Metals

Case Narrative

CH2M HILL Plateau Remediation Company

200W Pump & Treat – Extraction Well Water Sampling – F13-002

Work Order Number: 1606022

1. This report consists of 2 water samples.

2. The samples were received cool and intact by ALS on 06/01/16.

3. The samples had a pH less than 2 upon receipt.

4. The samples were prepared and analyzed based on SW-846, 3rd Edition procedures.

   For analysis by Trace ICP and ICP-MS, the samples were digested following method 3005A and the current revision of SOP 806.

5. Analysis by Trace ICP followed method 6010B and the current revision of SOP 834.

   Analysis by ICP-MS followed method 6020A and the current revision of SOP 827.

6. All standards and solutions are NIST traceable and were used within their recommended shelf life.

7. The samples were prepared and analyzed within the established hold times.

All in house quality control procedures were followed, as described below.

8. General quality control procedures.

   - A preparation (method) blank, laboratory control sample, and laboratory control sample duplicate were digested and analyzed with the samples in this digestion batch.
   - The preparation (method) blank associated with this digestion batch was below the reporting limit for the requested analytes. Copper, sodium, and uranium have results above the MDL. Sample results have been compared to the blank results.

- All laboratory control sample criteria were met.
- All initial and continuing calibration blanks were below the reporting limit for the requested analytes.
- All initial and continuing calibration verifications were within the acceptance criteria for the requested analytes.
- The interference check samples and high standard readbacks associated with Method 6010B were within acceptance criteria.
- The interference check samples associated with Method 6020A were analyzed.

9. Matrix specific quality control procedures.

   Due to limited sample volume, an LCSD (laboratory control sample duplicate) was performed in place of matrix QC.

10. The samples required a dilution to bring sodium into the analytical range of the Trace ICP.

    The samples were analyzed at a dilution in order to protect the ICP-MS from the high metal content of the samples.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

Jill Latelle — 6/14/16
Jill Latelle — Date
Inorganics Primary Data Reviewer

Inorganics Final Data Reviewer — 6/14/16
Date

Inorganic Data Reporting Qualifiers

The following qualifiers are used as needed by the laboratory when reporting results of inorganic analyses.

- Result qualifier -- A “B” is entered if the reported value was obtained from a reading that was less than the Reporting Limit but greater than or equal to the Method Detection Limit (MDL). If the analyte was analyzed for but not detected a “U” is entered. For samples, negative values are reported as non-detects (“U” flagged). For blanks, if the absolute value of the negative value is above the MDL and below the reporting limit, then the result is “B” flagged.

- QC qualifier -- Specified entries and their meanings are as follows:

  E - The reported value is estimated because of the presence of interference. An explanatory note may be included in the narrative.

  M - Duplicate injection precision was not met.

  N - Spiked sample recovery not within control limits. A post spike is analyzed for all ICP analyses when the matrix spike and or spike duplicate fail and the native sample concentration is less than four times the spike added concentration.

  Z - Spiked recovery not within control limits. An explanatory note may be included in the narrative.

  * - Duplicate analysis (relative percent difference) not within control limits.

  S - SAR value is estimated as one or more analytes used in the calculation were not detected above the detection limit.

  C - The analyte was detected in both the sample and the associated QC blank, and the sample concentration was <=20X the blank concentration.

  D - Analyte was reported at a secondary dilution factor, typically DF>1 (i.e., the primary preparation required dilution to either bring the analyte within the calibration range or to minimize interference). Required for organics/wetchem if the sample was diluted.

Total Recoverable ICP Metals

Method SW6010B

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1606022
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: 200W Pump & Treat - Extraction Well Water Sampling F13-002

Field ID: B35JR1
Lab ID: 1606022-1

Sample Matrix: WATER
% Moisture: N/A
Date Collected: 31-May-16
Date Extracted: 02-Jun-16
Date Analyzed: 03-Jun-16
Prep Method: SW3005 Rev A

Prep Batch: IP160602-2
QCBatchID: IP160602-2-6
Run ID: IT160603-1A9
Cleanup: NONE
Basis: As Received
File Name: 160603A.

Analyst: Steve Workman
Sample Aliquot: 50 ml
Final Volume: 50 ml
Result Units: UG/L
Clean DF: 1

CASNO	Target Analyte	Dilution Factor	Result	RptLimit/ LOQ/LOD	MDL/DL	Result Qualifier	EPA Qualifier
7440-42-8	BORON	1	96	30	6.4		
7440-70-2	CALCIUM	1	140000	1000	23		
7439-89-6	IRON	1	19	50	16	B	
7439-95-4	MAGNESIUM	1	56000	750	21		
7440-09-7	POTASSIUM	1	15000	1000	170		
7440-23-5	SODIUM	10	250000	5000	260	D	

Data Package ID: *it1606022-1*

Total Recoverable ICP Metals

Method SW6010B

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1606022
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: 200W Pump & Treat - Extraction Well Water Sampling F13-002

Field ID: B35K01
Lab ID: 1606022-2

Sample Matrix: WATER
% Moisture: N/A
Date Collected: 31-May-16
Date Extracted: 02-Jun-16
Date Analyzed: 03-Jun-16
Prep Method: SW3005 Rev A

Prep Batch: IP160602-2
QCBatchID: IP160602-2-6
Run ID: IT160603-1A9
Cleanup: NONE
Basis: As Received
File Name: 160603A.

Analyst: Steve Workman
Sample Aliquot: 50 ml
Final Volume: 50 ml
Result Units: UG/L
Clean DF: 1

CASNO	Target Analyte	Dilution Factor	Result	RptLimit/ LOQ/LOD	MDL/DL	Result Qualifier	EPA Qualifier
7440-42-8	BORON	1	95	30	6.4		
7440-70-2	CALCIUM	1	250000	1000	23		
7439-89-6	IRON	1	79	50	16		
7439-95-4	MAGNESIUM	1	100000	750	21		
7440-09-7	POTASSIUM	1	24000	1000	170		
7440-23-5	SODIUM	10	370000	5000	260	D	

Data Package ID: *it1606022-1*

Total Recoverable ICPMS Metals

Method SW6020A

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1606022
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: 200W Pump & Treat - Extraction Well Water Sampling F13-002

Field ID: B35JR1
Lab ID: 1606022-1

Analysis ReqCode: 6020_METALS_I

Sample Matrix: WATER
% Moisture: N/A
Date Collected: 31-May-16
Date Extracted: 02-Jun-16
Date Analyzed: 14-Jun-16
Prep Method: SW3005 Rev A

Prep Batch: IP160602-2
QCBatchID: IP160602-2-3
Run ID: IM160614-10A3
Cleanup: NONE
Basis: As Received
File Name: 026SMPL_

Analyst: Brent A. Stanfield
Sample Aliquot: 50 ml
Final Volume: 50 ml
Result Units: UG/L
Clean DF: 1

CASNO	Target Analyte	Dilution Factor	Result	RptLimit/ LOQ/LOD	MDL/DL	Result Qualifier	EPA Qualifier
7429-90-5	ALUMINUM	1000	1400	10000	1400	UD	
7440-38-2	ARSENIC	1000	18	200	18	UD	
7440-43-9	CADMIUM	1000	9.9	200	9.9	UD	
7440-47-3	CHROMIUM	1000	140	1000	110	BD	
7440-48-4	COBALT	1000	7	500	7	UD	
7440-50-8	COPPER	1000	110	800	110	UD	
7439-96-5	MANGANESE	1000	30	500	30	UD	
7439-98-7	MOLYBDENUM	1000	41	200	41	UD	
7440-02-0	NICKEL	1000	420	2000	420	UD	
7782-49-2	SELENIUM	1000	66	1000	66	UD	
7440-61-1	URANIUM	1000	45000	10	2.7	D	
7440-66-6	ZINC	1000	910	10000	910	UD	

Data Package ID: *im1606022-1*

Total Recoverable ICPMS Metals

Method SW6020A

Sample Results

Lab Name: ALS Environmental -- FC
Work Order Number: 1606022
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: 200W Pump & Treat - Extraction Well Water Sampling F13-002

Field ID: B35K01
Lab ID: 1606022-2

Analysis ReqCode: 6020_METALS_I

Sample Matrix: WATER
% Moisture: N/A
Date Collected: 31-May-16
Date Extracted: 02-Jun-16
Date Analyzed: 14-Jun-16
Prep Method: SW3005 Rev A

Prep Batch: IP160602-2
QCBatchID: IP160602-2-3
Run ID: IM160614-10A3
Cleanup: NONE
Basis: As Received
File Name: 027SMPL_

Analyst: Brent A. Stanfield
Sample Aliquot: 50 ml
Final Volume: 50 ml
Result Units: UG/L
Clean DF: 1

CASNO	Target Analyte	Dilution Factor	Result	RptLimit/ LOQ/LOD	MDL/DL	Result Qualifier	EPA Qualifier
7429-90-5	ALUMINUM	10000	14000	100000	14000	UD	
7440-38-2	ARSENIC	10000	180	2000	180	UD	
7440-43-9	CADMIUM	10000	99	2000	99	UD	
7440-47-3	CHROMIUM	10000	1100	10000	1100	UD	
7440-48-4	COBALT	10000	70	5000	70	UD	
7440-50-8	COPPER	10000	1100	8000	1100	UD	
7439-96-5	MANGANESE	10000	300	5000	300	UD	
7439-98-7	MOLYBDENUM	10000	410	2000	410	UD	
7440-02-0	NICKEL	10000	4200	20000	4200	UD	
7782-49-2	SELENIUM	10000	660	10000	660	UD	
7440-61-1	URANIUM	10000	100000	100	27	D	
7440-66-6	ZINC	10000	9100	100000	9100	UD	

Data Package ID: *im1606022-1*

ICP Metals

Method SW6010B

Method Blank

Lab Name: ALS Environmental -- FC
Work Order Number: 1606022
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: 200W Pump & Treat - Extraction Well Water Sampling F13-002

Lab ID: IP160602-2MB

Sample Matrix: WATER
% Moisture: N/A
Date Collected: N/A
Date Extracted: 02-Jun-16
Date Analyzed: 03-Jun-16

Prep Batch: IP160602-2
QCBatchID: IP160602-2-6
Run ID: IT160603-1A9
Cleanup: NONE
Basis: N/A
File Name: 160603A.

Sample Aliquot: 50 ml
Final Volume: 50 ml
Result Units: UG/L
Clean DF: 1

CASNO	Target Analyte	DF	Result	RptLimit/ LOQ/LOD	MDL/DL	Result Qualifier	EPA Qualifier
7440-42-8	BORON	1	6.4	30	6.4	U	
7440-70-2	CALCIUM	1	23	1000	23	U	
7439-89-6	IRON	1	16	50	16	U	
7439-95-4	MAGNESIUM	1	21	750	21	U	
7440-09-7	POTASSIUM	1	170	1000	170	U	
7440-23-5	SODIUM	1	78	500	26	B	

Data Package ID: *it1606022-1*

ICP Metals

Method SW6010B

Laboratory Control Sample and Laboratory Control Sample Duplicate

Lab Name: ALS Environmental -- FC
Work Order Number: 1606022
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: 200W Pump & Treat - Extraction Well Water Sampling F13-002

Lab ID: IP160602-2LCS

Sample Matrix: WATER
% Moisture: N/A
Date Collected: N/A
Date Extracted: 06/02/2016
Date Analyzed: 06/03/2016
Prep Method: SW3005A

Prep Batch: IP160602-2
QCBatchID: IP160602-2-6
Run ID: IT160603-1A9
Cleanup: NONE
Basis: N/A
File Name: 160603A.

Sample Aliquot: 50 ml
Final Volume: 50 ml
Result Units: UG/L
Clean DF: 1

CASNO	Target Analyte	Spike Added	LCS Result	Reporting Limit	Result Qualifier	LCS % Rec.	Control Limits
7440-42-8	BORON	1000	1030	30		103	80 - 120%
7440-70-2	CALCIUM	40000	40400	1000		101	80 - 120%
7439-89-6	IRON	1000	988	50		99	80 - 120%
7439-95-4	MAGNESIUM	40000	41000	750		102	80 - 120%
7440-09-7	POTASSIUM	40000	38800	1000		97	80 - 120%
7440-23-5	SODIUM	40000	39400	500		99	80 - 120%

Lab ID: IP160602-2LCSD

Sample Matrix: WATER
% Moisture: N/A
Date Collected: N/A
Date Extracted: 06/02/2016
Date Analyzed: 06/03/2016
Prep Method: SW3005A

Prep Batch: IP160602-2
QCBatchID: IP160602-2-6
Run ID: IT160603-1A9
Cleanup: NONE
Basis: N/A
File Name: 160603A.

Sample Aliquot: 50 ml
Final Volume: 50 ml
Result Units: UG/L
Clean DF: 1

CASNO	Target Analyte	Spike Added	LCSD Result	Reporting Limit	Result Qualifier	LCSD % Rec.	RPD Limit	RPD
7440-42-8	BORON	1000	1040	30		104	20	1
7440-70-2	CALCIUM	40000	41000	1000		103	20	1
7439-89-6	IRON	1000	991	50		99	20	0
7439-95-4	MAGNESIUM	40000	41500	750		104	20	1
7440-09-7	POTASSIUM	40000	39300	1000		98	20	1
7440-23-5	SODIUM	40000	39900	500		100	20	1

Data Package ID: *it1606022-1*

ICPMS Metals

Method SW6020A

Method Blank

Lab Name: ALS Environmental -- FC
Work Order Number: 1606022
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: 200W Pump & Treat - Extraction Well Water Sampling F13-002

Lab ID: IP160602-2MB

Sample Matrix: WATER
% Moisture: N/A
Date Collected: N/A
Date Extracted: 02-Jun-16
Date Analyzed: 13-Jun-16

Prep Batch: IP160602-2
QCBatchID: IP160602-2-3
Run ID: IM160613-11A4
Cleanup: NONE
Basis: N/A
File Name: 029SMPL_

Sample Aliquot: 50 ml
Final Volume: 50 ml
Result Units: UG/L
Clean DF: 1

CASNO	Target Analyte	DF	Result	RptLimit/ LOQ/LOD	MDL/DL	Result Qualifier	EPA Qualifier
7440-38-2	ARSENIC	10	0.18	2	0.18	U	
7440-43-9	CADMIUM	10	0.099	2	0.099	U	
7440-48-4	COBALT	10	0.07	5	0.07	U	
7439-96-5	MANGANESE	10	0.3	5	0.3	U	
7440-02-0	NICKEL	10	4.2	20	4.2	U	
7782-49-2	SELENIUM	10	0.66	10	0.66	U	
7440-61-1	URANIUM	10	0.03	0.1	0.027	B	
7440-66-6	ZINC	10	9.1	100	9.1	U	

Data Package ID: *im1606022-1*

ICPMS Metals

Method SW6020A

Method Blank

Lab Name: ALS Environmental -- FC
Work Order Number: 1606022
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: 200W Pump & Treat - Extraction Well Water Sampling F13-002

Lab ID: IP160602-2MB

Sample Matrix: WATER
% Moisture: N/A
Date Collected: N/A
Date Extracted: 02-Jun-16
Date Analyzed: 14-Jun-16

Prep Batch: IP160602-2
QCBatchID: IP160602-2-3
Run ID: IM160614-10A3
Cleanup: NONE
Basis: N/A
File Name: 008SMPL_

Sample Aliquot: 50 ml
Final Volume: 50 ml
Result Units: UG/L
Clean DF: 1

CASNO	Target Analyte	DF	Result	RptLimit/ LOQ/LOD	MDL/DL	Result Qualifier	EPA Qualifier
7429-90-5	ALUMINUM	10	14	100	14	U	
7440-47-3	CHROMIUM	10	1.1	10	1.1	U	
7440-50-8	COPPER	10	1.1	8	1.1	B	
7439-98-7	MOLYBDENUM	10	0.41	2	0.41	U	

Data Package ID: *im1606022-1*

ICPMS Metals

Method SW6020A

Laboratory Control Sample and Laboratory Control Sample Duplicate

Lab Name: ALS Environmental -- FC
Work Order Number: 1606022
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: 200W Pump & Treat - Extraction Well Water Sampling F13-002

Lab ID: IM160602-2LCS

Sample Matrix: WATER
% Moisture: N/A
Date Collected: N/A
Date Extracted: 06/02/2016
Date Analyzed: 06/13/2016
Prep Method: SW3005A

Prep Batch: IP160602-2
QCBatchID: IP160602-2-3
Run ID: IM160613-11A4
Cleanup: NONE
Basis: N/A
File Name: 030SMPL_

Sample Aliquot: 50 ml
Final Volume: 50 ml
Result Units: UG/L
Clean DF: 1

CASNO	Target Analyte	Spike Added	LCS Result	Reporting Limit	Result Qualifier	LCS % Rec.	Control Limits
7440-38-2	ARSENIC	100	109	2		109	80 - 120%
7440-43-9	CADMIUM	30	31.9	2		106	80 - 120%
7440-48-4	COBALT	100	111	5		111	80 - 120%
7439-96-5	MANGANESE	100	115	5		115	80 - 120%
7440-02-0	NICKEL	500	561	20		112	80 - 120%
7782-49-2	SELENIUM	100	109	10		109	80 - 120%
7440-61-1	URANIUM	10	9.65	0.1		96	80 - 120%
7440-66-6	ZINC	2000	2250	100		113	80 - 120%

Lab ID: IM160602-2LCSD

Sample Matrix: WATER
% Moisture: N/A
Date Collected: N/A
Date Extracted: 06/02/2016
Date Analyzed: 06/13/2016
Prep Method: SW3005A

Prep Batch: IP160602-2
QCBatchID: IP160602-2-3
Run ID: IM160613-11A4
Cleanup: NONE
Basis: N/A
File Name: 031SMPL_

Sample Aliquot: 50 ml
Final Volume: 50 ml
Result Units: UG/L
Clean DF: 1

CASNO	Target Analyte	Spike Added	LCSD Result	Reporting Limit	Result Qualifier	LCSD % Rec.	RPD Limit	RPD
7440-38-2	ARSENIC	100	111	2		111	20	2
7440-43-9	CADMIUM	30	32.6	2		108	20	2
7440-48-4	COBALT	100	111	5		111	20	0
7439-96-5	MANGANESE	100	114	5		114	20	1
7440-02-0	NICKEL	500	551	20		110	20	2
7782-49-2	SELENIUM	100	112	10		112	20	2
7440-61-1	URANIUM	10	9.88	0.1		99	20	2
7440-66-6	ZINC	2000	2240	100		112	20	0

Data Package ID: *im1606022-1*

ICPMS Metals

Method SW6020A

Laboratory Control Sample and Laboratory Control Sample Duplicate

Lab Name: ALS Environmental -- FC
Work Order Number: 1606022
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: 200W Pump & Treat - Extraction Well Water Sampling F13-002

Lab ID: IM160602-2LCS

Sample Matrix: WATER
% Moisture: N/A
Date Collected: N/A
Date Extracted: 06/02/2016
Date Analyzed: 06/14/2016
Prep Method: SW3005A

Prep Batch: IP160602-2
QCBatchID: IP160602-2-3
Run ID: IM160614-10A3
Cleanup: NONE
Basis: N/A
File Name: 009SMPL_

Sample Aliquot: 50 ml
Final Volume: 50 ml
Result Units: UG/L
Clean DF: 1

CASNO	Target Analyte	Spike Added	LCS Result	Reporting Limit	Result Qualifier	LCS % Rec.	Control Limits
7429-90-5	ALUMINUM	5000	4870	100		97	80 - 120%
7440-47-3	CHROMIUM	500	518	10		104	80 - 120%
7440-50-8	COPPER	1000	1080	8		108	80 - 120%
7439-98-7	MOLYBDENUM	100	101	2		101	80 - 120%

Lab ID: IM160602-2LCSD

Sample Matrix: WATER
% Moisture: N/A
Date Collected: N/A
Date Extracted: 06/02/2016
Date Analyzed: 06/14/2016
Prep Method: SW3005A

Prep Batch: IP160602-2
QCBatchID: IP160602-2-3
Run ID: IM160614-10A3
Cleanup: NONE
Basis: N/A
File Name: 010SMPL_

Sample Aliquot: 50 ml
Final Volume: 50 ml
Result Units: UG/L
Clean DF: 1

CASNO	Target Analyte	Spike Added	LCSD Result	Reporting Limit	Result Qualifier	LCSD % Rec.	RPD Limit	RPD
7429-90-5	ALUMINUM	5000	4840	100		97	20	1
7440-47-3	CHROMIUM	500	525	10		105	20	1
7440-50-8	COPPER	1000	1100	8		110	20	2
7439-98-7	MOLYBDENUM	100	100	2		100	20	0

Data Package ID: *im1606022-1*