	90-110			
Fluoride	3.95	0.10 mg/L	4.00		99	88-108			
Nitrate (as N)	3.99	0.010 mg/L	4.00		100	93-108			
Nitrite (as N)	1.95	0.010 mg/L	2.00		98	85-114			
Sulfate	15.8	1.0 mg/L	16.0		99	91-109			

General Parameters, Batch B8H0680

Blank (B8H0680-BLK1)			Prepared: 2018-08-09, Analyzed: 2018-08-09						
Turbidity	< 0.10	0.10 NTU							

LCS (B8H0680-BS1)			Prepared: 2018-08-09, Analyzed: 2018-08-09						
Turbidity	39.5	0.10 NTU	40.0		99	90-110			

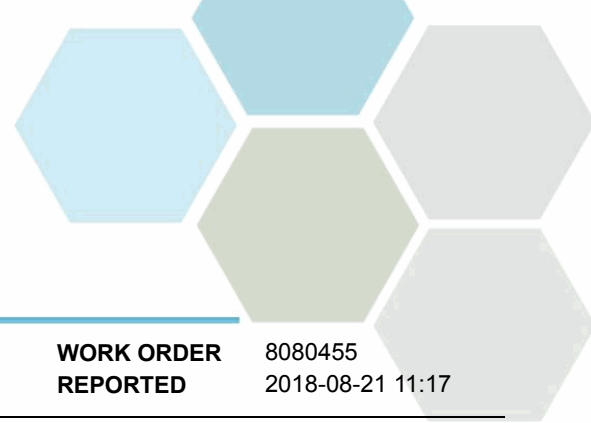
General Parameters, Batch B8H0703

Blank (B8H0703-BLK1)			Prepared: 2018-08-09, Analyzed: 2018-08-09						
Colour, True	< 5.0	5.0 CU							

LCS (B8H0703-BS1)			Prepared: 2018-08-09, Analyzed: 2018-08-09						
Colour, True	9.0	5.0 CU	10.0		90	85-115			

General Parameters, Batch B8H1343

Blank (B8H1343-BLK1)			Prepared: 2018-08-16, Analyzed: 2018-08-16						
Alkalinity, Total (as CaCO3)	< 1.0	1.0 mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0 mg/L							



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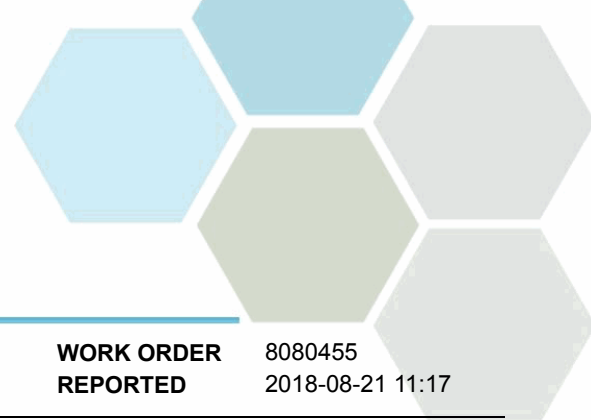
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Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B8H1343, Continued									
Blank (B8H1343-BLK1), Continued					Prepared: 2018-08-16, Analyzed: 2018-08-16				
Alkalinity, Bicarbonate (as CaCO ₃)	< 1.0	1.0 mg/L							
Alkalinity, Carbonate (as CaCO ₃)	< 1.0	1.0 mg/L							
Alkalinity, Hydroxide (as CaCO ₃)	< 1.0	1.0 mg/L							
Conductivity (EC)	< 2.0	2.0 µS/cm							
Blank (B8H1343-BLK2)					Prepared: 2018-08-17, Analyzed: 2018-08-17				
Alkalinity, Total (as CaCO ₃)	< 1.0	1.0 mg/L							
Alkalinity, Phenolphthalein (as CaCO ₃)	< 1.0	1.0 mg/L							
Alkalinity, Bicarbonate (as CaCO ₃)	< 1.0	1.0 mg/L							
Alkalinity, Carbonate (as CaCO ₃)	< 1.0	1.0 mg/L							
Alkalinity, Hydroxide (as CaCO ₃)	< 1.0	1.0 mg/L							
Conductivity (EC)	< 2.0	2.0 µS/cm							
Blank (B8H1343-BLK3)					Prepared: 2018-08-17, Analyzed: 2018-08-17				
Alkalinity, Total (as CaCO ₃)	< 1.0	1.0 mg/L							
Alkalinity, Phenolphthalein (as CaCO ₃)	< 1.0	1.0 mg/L							
Alkalinity, Bicarbonate (as CaCO ₃)	< 1.0	1.0 mg/L							
Alkalinity, Carbonate (as CaCO ₃)	< 1.0	1.0 mg/L							
Alkalinity, Hydroxide (as CaCO ₃)	< 1.0	1.0 mg/L							
Conductivity (EC)	< 2.0	2.0 µS/cm							
LCS (B8H1343-BS1)					Prepared: 2018-08-16, Analyzed: 2018-08-16				
Alkalinity, Total (as CaCO ₃)	104	1.0 mg/L	100		104	92-106			
LCS (B8H1343-BS2)					Prepared: 2018-08-17, Analyzed: 2018-08-17				
Alkalinity, Total (as CaCO ₃)	103	1.0 mg/L	100		103	92-106			
LCS (B8H1343-BS3)					Prepared: 2018-08-17, Analyzed: 2018-08-17				
Alkalinity, Total (as CaCO ₃)	105	1.0 mg/L	100		105	92-106			
LCS (B8H1343-BS4)					Prepared: 2018-08-16, Analyzed: 2018-08-16				
Conductivity (EC)	1400	2.0 µS/cm	1410		99	95-104			
LCS (B8H1343-BS5)					Prepared: 2018-08-17, Analyzed: 2018-08-17				
Conductivity (EC)	1400	2.0 µS/cm	1410		99	95-104			
LCS (B8H1343-BS6)					Prepared: 2018-08-17, Analyzed: 2018-08-17				
Conductivity (EC)	1410	2.0 µS/cm	1410		100	95-104			
Reference (B8H1343-SRM1)					Prepared: 2018-08-16, Analyzed: 2018-08-16				
pH	6.94	0.10 pH units	7.01		99	98-102			HT2
Reference (B8H1343-SRM2)					Prepared: 2018-08-17, Analyzed: 2018-08-17				
pH	6.95	0.10 pH units	7.01		99	98-102			HT2
Reference (B8H1343-SRM3)					Prepared: 2018-08-17, Analyzed: 2018-08-17				
pH	6.95	0.10 pH units	7.01		99	98-102			HT2

Total Metals, Batch B8H0397

Blank (B8H0397-BLK1)					Prepared: 2018-08-07, Analyzed: 2018-08-09				
Mercury, total	< 0.010	0.010 µg/L							
Blank (B8H0397-BLK2)					Prepared: 2018-08-07, Analyzed: 2018-08-09				
Mercury, total	< 0.010	0.010 µg/L							

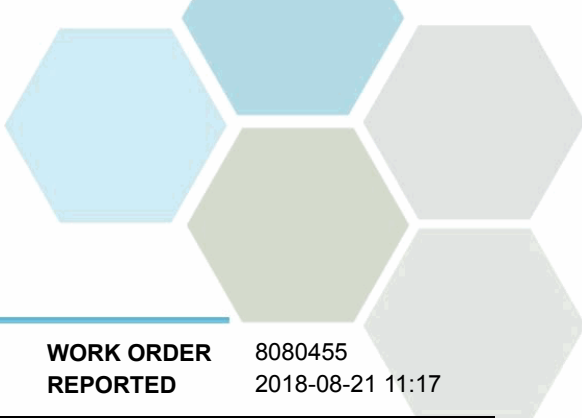


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Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B8H0397, Continued									
Reference (B8H0397-SRM1)			Prepared: 2018-08-07, Analyzed: 2018-08-09						
Mercury, total	4.70	0.010 µg/L	4.89		96	80-120			
Reference (B8H0397-SRM2)			Prepared: 2018-08-07, Analyzed: 2018-08-09						
Mercury, total	4.69	0.010 µg/L	4.89		96	80-120			
Total Metals, Batch B8H0526									
Blank (B8H0526-BLK1)			Prepared: 2018-08-08, Analyzed: 2018-08-11						
Lead, total	< 0.20	0.20 µg/L							
Blank (B8H0526-BLK2)			Prepared: 2018-08-08, Analyzed: 2018-08-11						
Lead, total	< 0.20	0.20 µg/L							
LCS (B8H0526-BS1)			Prepared: 2018-08-08, Analyzed: 2018-08-11						
Lead, total	20.3	0.20 µg/L	20.0		101	80-120			
LCS (B8H0526-BS2)			Prepared: 2018-08-08, Analyzed: 2018-08-11						
Lead, total	20.5	0.20 µg/L	20.0		102	80-120			
Duplicate (B8H0526-DUP1)			Source: 8080455-01		Prepared: 2018-08-08, Analyzed: 2018-08-11				
Lead, total	2.02	0.20 µg/L		1.99			2	20	
Reference (B8H0526-SRM1)			Prepared: 2018-08-08, Analyzed: 2018-08-11						
Lead, total	203	0.20 µg/L	204		100	90-110			
Reference (B8H0526-SRM2)			Prepared: 2018-08-08, Analyzed: 2018-08-11						
Lead, total	207	0.20 µg/L	204		101	90-110			
Total Metals, Batch B8H0779									
Blank (B8H0779-BLK1)			Prepared: 2018-08-10, Analyzed: 2018-08-11						
Aluminum, total	< 5.0	5.0 µg/L							
Antimony, total	< 0.20	0.20 µg/L							
Arsenic, total	< 0.50	0.50 µg/L							
Barium, total	< 5.0	5.0 µg/L							
Boron, total	< 5.0	5.0 µg/L							
Cadmium, total	< 0.010	0.010 µg/L							
Calcium, total	< 200	200 µg/L							
Chromium, total	< 0.50	0.50 µg/L							
Copper, total	< 0.40	0.40 µg/L							
Iron, total	< 10	10 µg/L							
Lead, total	< 0.20	0.20 µg/L							
Magnesium, total	< 10	10 µg/L							
Manganese, total	< 0.20	0.20 µg/L							
Potassium, total	< 100	100 µg/L							
Selenium, total	< 0.50	0.50 µg/L							
Sodium, total	< 100	100 µg/L							
Uranium, total	< 0.020	0.020 µg/L							
Zinc, total	< 4.0	4.0 µg/L							
LCS (B8H0779-BS1)			Prepared: 2018-08-10, Analyzed: 2018-08-11						
Aluminum, total	20.3	5.0 µg/L	20.0		102	80-120			
Antimony, total	21.9	0.20 µg/L	20.0		109	80-120			
Arsenic, total	20.2	0.50 µg/L	20.0		101	80-120			
Barium, total	22.4	5.0 µg/L	20.0		112	80-120			
Boron, total	19.3	5.0 µg/L	20.0		96	80-120			



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Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B8H0779, Continued									
LCS (B8H0779-BS1), Continued					Prepared: 2018-08-10, Analyzed: 2018-08-11				
Cadmium, total	22.2	0.010 µg/L	20.0		111	80-120			
Calcium, total	2040	200 µg/L	2000		102	80-120			
Chromium, total	19.0	0.50 µg/L	20.0		95	80-120			
Copper, total	19.8	0.40 µg/L	20.0		99	80-120			
Iron, total	1900	10 µg/L	2000		95	80-120			
Lead, total	22.6	0.20 µg/L	20.0		113	80-120			
Magnesium, total	1920	10 µg/L	2000		96	80-120			
Manganese, total	20.4	0.20 µg/L	20.0		102	80-120			
Potassium, total	1790	100 µg/L	2000		90	80-120			
Selenium, total	20.6	0.50 µg/L	20.0		103	80-120			
Sodium, total	1880	100 µg/L	2000		94	80-120			
Uranium, total	22.4	0.020 µg/L	20.0		112	80-120			
Zinc, total	21.4	4.0 µg/L	20.0		107	80-120			

Reference (B8H0779-SRM1)					Prepared: 2018-08-10, Analyzed: 2018-08-11				
Aluminum, total	312	5.0 µg/L	303		103	82-114			
Antimony, total	51.8	0.20 µg/L	51.1		101	88-115			
Arsenic, total	121	0.50 µg/L	118		102	88-111			
Barium, total	870	5.0 µg/L	823		106	83-110			
Boron, total	3260	5.0 µg/L	3450		94	80-118			
Cadmium, total	53.4	0.010 µg/L	49.5		108	90-110			
Calcium, total	10200	200 µg/L	11600		88	85-113			
Chromium, total	236	0.50 µg/L	250		94	88-111			
Copper, total	499	0.40 µg/L	486		103	90-117			
Iron, total	456	10 µg/L	488		93	90-116			
Lead, total	217	0.20 µg/L	204		107	90-110			
Magnesium, total	3600	10 µg/L	3790		95	88-116			
Manganese, total	109	0.20 µg/L	109		100	88-108			
Potassium, total	6680	100 µg/L	7210		93	87-116			
Selenium, total	127	0.50 µg/L	121		105	90-122			
Sodium, total	7000	100 µg/L	7540		93	86-118			
Uranium, total	33.6	0.020 µg/L	30.6		110	88-112			
Zinc, total	2490	4.0 µg/L	2490		100	90-113			

QC Qualifiers:

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.