A Data Validation Memoranda

DATA REVIEW MEMORANDUM

DATE: November 21, 2016

TO: Jonathan Reeve, Project Manager, E & E, Seattle, WA

FROM: Howard Edwards, E & E, San Francisco, CA

SUBJ: Data Review: Red Devil Mine Fall 2016

REFERENCE:

Project ID	Lab Work Order	Lab
1001095.0009.02	580-63069-1	Test America – Seattle

Validated data is attached to the end of this memorandum.

1. SAMPLE IDENTIFICATION

For the sampling activities at the Red Devil Mine site, Ecology and Environment, Inc. (E & E) collected the samples listed in Table 1. Project-specific matrix spike/matrix spike duplicates (MS/MSD) were designated in the field. All samples were sent to Test America's labs in Tacoma, Washington, for select analyses. This report addresses only Test America-generated data.

The analytical report was issued by Test America on October 27, 2016. The data in the analytical report were reviewed for field and laboratory precision, accuracy, and completeness in accordance with procedures and quality control (QC) limits, the current laboratory Quality Assurance Manual (QAM), and current standard operating procedures (SOPs). Laboratory data qualifiers for identified analytes and analyte quantitation were accepted. Any additional data review qualifiers added are noted below and listed on the tables at the end of this memorandum. Definitions of all data qualifiers are given in the report.

Work Orders, Tests, and Number of Samples Included in this Data Review Memo

Work Orders/ Job Number	Matrix	Test Method	Method Name	Number of Samples
580-63069-1	Surface Water	EPA 7470A	Mercury (CVAA)	8
580-63069-1	Surface Water	EPA 6010B/6020A	Total TAL Metals by ICP	8
580-63069-1	Surface Water	EPA 7470A	Dissolved Mercury (CVAA)	8
580-63069-1	Surface Water	EPA 6010B/6020A	Dissolved TAL Metals by ICP	8
580-63069-1	Surface Water	EPA 9060	TOC	8
580-63069-1	Surface Water	SM2540D	TSS	8
580-63069-1	Surface Water	SM2540C	TDS	8
580-63069-1	Surface Water	EPA 300.0	Inorganic Ions (Cl, F, SO4)	8
580-63069-1	Surface Water	EPA 353.2	Nitrate-Nitrite as N	8
580-63069-1	Surface Water	SM2320B	Alkalinity as CO3/HCO3	8
580-63069-1	Ground Water	EPA 6010B/6020A	Total TAL Metals by ICP	21
580-63069-1	Ground Water	EPA 7470A	Mercury (CVAA)	21
580-63069-1	Ground Water	EPA 300.0	Inorganic Ions (Cl, F, SO4)	21
580-63069-1	Ground Water	EPA 353.2	Nitrate-Nitrite as N	21
580-63069-1	Ground Water	SM2320B	Alkalinity as CO3/HCO3	21
580-63069-1	Ground Water	EPA 8270D	SVOCs	3
580-63069-1	Ground Water	AK102/103	DRO	3
580-63069-1	Ground Water	EPA 8260C	BTEX	3
580-63069-1	Ground Water	AK101	GRO	3
580-63069-1	Rinse Blank	EPA 7470A	Mercury (CVAA)	1
580-63069-1	Rinse Blank	EPA 6010B/6020A	Total TAL Metals by ICP	1
580-63069-1	Rinse Blank	EPA 7470A	Dissolved Mercury (CVAA)	1
580-63069-1	Rinse Blank	EPA 6010B/6020A	Dissolved TAL Metals by ICP	1
580-63069-1	Rinse Blank	SM2540C	TDS	1
580-63069-1	Rinse Blank	EPA 353.2	Nitrate-Nitrite as N	1
580-63069-1	Rinse Blank	SM2320B	Alkalinity as CO3/HCO3	1
580-63069-1	Field Blank	EPA 8260C	BTEX	1
580-63069-1	Field Blank	AK101	GRO	1

2. SAMPLE PROCEDURES

All samples were collected as specified in the work plan and as documented on the chain-of-custody (COC) and in field notebooks. Samples were analyzed as specified on the COC. Samples were packaged, shipped, and received as specified in the work plan. All samples must be received cold (4 ±2 degrees Celsius [^{o}C]) and in good condition as documented on the Cooler Receipt Form.

REVIEW RESULTS

All sample procedures were followed and the sample coolers were received at -0.2 to 2.5 ^{o}C. No problems with the condition of the samples upon receipt are documented.

3. LABORATORY DATA

3.1 HOLDING TIMES

Holding times are established and monitored to ensure analytical results accurately represent analyte concentrations in a sample at the time of collection. These results are presented in Table 2 (if applicable). Exceeding the holding time for a sample generally results in a loss of the analyte due to a variety of mechanisms, such as deposition on the sample container walls or precipitation.

REVIEW RESULTS

Samples requiring the determination of total dissolved solids (TDS) and total suspended solids (TSS) were received by the laboratory three days after the method specified holding time of 7 days had passed. TDS and TSS were determined approximately three days after sample receipt and 13 days after the date of sample collection. All associated TSS and TDS data was J qualified as estimated. All other samples were analyzed within the project and method specified holding times for all analytes (see Table 2).

3.2 BLANKS

Laboratory and field blank samples are analyzed and evaluated to determine the existence and magnitude of possible contamination during the sampling and analysis process. These results are presented in Table 3 (if applicable). If the analyte is present in the sample at similar trace levels (less than 5 times the blank concentration), then the analyte is likely a common background contaminant from some phase of the sampling, extraction, or analytical procedure and associated low-level sample concentrations are not considered to be site related. Sample results in these cases are qualified as not detected, “U”.

REVIEW RESULTS

All laboratory blanks were performed at the required frequency. As noted in Table 3a, analyte concentrations in the blanks were below the practical quantitation limit (PQL). All associated reported concentration of lead, silver, Nitrate-Nitrite as Nitrogen (N), and

DRO that were less than 5 times the concentration found in the preparation blank/ method blank (MB) were U-qualified as not detected. A number of Nitrate-Nitrite as N samples were “J” qualified as estimated due to the analyte concentration being less than 10 times the blank concentration. Butyl benzyl phthalate, which was found in the MB, was not found in any associated sample, therefore no qualification was necessary. A summary of qualified data due to method blank contamination is presented in Table 3b.

One equipment rinsate blank was collected, with several EPA Method 6010, 6020, and 300.0 analytes detected in at concentrations less than the PQL. All associated sample results that were detected at levels less than 5 times the blank were U-qualified as not detected. Associated samples with detection greater than 5 times the blank were not qualified. A summary of qualified data due to equipment rinsate blank contamination is presented in Table 3c.

3.3 SURROGATE SPIKE RECOVERY

Laboratory performance for individual samples analyzed for organic compounds is established by means of surrogate spiking activities. Samples are spiked with surrogate compounds prior to preparation and analysis. Unusually low or high surrogate recovery values may indicate some deficiency in the analytical system or that some matrix effects exist, resulting in low or high sample results for target compounds. Sample surrogate recoveries outside QC limits (if applicable) are presented in Table 4.

REVIEW RESULTS

All surrogates were run at the required frequency with no exceptions noted.

3.4 MATRIX SPIKE AND MATRIX SPIKE DUPLICATE ANALYSIS

The MS/MSD analyses are intended to provide information about the effects that the sample matrix exerts on the digestion / extraction and measurement methodology. MS recovery values that do not meet laboratory QC criteria may indicate that sample analyte results are being attenuated in the analysis procedure. The potential sample bias may be estimated by noting the degree to which the MS concentration was elevated or lowered in the spike analysis. However, this estimated bias should serve only as an approximation; sample-specific problems may be the cause of the discrepancy, particularly in soil samples.

Recoveries of a post-digestion spike or a laboratory control sample (LCS) are used to verify that the analytical methodology is acceptable and that MS recoveries are due to matrix effects. An MSD analysis is performed to evaluate the precision of the sample results. Precision is measured as the relative percent difference (RPD) between analytical results for duplicate samples. The laboratory's failure to produce similar results for MSD samples may indicate that the samples were non-homogeneous (particularly in soil samples), or that method defects may exist in the laboratory's techniques.

Recovery calculations are not required if the spiking concentration added is less than 25% of the sample background concentration.

REVIEW RESULTS

The MS/MSD sample analyses were performed on three samples: 1016MW22GW, 0916RD10SW, and10916MW01GW, at the required frequency. MS/MSD recoveries were within the control limits generated by the laboratory with the following exceptions:

- For sample 1016MW22GW, the EPA Methods 8260C, EPA 8272D, EPA 300.0, EPA 353.2 and AK102/103 had MS and/or MSD recoveries for benzene, toluene, Bis(2-ethyhexyl) Phthalate, fluoride, DRO and Nitrate-Nitrite as N that were above laboratory control limits. The sample result for benzene, Bis(2-ethyhexyl) Phthalate, and fluoride were not detected in associated sample and required no qualification. The results for DRO and Nitrate-Nitrite as N in the parent sample have been qualified as estimated with a high bias, “J-“. The results for toluene in the parent sample have been qualified as estimated with a high bias, “J+“.
- For sample 0916RD10SW, the EPA Methods EPA 300.0, EPA 353.2 had MS and/or MSD recoveries of fluoride and Nitrate-Nitrite as N that were above laboratory control limits. The sample result for fluoride were not detected in associated sample and required no qualification. The results for Nitrate-Nitrite as N in the parent sample have been qualified as estimated with a high bias, “J-“.
- For sample 10916MW01GW, the EPA Methods EPA 353.2 had MS and/or MSD recoveries of Nitrate-Nitrite as N that were above laboratory control limits. The results for Nitrate-Nitrite as N in the parent sample have been qualified as estimated with a high bias, “J-“.

The accuracy of MS/MSD recoveries were within the control limits generated by the laboratory with the following exceptions:

- For sample 1016MW22GW, the EPA Methods EPA 8270D and AK102/103 had MS and/or MSD RPDs for Bis(2-ethyhexyl) Phthalate, 3,3- Dichlorobenzidine, and DRO that were above laboratory control limits. The sample result for 3,3-Dichlorobenzidine and Bis(2-ethyhexyl) Phthalate was not detected in associated samples and required no qualification. The results for DRO in all three associated sample have been qualified as estimated with a "J".
- For sample 0916RD10SW, the EPA Methods EPA 6010C had MS and/or MSD RPDs for potassium that were above laboratory control limits. The results for potassium in the parent sample have been qualified as estimated with a "J".
- For sample 10916MW01GW, the EPA Methods EPA 6020A had MS and/or MSD RPDs for selenium that were above laboratory control limits. Selenium was not detected in associated samples and required no qualification.

A summary of sample data qualified due to MS/MSD precision and accuracy are presented in Tables 5a and 5b.

3.5 LABORATORY CONTROL SAMPLE ANALYSIS

The LCS is analyzed to monitor the efficiency of the digestion/extraction procedure and analytical instrument operation. The ability of the laboratory to successfully analyze an LCS demonstrates that there are no analytical problems related to the digestion/sample preparation procedures and/or instrument operations. The LCS results outside QC limits are presented in Table 6 (if applicable). Sporadic and marginal QC failures for multiple component methods do not indicate an analytical concern. If recoveries are high and the compounds are not detected in the samples, then no data qualification is required. All recoveries should be above 10% or the non-detect results flagged "UR" as rejected.

REVIEW RESULTS

All LCS analyses were within control limits and performed at the required frequency for all method with the exception of EPA 8270D. Most out of control analytes had high and not present in the samples and thus required no qualification. The compound 4-Chloroaniline had recoveries below 10% and the associated non-detection in three samples were qualified as rejected with a “UR”.

3.6 COMPOUND IDENTIFICATION AND QUANTITATION

Compound identities are assigned by comparing sample compound retention times to retention times from known (standard) compounds and identification of an acceptable mass spectrum. Compounds detected below the PQL in samples should be considered estimated and are qualified "J." The samples with compounds above the linear range were all re-analyzed at a higher dilution factor.

REVIEW RESULTS

All compound identification and quantitation criteria were achieved. As noted in Table 7, no samples were reported as reanalyzed.

4. FIELD DUPLICATE SAMPLE RESULTS

Field duplicate samples were collected and analyzed as an indication of overall precision for both field and laboratory. Field duplicate results are summarized in Table 8 (if applicable). The results are expected to have more variability than laboratory duplicates, which measure only laboratory precision. It is expected also that soil field duplicates will exhibit greater variance than water field duplicates due to the difficulties associated with collecting identical field samples. The QC criteria used to assess field duplicate samples for this project was limits of 70% RPD for soils and 40% RPD for waters, or twice the general laboratory duplicate criteria. If a given compound in both the regular sample and associated field duplicate sample was below the laboratory PQL, or the compound was not detected in one of the samples, then the compound is generally not qualified due to field duplicate precision. There are no guidelines regarding data qualification based on poor field duplicate precision. Professional judgment was used to determine whether or not to qualify results.

REVIEW RESULTS

Three field duplicates analyses were performed on this SDG. The RPD ratings are listed on Tables 8a through 8c as “Good” if the RPD is less than field duplicate QC criteria of 40% and as “Poor” if the RPD exceeded the field duplicate QC criteria.

All the results show good precision in the sample pair with the exceptions noted on Tables 8a through 8c. Qualifiers were only added to the field duplicate sample pair results as noted.

5. OVERALL ASSESSMENT OF DATA

All data were reviewed and considered usable with qualification as noted in this report.

Table 1 - Sample Listing

Work Order	Matrix	Sample ID	Lab ID	Sample Date	QA/QC	Analysis
580-63069-1	SW	0916RD05SW	580-63069-25	9/28/2016		6010B, 6020A, 7471A, 9060, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-63069-1	SW	0916RD06SW	580-63069-26	9/28/2016		6010B, 6020A, 7471A, 9060, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-63069-1	SW	0916RD08SW	580-63069-27	9/28/2016		6010B, 6020A, 7471A, 9060, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-63069-1	SW	0916RD09SW	580-63069-28	9/29/2016		6010B, 6020A, 7471A, 9060, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-63069-1	SW	0916RD10SW	580-63069-29	9/29/2016	MS/MSD	6010B, 6020A, 7471A, 9060, 300.0' 353.2, SM2320B, SM2540C, SM2540D
580-63069-1	SW	0916RD14SW	580-63069-30	9/29/2016	FD1	6010B, 6020A, 7471A, 9060, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-63069-1	SW	0916RD15SW	580-63069-31	9/29/2016		6010B, 6020A, 7471A, 9060, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-63069-1	SW	0916RD50SW	580-63069-32	9/29/2016	FD1 of 0916RD14 SW	6010B, 6020A, 7471A, 9060, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-63069-1	GW	0916MW01GW	580-63069-1	9/30/2016	MS/MSD	6010B, 6020A, 7471A, 300.0, 353.2, SM2320B
580-63069-1	GW	0916MW17GW	580-63069-7	9/30/2016	FD2	6010B, 6020A, 7471A, 300.0, 353.2, SM2320B
580-63069-1	GW	0916MW32GW	580-63069-15	9/29/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B
580-63069-1	GW	0916MW50GW	580-63069-20	9/30/2016	FD2 of 0916MW17GW	6010B, 6020A, 7471A, 300.0, 353.2, SM2320B
580-63069-1	GW	1016MW06GW	580-63069-2	10/1/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B
580-63069-1	GW	1016MW08GW	580-63069-3	10/1/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B
580-63069-1	GW	1016MW09GW	580-63069-4	10/3/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B
580-63069-1	GW	1016MW10GW	580-63069-5	10/2/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B
580-63069-1	GW	1016MW16GW	580-63069-6	10/3/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B
580-63069-1	GW	1016MW19GW	580-63069-8	10/4/2016	FD3	6010B, 6020A, 7471A, 300.0, 353.2, SM2320B
580-63069-1	GW	1016MW22GW	580-63069-9	10/5/2016	MS/MSD	6010B, 6020A, 7471A, 300.0,AK102/103, AK101,8260C,8270D,353.2, SM2320B
580-63069-1	GW	1016MW26GW	580-63069-10	10/5/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B
580-63069-1	GW	1016MW27GW	580-63069-11	10/5/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B
580-63069-1	GW	1016MW28GW	580-63069-12	10/2/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B
580-63069-1	GW	1016MW29GW	580-63069-13	10/3/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B

Table 1 - Sample Listing

Work Order	Matrix	Sample ID	Lab ID	Sample Date	QA/QC	Analysis
580-63069-1	GW	1016MW31GW	580-63069-14	10/1/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B
580-63069-1	GW	1016MW33GW	580-63069-16	10/2/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B
580-63069-1	GW	1016MW40GW	580-63069-17	10/4/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B
580-63069-1	GW	1016MW42GW	580-63069-18	10/5/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B
580-63069-1	GW	1016MW43GW	580-63069-19	10/2/2016		6010B, 6020A, 7471A, 300.0,AK102/103, AK101,8260C,8270D,353.2, SM2320B
580-63069-1	GW	1016MW55GW	580-63069-21	10/4/2016	FD3 of 1016MW19GW	6010B, 6020A, 7471A, 300.0,AK102/103, AK101,8260C,8270D,353.2, SM2320B
580-63069-1	GW	1016RB01	580-63069-23	10/6/2016	EB	6010B, 6020A, 7471A, 353.2, SM2540D
580-63069-1	GW	1016EB01	580-63069-24	10/6/2016	EB	6020A, 7471A, SM2540C
580-63069-1	GW	0916TB01	580-63069-22	9/22/2016	TB	8260C, AK101

Table 2 - List of Samples Qualified for Holding Time Exceedance

Method	Analyte	Sample IDs	HT	Sampling Date	Analysis Date	Qual
SM2540 C & D	TSS and TDS	0916RD05SW	7 day	9/28/2016	10/11/2016	J
SM2540 C & D	TSS and TDS	0916RD06SW	7 day	9/28/2016	10/11/2016	J
SM2540 C & D	TSS and TDS	0916RD08SW	7 day	9/28/2016	10/11/2016	J
SM2540 C & D	TSS and TDS	0916RD09SW	7 day	9/29/2016	10/11/2016	J
SM2540 C & D	TSS and TDS	0916RD10SW	7 day	9/29/2016	10/11/2016	J
SM2540 C & D	TSS and TDS	0916RD14SW	7 day	9/29/2016	10/11/2016	J
SM2540 C & D	TSS and TDS	0916RD15SW	7 day	9/28/2016	10/11/2016	J
SM2540 C & D	TSS and TDS	0916RD50SW	7 day	9/28/2016	10/11/2016	J

Table 3a - List of Positive Results for Blank Samples

Method	Sample ID	Sample Type	Analyte	Result	Analysis Type	Units	PQL
EPA 6020A	MB 580-229926/15A	AQ	Lead	0.000289J	MB	mg/L	0.0020
EPA 6020A	MB 580-229926/15A	AQ	Silver	0.000241J	MB	mg/L	0.0020
EPA 353.2	MB 580-230140/14	AQ	Nitrate-Nitrite as Nitrogen	0.0210J	MB	mg/L	0.050
EPA 353.2	MB 580-230140/48	AQ	Nitrate-Nitrite as Nitrogen	0.0220J	MB	mg/L	0.050
AK10/103	MB 580-230089/1-A	AQ	DRO	0.0350J	MB	mg/L	0.10
EPA 8270D	MB 580-229524/1-A	AQ	Butyl benzyl phthalate	0.206J	MB	ug/L	0.60
EPA 353.2	1016RB01	AQ	Nitrate-Nitrite as Nitrogen	0.024J	RB	mg/L	0.050
EPA 300.0	1016RB01	AQ	Sulfate	0.44J	RB	mg/L	1.2
EPA 6020A	1016RB01	AQ	Antimony	0.00062J	RB	mg/L	0.0020
EPA 6020A	1016RB01	AQ	Barium	0.00033J	RB	mg/L	0.0060
EPA 6010B	1016RB01	AQ	Calcium	0.08J	RB	mg/L	1.1

Table 3b - List of Samples Qualified for Method Blank Contamination

Method	Sample ID	Analyte	Blank Result	Sample Result	Sample Qual	PQL
EPA 6020A	0916RD10SW	Lead	0.000289	0.00027	U	0.0020
EPA 6020A	0916RD10SW	Silver	0.000241	0.00023	U	0.0020
EPA 353.2	0916RD05SW	Nitrate-Nitrite as N	0.0220	0.026	J	0.05
EPA 353.2	0916RD06SW	Nitrate-Nitrite as N	0.0220	0.20	J	0.05
EPA 353.2	0916RD08SW	Nitrate-Nitrite as N	0.0220	0.20	J	0.05
EPA 353.2	0916RD09SW	Nitrate-Nitrite as N	0.0220	0.19	J	0.05
EPA 353.2	0916RD10SW	Nitrate-Nitrite as N	0.0220	0.21	J	0.05
EPA 353.2	0916RD14SW	Nitrate-Nitrite as N	0.0220	0.21	J	0.05
EPA 353.2	0916RD15SW	Nitrate-Nitrite as N	0.0220	0.21	J	0.05
EPA 353.2	0916RD50SW	Nitrate-Nitrite as N	0.0220	0.21	J	0.05
EPA 353.2	1016RB01	Nitrate-Nitrite as N	0.0220	0.024	U	0.05
EPA 353.2	0916MW50GW	Nitrate-Nitrite as N	0.0220	0.078	U	0.05
EPA 353.2	0916MW01GW	Nitrate-Nitrite as N	0.0220	0.23	J	0.05
EPA 353.2	0916MW17GW	Nitrate-Nitrite as N	0.0220	0.074	U	0.05
EPA 353.2	1016MW06GW	Nitrate-Nitrite as N	0.0220	0.032	U	0.05
EPA 353.2	1016MW09GW	Nitrate-Nitrite as N	0.0220	0.026	U	0.05
EPA 353.2	1016MW10GW	Nitrate-Nitrite as N	0.0220	0.024	U	0.05
EPA 353.2	1016MW16GW	Nitrate-Nitrite as N	0.0220	0.025	U	0.05
EPA 353.2	1016MW19GW	Nitrate-Nitrite as N	0.0220	0.12	J	0.05
EPA 353.2	1016MW22GW	Nitrate-Nitrite as N	0.0220	0.074	U	0.05
EPA 353.2	1016MW26GW	Nitrate-Nitrite as N	0.0220	0.061	U	0.05
EPA 353.2	1016MW28GW	Nitrate-Nitrite as N	0.0220	0.0220	U	0.05
EPA 353.2	1016MW29GW	Nitrate-Nitrite as N	0.0220	0.025	U	0.05
EPA 353.2	1016MW31GW	Nitrate-Nitrite as N	0.0220	0.063	U	0.05
EPA 353.2	1016MW40GW	Nitrate-Nitrite as N	0.0220	0.025	U	0.05
EPA 353.2	1016MW42GW	Nitrate-Nitrite as N	0.0220	0.023	U	0.05
EPA 353.2	1016MW43GW	Nitrate-Nitrite as N	0.0220	0.030	U	0.05
EPA 353.2	1016MW55GW	Nitrate-Nitrite as N	0.0220	0.12	J	0.05
AK102/103	1016MW22GW	DRO	0.0350	0.038	U	0.10

Table 3c - List of Samples Qualified for Equipment Rinsate Blank Contamination

Method	Sample ID	Analyte	Blank Result	Sample Result	Sample Qual	PQL
EPA 300.0	1016MW31GW	Sulfate	0.44	1.5	U	1.2
EPA 6020A	0916RD08SW	antimony	0.00062	0.00059	U	0.002
EPA 6020A	1016MW19GW	antimony	0.00062	0.00056	U	0.002
EPA 6020A	1016MW29GW	antimony	0.00062	0.0012	U	0.002
EPA 6020A	1016MW55GW	antimony	0.00062	0.0006	U	0.002

Table 4 - List of Samples with Surrogates outside Control Limits

Method	Sample ID	Sample Type	Analyte	Rec.	Low Limit	High Limit	Dil Fac	Sample Qual.
None.								

Table 5a - List of MS/MSD Recoveries outside Control Limits

Method	Sample ID	Sample Type	Analyte	Orig. Result	Spike Amount	Rec.	Dil Fac.	Low Limit	High Limit	Sample Qual
EPA 8260C	1016MW22GW	AQ	Benzene	0.2 U	4.32	129	1.0	73	120	None - ND
EPA 8260C	1016MW22GW	AQ	Toluene	0.55	4.3	134	1.0	70	126	J+
EPA 8270D	1016MW22GW	AQ	Bis(2-ethyhexyl) Phthalate	2.8 U	190	201	1.0	22	150	None- ND
EPA 300.0	1016MW22GW	AQ	Fluoride	0.2 U	5.0	112	1.0	90	110	None- ND
EPA 300.0	0916RD10SW	AQ	Fluoride	0.2 U	5.0	119	1.0	90	110	None- ND
EPA 300.0	0916RD10SW	AQ	Chloride	0.97	5.0	114	1.0	90	110	J+
EPA 300.0	0916RD10SW	AQ	Sulfate	7.1	5.0	121	1.0	90	110	J+
AK102/103	1016MW22GW	AQ	DRO	0.038	2.03	61	1.0	75	425	None- ND
EPA 353.2	0916MW01GW	AQ	Nitrate-Nitrite as N	0.23	0.5	65	1.0	90	110	J-
EPA 353.2	1016MW22GW	AQ	Nitrate-Nitrite as N	0.074	0.5	86	1.0	90	110	None- ND
EPA 353.2	0916RD10SW	AQ	Nitrate-Nitrite as N	0.21	0.5	88	1.0	90	110	J-

Table 5b - List of Lab and MS Duplicate RPDs outside Control Limits

Sample ID	Analyte	Method	RPD	RPD Limit	No. of Affected Samples	Samp Qual
1016MW22GW	Bis(2-ethyhexyl) Phthalate	EPA 8270D	69	35	0	*
1016MW22GW	3,3- Dichlorobenzidine	EPA 8270D	36	35	0	*
1016MW22GW	DRO	AK102/103	33	20	2	J
0916RD10SW	Potassium	EPA 6010C	21	20	1	J
0916MW01GW	Selenium	EPA 6020A	30	20	0	*

*Not detected in associated samples.

Table 6 - List of LCS Recoveries outside Control Limits

Method	Sample ID	Analyte	%Rec.	Low Limit	High Limit	No. of Affected Samples	Samp Qual
EPA 8270D	LCS 580-229524/2-A	4-Chloroaniline	5	20	110	3	UR
EPA 8270D	LCS 580-229524/2-A	Bis(chloroisopropyl) ether	128	44	123	0	*
EPA 8270D	LCS 580-229524/2-A	Dibenz(a,h)anthracene	127	56	124	0	*
EPA 8270D	LCS 580-229524/3-A	4-Chloroaniline	3	20	110	3	UR
EPA 8270D	LCS 580-229524/3-A	Dibenz(a,h)anthracene	131	56	124	0	*
EPA 8270D	LCS 580-229524/3-A	bis(chloroisopropyl) ether	127	44	123	0	*
EPA 8270D	LCS 580-229524/3-A	Di-n-octyl phthalate	153	55	150	0	*
EPA 8270D	LCS 580-229524/3-A	Bis(2-ethylhexyl) phthalate	200	22	150	0	*
EPA 8270D	LCS 580-229524/3-A	2-Nitroaniline	129	58	124	0	*

*= no qualification required

Table 7 - Samples that were Re-analyzed

Sample ID	Lab ID	Method	Sample Type	Action
None.				

Table 8a - Summary of Field Duplicate Results

Method	Analyte	Units	0916RD14SW	0916RD50SW	RPD	Rating	Sample Qualifier
EPA 9060	TOC	mg/L	2.5	2.5	0.0%	Good	None
EPA 300.0	Chloride	mg/L	0.98	0.98	0.0%	Good	None
EPA 300.0	Fluoride	mg/L	8.1	7.4	0.9%	Good	None
EPA 300.0	Sulfate	mg/L	0.21	0.21	0.0%	Good	None
EPA 353.2	Nitrate-Nitrite and N	mg/L	2.5	2.5	0.0%	Good	None
SM2320B	Alkalinity	mg/L	64	63	1.5%	Good	None
SM2320B	Bicarbonate Alkalinity	mg/L	64	63	1.5%	Good	None
SM2320C	TDS	mg/L	67	77	13.9%	Good	None
EPA 6010B	Dissolved Calcium	mg/L	15	14	6.9%	Good	None
EPA 6010B	Dissolved Magnesium	mg/L	8.3	7.9	4.9%	Good	None
EPA 6010B	Dissolved Potassium	mg/L	0.28	0.30	6.9%	Good	None
EPA 6010B	Dissolved Sodium	mg/L	1.5	1.5	0.0%	Good	None
EPA 6020A	Dissolved Antimony	mg/L	0.11	0.036	93%	Poor	J
EPA 6020A	Dissolved Arsenic	mg/L	0.041	0.020	69%	OK	J
EPA 6020A	Dissolved Barium	mg/L	0.023	0.023	0.0%	Good	None
EPA 6020A	Dissolved Manganese	mg/L	0.019	0.0094	42%	Poor	J
EPA 6010B	Calcium	mg/L	15	14	6.9%	Good	None
EPA 6010B	Magnesium	mg/L	8.3	8.1	2.4%	Good	None
EPA 6010B	Potassium	mg/L	0.25	0.20	22.2%	Good	None
EPA 6010B	Sodium	mg/L	1.6	1.5	6.5%	Good	None
EPA 6020A	Antimony	mg/L	0.090	0.031	100%	Poor	J
EPA 6020A	Arsenic	mg/L	0.035	0.018	59%	Poor	J
EPA 6020A	Barium	mg/L	0.023	0.022	4.4%	Good	None
EPA 6020A	Manganese	mg/L	0.019	0.014	30.3%	Good	None

Table 8b - Summary of Field Duplicate Results

Method	Analyte	Units	0916MW17GW	0916MW50GW	RPD	Rating	Sample Qualifier
EPA7471	Mercury	mg/L	0.0017	0.0032	60%	Poor	J
EPA 300.0	Chloride	mg/L	1.1	1.1	0.0%	Good	None
EPA 300.0	Fluoride	mg/L	0.060	0.060	0.0%	Good	None
EPA 300.0	Sulfate	mg/L	7.2	6.7	7%	Good	None
EPA 353.2	Nitrate-Nitrite as N	mg/L	0.074	0.078	5%	Good	None
SM2320B	Alkalinity	mg/L	100	120	9%	Good	None
ESM2320B	Bicarbonate Alkalinity	mg/L	100	120	9%	Good	None
EPA 6010B	Aluminum	mg/L	0.31	0.22	35%	Good	None
EPA 6010B	Calcium	mg/L	21	19	10%	Good	None
EPA 6010B	Iron	mg/L	0.31	0.42	33%	Good	None
EPA 6010B	Magnesium	mg/L	16	14	13%	Good	None
EPA 6010B	Potassium	mg/L	0.42	0.44	4.6%	Good	None
EPA 6010B	Sodium	mg/L	2.6	2.4	8%	Good	None
EPA 6020A	Antimony	mg/L	0.075	0.061	21%	Good	None
EPA 6020A	Arsenic	mg/L	0.021	0.019	10%	Good	None
EPA 6020A	Barium	mg/L	0.042	0.043	2%	Good	None
EPA 6020A	Chromium	mg/L	0.00083	0.00083	0.0%	Good	None
EPA 6020A	Cobalt	mg/L	0.00035	0.00036	3%	Good	None
EPA 6020A	Lead	mg/L	0.00043	0.00057	28%	Good	None
EPA 6020A	Manganese	mg/L	0.014	0.018	12.5%	Good	None
EPA 6020A	Silver	mg/L	0.002 U	0.00016 J	NA	Good	None

Table 8c - Summary of Field Duplicate Results

Method	Analyte	Units	1016MW19GW	1016MW55GW	RPD	Rating	Sample Qualifier
EPA 8260C	Toluene	ugL	0.64	0.41	44%	Poor	J
AK 101	GRO	mg/L	0.05 U	0.026	NA	Good	None
EPA 8270D	1-Methylnaphthalene	ugL	0.044	0.046	2.2%	Good	None
EPA 8270D	Benzoic acid	ugL	0.70	2.8 U	NA	Good	None
EPA 8270D	Bis(2-ethyhexyl) Phthalate	ugL	2.2	2.8 U	NA	Good	None
EPA 8270D	Phenol	ugL	0.15	0.57 U	NA	Good	None
AK102/103	DRO	mg/L	0.045	0.048	6.5%	Good	None
EPA 300.0	Chloride	mg/L	0.93	0.96	3.2%	Good	None
EPA 300.0	Fluoride	mg/L	0.070	0.080	13%	Good	None
EPA 300.0	Sulfate	mg/L	5.8	6.0	3.3%	Good	None
EPA 353.2	Nitrate-Nitrite as N	mg/L	0.12	0.12	0.0%	Good	None
SM2320B	Alkalinity	mg/L	82	82	0.0%	Good	None
ESM2320B	Bicarbonate Alkalinity	mg/L	82	82	0.0%	Good	None
EPA 6010B	Calcium	mg/L	18	18	0.0%	Good	None
EPA 6010B	Magnesium	mg/L	13	12	8.0%	Good	None
EPA 6010B	Potassium	mg/L	0.26	0.27	3.8%	Good	None
EPA 6010B	Sodium	mg/L	2.3	2.2	4.4%	Good	None
EPA 6010B	Antimony	mg/L	0.00056	0.00060	6.9%	Good	None
EPA 6010B	Arsenic	mg/L	0.0030	0.005 U	NA	Good	None
EPA 6020A	Barium	mg/L	0.046	0.044	4.4%	Good	None
EPA 6020A	Manganese	mg/L	0.016	0.0076	33%	Good	None
EPA 6020A	Selenium	mg/L	0.0015	0.005 U	NA	Good	None

DATA REVIEW MEMORANDUM

DATE: December 7, 2016 (Revised March 28, 2017)

TO: Jonathan Reeve, Project Manager, E & E, Seattle, WA

FROM: Howard Edwards, E & E, San Francisco, CA

SUBJ: Data Review: Red Devil Mine Fall 2016

REFERENCE:

Project ID	Lab Work Order	Lab
1001095.0009.02	EEI-SA1601	Brooks Applied Labs – Seattle

Validated data is attached to the end of this memorandum.

1. SAMPLE IDENTIFICATION

For the sampling activities at the Red Devil Mine site, Ecology and Environment, Inc. (E & E) collected the samples listed in Table 1. Project-specific matrix spike/matrix spike duplicates (MS/MSD) were designated in the field. All samples were sent to Brooks Applied Labs in Tacoma, Washington, for low-level analyses. This report addresses only Brooks Applied Labs-generated data.

The analytical report was issued by Brooks Applied Labs on November 25, 2016. The data in the analytical report were reviewed for field and laboratory precision, accuracy, and completeness in accordance with procedures and quality control (QC) limits, the current laboratory Quality Assurance Manual (QAM) and current standard operating procedures (SOPs). Any additional data review qualifiers added are noted below and listed on the tables at the end of this memorandum. Definitions of all data qualifiers are given in the report.

Work Orders, Tests, and Number of Samples Included in this Data Review Memo

Work Orders/ Job Number	Matrix	Test Method	Method Name	Number of Samples
EEI-SA1601	Surface Water	EPA 1631	Total Low-Level Mercury (CVAFS)	8
EEI-SA1601	Surface Water	EPA 1631	Dissolved Low-Level Mercury (CVAFS)	8
EEI-SA1601	Ground Water	EPA 1631	Total Low-Level Mercury (CVAFS)	21
EEI-SA1601	Ground Water	EPA 1631	Dissolved Low-Level Mercury (CVAFS)	21
EEI-SA1601	Rinse Blank	EPA 1631	Dissolved Low-Level Mercury (CVAFS)	1
EEI-SA1601	Trip Blank	EPA 1631	Dissolved Low-Level Mercury (CVAFS)	1
EEI-SA1601	Field Blank	EPA 1631	Dissolved Low-Level Mercury (CVAFS)	6

2. SAMPLE PROCEDURES

All samples were collected as specified in the work plan and documented on the chain-of-custody (COC) and in field notebooks. Samples were analyzed as specified on the COC. Samples were packaged, shipped, and received as specified in the work plan. All samples for organic analyses must be received cold (4 ± 2 degrees Celsius [^{o}C]) and in good condition as documented on the Cooler Receipt Form.

REVIEW RESULTS

All sample procedures were followed and the sample coolers were received by the laboratory at 6.0^{o}C and 11^{o}C. Since the samples were acidified in the field, the Field Sampling Plan requirement indicating 4 ±2 ^{o}C requirement, did not result in qualification. Since the temperature is not a method requirement.

3. LABORATORY DATA

3.1 HOLDING TIMES

Holding times are established and monitored to ensure analytical results accurately represent analyte concentrations in a sample at the time of collection. These qualified results based upon missed holding times are presented in Table 2 (if applicable). Exceeding the holding time for a sample generally results in a loss of the analyte due to a variety of mechanisms, such as deposition on the sample container walls or precipitation.

3.2 BLANKS

All laboratory blanks are integrated into the method and all results are corrected for blank values provided that the laboratory blank values are within method-set limits. When blanks are outside of the method limits, associated samples are re-analyzed. Method blanks are shown in Table 3a. No data was qualified due to laboratory method blanks (see Table 3b).

Field blank samples are analyzed and evaluated to determine the existence and magnitude of possible contamination during the sampling and analysis process. All field blank with reported results are also presented in Table 3a (if applicable). If the mercury is present in the sample at similar trace levels (less than 5 times the blank concentration), then the analyte is likely a common background contaminant from some phase of the sampling, extraction, or analytical procedure and associated low-level sample concentrations are not considered to be site related. Sample results in these cases are qualified as not detected, “U”.

REVIEW RESULTS

All laboratory blanks were performed at the required frequency. As noted in Table 3a, analyte concentrations in the method blanks were below the practical quantitation limit (PQL). Several field blanks were at a concentration above the detection limit. All associated reported concentration of mercury that were less than 5 times the concentration found in their associated field blank were U qualified as not detected. A summary of qualified data due to method blank contamination is presented in Table 3c.

Two equipment rinsate blank was collected. One rinsate blank was at a concentration above the method reporting limit. All associated sample results that were detected at levels less than 5 times the blank were U qualified as not detected. Associated samples with detection greater than 5 times the blank were not qualified. A summary of qualified data due to equipment rinsate blank contamination is also presented in Table 3c.

3.3 MATRIX SPIKE AND MATRIX SPIKE DUPLICATE ANALYSIS

The MS/MSD analyses are intended to provide information about the effects that the sample matrix exerts on the digestion / extraction and measurement methodology. MS

recovery values that do not meet laboratory QC criteria may indicate that sample analyte results are being attenuated in the analysis procedure. The potential sample bias may be estimated by noting the degree to which the MS concentration was elevated or lowered in the spike analysis. However, this estimated bias should serve only as an approximation; sample-specific problems may be the cause of the discrepancy, particularly in soil samples.

Recovery calculations are not required if the spiking concentration added is less than 25% of the sample background concentration.

REVIEW RESULTS

The MS/MSD sample analyses were performed on five samples: 1016MW19GW, 1016MW16GW, 1016MW27GW, 10916MW22GW, and10916MW32GW, at the required frequency. All MS/MSD recoveries and accuracies were within the control limits

A summary of sample data qualified due to MS/MSD precision and accuracy are presented in Tables 5a and 5b (if applicable).

3.4 LABORATORY CONTROL SAMPLE ANALYSIS

The LCS or Certified Reference Material standard is analyzed to monitor the efficiency of the digestion/extraction procedure and analytical instrument operation. The ability of the laboratory to successfully analyze an LCS or Certified Reference Material standard demonstrates that there are no analytical problems related to the digestion/sample preparation procedures and/or instrument operations. The LCS or Certified Reference Material standard results outside QC limits are presented in Table 6 (if applicable). Sporadic and marginal QC failures for multiple component methods do not indicate an analytical concern. If recoveries are high and the compounds are not detected in the samples, then no data qualification is required. All recoveries should be above 10% or the non-detect results flagged “UR” as rejected.

REVIEW RESULTS

The analysis of the Certified Reference Material Sample was within control limits.

3.5 COMPOUND IDENTIFICATION AND QUANTITATION

Compound identities are assigned by comparing sample compound retention times to retention times from known (standard) compounds and identification of an acceptable mass spectrum. Compounds detected below the PQL in samples should be considered estimated and are qualified "J." The samples with compounds above the linear range were all re-analyzed at a higher dilution factor.

REVIEW RESULTS

All compound identification and quantitation criteria were achieved. As noted in Table 7, samples were reported as reanalyzed based upon laboratory blank concentrations in the batch. All reported concentrations were from batches with acceptable blanks. Sample 0916RD08SW had a dissolved low-level lead concentration that was greater than the total low-level lead concentration. The data was “J” qualified, as this is an unrealistic scenario.

4. FIELD DUPLICATE SAMPLE RESULTS

Field duplicate samples were collected and analyzed as an indication of overall precision for both field and laboratory. Field duplicate results are summarized in Table 8 (if applicable). The results are expected to have more variability than laboratory duplicates, which measure only laboratory precision. The QC criteria used to assess field duplicate samples for this project was limits of 40% RPD for waters, or twice the general laboratory duplicate criteria. If a given compound in both the regular sample and associated field duplicate sample was below the laboratory PQL, or the compound was not detected in one of the samples, then the compound is generally not qualified due to field duplicate precision. There are no guidelines regarding data qualification based on poor field duplicate precision. Professional judgment was used to determine whether or not to qualify results.

REVIEW RESULTS

Three field duplicates analyses were performed on this SDG. The RPD ratings are listed on Tables 8a through 8c as “Good” if the RPD is less than field duplicate QC criteria of 40% and as “Poor” if the RPD exceeded the field duplicate QC criteria.

Two results show good precision in the sample pair for both total and dissolved mercury. One set of field duplicate samples had good precision for total mercury and poor precision for dissolved mercury. Results are noted on Tables 8a through 8c. Qualifiers were only added to the field duplicate results as noted.

5. OVERALL ASSESSMENT OF DATA

The data from several of the QA samples suggest the following:

- That there was a sample related problem at two locations. The lead concentrations in the filtered and unfiltered sample 1016MW55GW (duplicate of the MW19 sample) suggests that there was a filtering problem with that sample. The lead concentrations in the filtered and unfiltered sample 0916RD08 also suggest a filtering or labeling problem.
- That there was an equipment decontamination problem with the bladder pump that was used to collect some of the groundwater samples. The equipment rinsate blank indicates the potential of inadequate decontamination of the bladder pump. Since the rinsate blank sample was not field filtered, it is only associated with the total mercury concentration in unfiltered samples collected with a bladder pump. Future rinsate blanks sampling should include a filtered rinsate blanks.
- E & E notified the laboratory that the mercury (Hg) result associated with sample 1016MW19GW (1642012-54) was an outlier of what was expected. The laboratory re-analyzed the sample in duplicate and obtained a much lower result. The original Hg result was reported as 38.8 ng/L, and the re-analyses, performed in two separate sequences (analytical runs), were 3.32 ng/L and 3.38 ng/L. The result of 3.32 ng/L was reported. The value of 3.32 ng/L is consistent with the sample's field duplicate value and with historic data for the location. The originally reported value of 38.8 ng/L was in error due to a unique instrument-related problem that was identified by the laboratory. According to the laboratory, the problem only affected that sample 1016MW19GW (1642012-54). The laboratory has implemented a corrective action measures that will prevent the error in future analyses.

All data were reviewed and considered usable with qualification as noted in this report.

Table 1 - Sample Listing

Work Order	Matrix	Sample ID	Lab ID	Sample Date	QA/QC	Analysis
EE-IS-1601	F-GW	*0916MW32GW*	1642012-01	9/29/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW09GW*	1642012-02	10/3/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW55GW*	1642012-03	10/4/2016	FD of 1016MW19GW	EPA 1631
EE-IS-1601	F-GW	*1016MW40GW*	1642012-04	10/4/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW19GW*	1642012-05	10/4/2016	FD of 1016MW55GW MS/MSD	EPA 1631
EE-IS-1601	F-GW	*1016MW28GW*	1642012-06	10/2/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW06GW*	1642012-07	10/1/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW08GW*	1642012-08	10/1/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW42GW*	1642012-09	10/5/2016		EPA 1631
EE-IS-1601	F-GW	*0916MW01GW*	1642012-10	9/30/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW33GW*	1642012-11	10/2/2016		EPA 1631
EE-IS-1601	F-DW	*0916RD05SW*	1642012-12	9/29/2016		EPA 1631
EE-IS-1601	F-DW	*0916RD06SW*	1642012-13	9/28/2016		EPA 1631
EE-IS-1601	F-DW	*0916RD08SW*	1642012-14	9/28/2016		EPA 1631
EE-IS-1601	F-DW	*0916RD09SW*	1642012-15	9/29/2016		EPA 1631
EE-IS-1601	F-DW	*0916RD10SW*	1642012-16	9/29/2016		EPA 1631
EE-IS-1601	F-DW	*0916RD14SW*	1642012-17	9/29/2016	FD of 0916RD50SW	EPA 1631
EE-IS-1601	F-DW	*0916RD15SW*	1642012-18	9/29/2016		EPA 1631
EE-IS-1601	F-DW	*0916RD50SW*	1642012-19	9/29/2016	FD of 0916RD14SW	EPA 1631
EE-IS-1601	F-GW	*0916MW50GW*	1642012-20	9/30/2016	FD of 0916MW17GW	EPA 1631
EE-IS-1601	F-GW	*1016MW16GW*	1642012-21	10/3/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW43GW*	1642012-22	10/2/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW10GW*	1642012-23	10/2/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW27GW*	1642012-24	10/5/2016		EPA 1631
EE-IS-1601	F-GW	*0916MW17GW*	1642012-25	9/30/2016	FD of 0916MW50GW	EPA 1631
EE-IS-1601	F-GW	*1016MW31GW*	1642012-26	10/1/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW26GW*	1642012-27	10/5/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW29GW*	1642012-28	10/3/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW22GW*	1642012-29	10/5/2016		EPA 1631
EE-IS-1601	GW	*1016MW16GW*	1642012-30	10/3/2016	MS/MSD	EPA 1631
EE-IS-1601	GW	*1016MW43GW*	1642012-31	10/2/2016		EPA 1631
EE-IS-1601	GW	*0916MW32GW*	1642012-32	9/29/2016	MS/MSD	EPA 1631
EE-IS-1601	Blank	*0916FB02*	1642012-33	9/29/2016	Field Blank	EPA 1631
EE-IS-1601	SW	*0916RD05SW*	1642012-34	9/29/2016		EPA 1631
EE-IS-1601	GW	*1016MW27GW*	1642012-35	10/5/2016	MS/MSD	EPA 1631
EE-IS-1601	SW	*0916RD06SW*	1642012-36	9/28/2016		EPA 1631
EE-IS-1601	SW	*0916RD09SW*	1642012-37	9/29/2016		EPA 1631
EE-IS-1601	SW	*0916RD08SW*	1642012-38	9/28/2016		EPA 1631
EE-IS-1601	SW	*0916RD15SW*	1642012-39	9/29/2016		EPA 1631
EE-IS-1601	GW	*0916MW01GW*	1642012-40	9/30/2016		EPA 1631
EE-IS-1601	SW	*0916RD50SW*	1642012-41	9/29/2016	FD of 0916RD14SW	EPA 1631
EE-IS-1601	Blank	1016RB01	1642012-42	10/6/2016	Rinse Blank	EPA 1631

Table 1 - Sample Listing

Work Order	Matrix	Sample ID	Lab ID	Sample Date	QA/QC	Analysis
EE-IS-1601	SW	0916RD10SW	1642012-43	9/29/2016		EPA 1631
EE-IS-1601	GW	1016MW26GW	1642012-44	10/5/2016		EPA 1631
EE-IS-1601	SW	0916RD14SW	1642012-45	9/29/2016	FD of 0916RD50SW	EPA 1631
EE-IS-1601	Blank	0916FB03	1642012-46	9/30/2016	Field Blank	EPA 1631
EE-IS-1601	Blank	0916TB02	1642012-47	9/22/2016	Trip Blank	EPA 1631
EE-IS-1601	GW	1016MW42GW	1642012-48	10/5/2016		EPA 1631
EE-IS-1601	GW	1016MW09GW	1642012-49	10/3/2016		EPA 1631
EE-IS-1601	GW	1016MW29GW	1642012-50	10/3/2016		EPA 1631
EE-IS-1601	GW	1016MW55GW	1642012-51	10/4/2016	FD of 1016MW19GW	EPA 1631
EE-IS-1601	GW	1016MW40GW	1642012-52	10/4/2016		EPA 1631
EE-IS-1601	GW	0916MW17GW	1642012-53	9/30/2016	FD of 0916MW17GW	EPA 1631
EE-IS-1601	GW	1016MW19GW	1642012-54	10/4/2016	FD of 1016MW55GW	EPA 1631
EE-IS-1601	Blank	1016FB08	1642012-55	10/5/2016	Field Blank	EPA 1631
EE-IS-1601	GW	0916MW50GW	1642012-56	9/30/2016	FD of 0916MW17GW	EPA 1631
EE-IS-1601	Blank	1016FB06	1642012-57	10/30/2016	Field Blank	EPA 1631
EE-IS-1601		1016MW33GW	1642012-58	10/2/2016		EPA 1631
EE-IS-1601	Blank	0916FB01	1642012-59	9/28/2016	Field Blank	EPA 1631
EE-IS-1601	GW	1016MW28GW	1642012-60	10/2/2016		EPA 1631
EE-IS-1601	GW	1016MW10GW	1642012-61	10/2/2016		EPA 1631
EE-IS-1601	GW	1016MW06GW	1642012-62	10/1/2016		EPA 1631
EE-IS-1601	GW	1016MW08GW	1642012-63	10/1/2016		EPA 1631
EE-IS-1601	Blank	1016FB05	1642012-64	10/2/2016	Field Blank	EPA 1631
EE-IS-1601	Blank	1016FB04	1642012-65	10/1/2016	Field Blank	EPA 1631
EE-IS-1601	GW	1016MW22GW	1642012-66	10/5/2016	MS/MSD	EPA 1631
EE-IS-1601	GW	1016MW31GW	1642012-67	10/1/2016		EPA 1631
EE-IS-1601	GW	1016FB07	1642012-68	10/4/2016	Field Blank	EPA 1631
EE-IS-1601		SGS Reagent Water Blank	1642012-69	10/4/2016		EPA 1631
EE-IS-1601	Blank	Filter Blank	1642012-70	10/4/2016	Rinse Blank	EPA 1631
F-SW = Filtered surface water F-GW =Filtered ground water FD = Field duplicate sample					SW = Surface water GW = Ground water	

Table 2 - List of Samples Qualified for Holding Time Exceedance

Method	Analyte	Sample IDs	HT	Sampling Date	Analysis Date	Qual
None						

Table 3a - List of Positive Results for Blank Samples

Method	Sample ID	Sample Type	Analyte	Result**	Analysis Type	Units	PQL
EPA1631	B162578-BLK1	AQ	Lead	0.07	MB	ng/L	0.40
EPA1631	B162578-BLK2	AQ	Lead	0.05	MB	ng/L	0.40
EPA1631	B162578-BLK3	AQ	Lead	0.10	MB	ng/L	0.40
EPA1631	B162578-BLK4	AQ	Lead	0.10	MB	ng/L	0.40
EPA1631	B162579-BLK5	AQ	Lead	0.23	MB	ng/L	0.40
EPA1631	B162579-BLK6	AQ	Lead	0.14	MB	ng/L	0.40
EPA1631	B162579-BLK7	AQ	Lead	0.15	MB	ng/L	0.40
EPA1631	B162579-BLK8	AQ	Lead	0.16	MB	ng/L	0.40
EPA1631	1016FB02	AQ	Lead	0.17	FB	ng/L	0.40
EPA1631	1016FB03	AQ	Lead	0.13	FB	ng/L	0.40
EPA1631	1016FB06	AQ	Lead	0.16	FB	ng/L	0.40
EPA1631	1016FB07	AQ	Lead	0.18	FB	ng/L	0.40
EPA1631	1016FB08	AQ	Lead	0.21	FB	ng/L	0.40
EPA1631	1016RB01	AQ	Lead	1.98	RB	ng/L	0.40

Table 3b - List of Samples Qualified for Method Blank Contamination

Method	Sample ID	Analyte	Blank Result	Sample Result	Sample Qual	PQL
None *						

*EPA 1631 method monitors laboratory blank concentration and uses blank concentration to correct reported sample data. Detected values less than the quantitation limit are normal.
** Field blanks (FB) and Rinsate blank (RB) value are laboratory blank corrected.

Table 3c - List of Samples Qualified for Field or Equipment Rinsate Blank Contamination

Method	Sample ID	Analyte	Blank Result ng/L	Sample Result ng/L	Sample Qual	PQL ng/L
EPA 1631	1016MW19GW	Dissolved Mercury	0.18	0.61	U	0.61*
EPA1631	1016MW43GW	Total Mercury	1.98	6.77	U	6.77*
* Adjusted from 0.5 ng/L						

Table 4 - List of Samples with Surrogates outside Control Limits

Method	Sample ID	Sample Type	Analyte	Rec.	Low Limit	High Limit	Dil Fac	Sample Qual.
None.								

Table 5a - List of MS/MSD Recoveries outside Control Limits

Method	Sample ID	Sample Type	Analyte	Orig. Result	Spike Amount	Rec.	Dil Fac.	Low Limit	High Limit	Sample Qual
None										

Table 5b - List of Lab and MS Duplicate RPDs outside Control Limits

Sample ID	Analyte	Method	RPD	RPD Limit	No. of Affected Samples	Samp Qual
None						

Table 6 - List of LCS Recoveries outside Control Limits

Method	Sample ID	Analyte	%Rec.	Low Limit	High Limit	No. of Affected Samples	Samp Qual
None							

Table 7 - Samples that were Re-analyzed

Sample ID	Lab ID	Method	Sample Type	Action
0916RD05SW	1642012-12	EPA1631	Filtered surface water	High blank with no Qualification
0916RD08SW	1642012-14	EPA1631	Filtered surface water	Confirmation with no Qualification High blank with no Qualification
0916RD09SW	1642012-15	EPA1631	Filtered surface water	High blank with no Qualification
0916RD10SW	1642012-16	EPA1631	Filtered surface water	High blank with no Qualification
0916MW50GW	1642012-20	EPA1631	Filtered ground water	High blank with no Qualification
1016MW16GW	1642012-21	EPA1631	Filtered ground water	High blank with no Qualification
1016MW43GW	1642012-22	EPA1631	Filtered ground water	High blank with no Qualification
1016MW10GW	1642012-23	EPA1631	Filtered ground water	High blank with no Qualification
1016MW31GW	1642012-26	EPA1631	Filtered ground water	High blank with no Qualification
1016MW29GW	1642012-28	EPA1631	Filtered ground water	High blank with no Qualification
1016MW22GW	1642012-29	EPA1631	Filtered ground water	High blank with no Qualification
1016MW43GW	1642012-31	EPA1631	ground water	High blank with no Qualification
0916RD06SW	1642012-36	EPA1631	Surface water	High blank with no Qualification
0916RD09SW	1642012-37	EPA1631	Surface water	High blank with no Qualification
0916RD08SW	1642012-38	EPA1631	Surface water	Confirmation with no Qualification High blank with no Qualification
1016RB01	1642012-42	EPA1631	Rinsate blank water	Per method with no Qualification
1016MW55GW	1642012-51	PA1631	ground water	Confirmation with no Qualification High blank with no Qualification
0916MW50GW	1642012-56	EPA1631	ground water	High blank with no Qualification
1016MW33GW	1642012-58	EPA1631	ground water	High blank with no Qualification
Filter Blank	1642012-70	EPA1631	Rinsate blank water	High blank with no Qualification

Table 8a - Summary of Field Duplicate Results

Method	Analyte	Units	0916RD14SW	0916RD50SW	RPD	Rating	Sample Qualifier
EPA 1631	Mercury	ng/L	28.9	27	6.8	Good	None
EPA 1631	Dissolved Mercury	ng/L	14.6	15.8	7.9	Good	None

Table 8b - Summary of Field Duplicate Results

Method	Analyte	Units	0916MW17GW	0916MW50GW	RPD	Rating	Sample Qualifier
EPA 1631	Mercury	ng/L	2,590	2,320	11.2	Good	None
EPA 1631	Dissolved Mercury	ng/L	1,100	990	10.5	Good	None

Table 8c - Summary of Field Duplicate Results

Method	Analyte	Units	1016MW19GW	1016MW55GW	RPD	Rating	Sample Qualifier
EPA 1631	Mercury	ng/L	3.32	3.94	17.0	Good	None
EPA 1631	Dissolved Mercury	ng/L	0.61	4.94	156	Poor	J

DATA REVIEW MEMORANDUM

DATE: December 7, 2016 (Revised March 28, 2017)

TO: Jonathan Reeve, Project Manager, E & E, Seattle, WA

FROM: Howard Edwards, E & E, San Francisco, CA

SUBJ: Data Review: Red Devil Mine Fall 2016

REFERENCE:

Project ID	Lab Work Order	Lab
1001095.0009.02	EEI-SA1601	Brooks Applied Labs – Seattle

Validated data is attached to the end of this memorandum.

1. SAMPLE IDENTIFICATION

For the sampling activities at the Red Devil Mine site, Ecology and Environment, Inc. (E & E) collected the samples listed in Table 1. Project-specific matrix spike/matrix spike duplicates (MS/MSD) were designated in the field. All samples were sent to Brooks Applied Labs in Tacoma, Washington, for low-level analyses. This report addresses only Brooks Applied Labs-generated data.

The analytical report was issued by Brooks Applied Labs on November 25, 2016. The data in the analytical report were reviewed for field and laboratory precision, accuracy, and completeness in accordance with procedures and quality control (QC) limits, the current laboratory Quality Assurance Manual (QAM) and current standard operating procedures (SOPs). Any additional data review qualifiers added are noted below and listed on the tables at the end of this memorandum. Definitions of all data qualifiers are given in the report.

Work Orders, Tests, and Number of Samples Included in this Data Review Memo

Work Orders/ Job Number	Matrix	Test Method	Method Name	Number of Samples
EEI-SA1601	Surface Water	EPA 1631	Total Low-Level Mercury (CVAFS)	8
EEI-SA1601	Surface Water	EPA 1631	Dissolved Low-Level Mercury (CVAFS)	8
EEI-SA1601	Ground Water	EPA 1631	Total Low-Level Mercury (CVAFS)	21
EEI-SA1601	Ground Water	EPA 1631	Dissolved Low-Level Mercury (CVAFS)	21
EEI-SA1601	Rinse Blank	EPA 1631	Dissolved Low-Level Mercury (CVAFS)	1
EEI-SA1601	Trip Blank	EPA 1631	Dissolved Low-Level Mercury (CVAFS)	1
EEI-SA1601	Field Blank	EPA 1631	Dissolved Low-Level Mercury (CVAFS)	6

2. SAMPLE PROCEDURES

All samples were collected as specified in the work plan and documented on the chain-of-custody (COC) and in field notebooks. Samples were analyzed as specified on the COC. Samples were packaged, shipped, and received as specified in the work plan. All samples for organic analyses must be received cold (4 ± 2 degrees Celsius [^{o}C]) and in good condition as documented on the Cooler Receipt Form.

REVIEW RESULTS

All sample procedures were followed and the sample coolers were received by the laboratory at 6.0^{o}C and 11^{o}C. Since the samples were acidified in the field, the Field Sampling Plan requirement indicating 4 ±2 ^{o}C requirement, did not result in qualification. Since the temperature is not a method requirement.

3. LABORATORY DATA

3.1 HOLDING TIMES

Holding times are established and monitored to ensure analytical results accurately represent analyte concentrations in a sample at the time of collection. These qualified results based upon missed holding times are presented in Table 2 (if applicable). Exceeding the holding time for a sample generally results in a loss of the analyte due to

a variety of mechanisms, such as deposition on the sample container walls or precipitation.

3.2 BLANKS

All laboratory blanks are integrated into the method and all results are corrected for blank values provided that the laboratory blank values are within method-set limits. When blanks are outside of the method limits, associated samples are re-analyzed. Method blanks are shown in Table 3a. No data was qualified due to laboratory method blanks (see Table 3b).

Field blank samples are analyzed and evaluated to determine the existence and magnitude of possible contamination during the sampling and analysis process. All field blank with reported results are also presented in Table 3a (if applicable). If the mercury is present in the sample at similar trace levels (less than 5 times the blank concentration), then the analyte is likely a common background contaminant from some phase of the sampling, extraction, or analytical procedure and associated low-level sample concentrations are not considered to be site related. Sample results in these cases are qualified as not detected, “U”.

REVIEW RESULTS

All laboratory blanks were performed at the required frequency. As noted in Table 3a, analyte concentrations in the method blanks were below the practical quantitation limit (PQL). Several field blanks were at a concentration above the detection limit. All associated reported concentration of mercury that were less than 5 times the concentration found in their associated field blank were U qualified as not detected. A summary of qualified data due to method blank contamination is presented in Table 3c.

Two equipment rinsate blank was collected. One rinsate blank was at a concentration above the method reporting limit. All associated sample results that were detected at levels less than 5 times the blank were U qualified as not detected. Associated samples with detection greater than 5 times the blank were not qualified. A summary of qualified data due to equipment rinsate blank contamination is also presented in Table 3c.

3.3 MATRIX SPIKE AND MATRIX SPIKE DUPLICATE ANALYSIS

The MS/MSD analyses are intended to provide information about the effects that the sample matrix exerts on the digestion / extraction and measurement methodology. MS recovery values that do not meet laboratory QC criteria may indicate that sample analyte results are being attenuated in the analysis procedure. The potential sample bias may be estimated by noting the degree to which the MS concentration was elevated or lowered in the spike analysis. However, this estimated bias should serve only as an approximation; sample-specific problems may be the cause of the discrepancy, particularly in soil samples.

Recovery calculations are not required if the spiking concentration added is less than 25% of the sample background concentration.

REVIEW RESULTS

The MS/MSD sample analyses were performed on five samples: 1016MW19GW, 1016MW16GW, 1016MW27GW, 10916MW22GW, and10916MW32GW, at the required frequency. All MS/MSD recoveries and accuracies were within the control limits

A summary of sample data qualified due to MS/MSD precision and accuracy are presented in Tables 5a and 5b (if applicable).

3.4 LABORATORY CONTROL SAMPLE ANALYSIS

The LCS or Certified Reference Material standard is analyzed to monitor the efficiency of the digestion/extraction procedure and analytical instrument operation. The ability of the laboratory to successfully analyze an LCS or Certified Reference Material standard demonstrates that there are no analytical problems related to the digestion/sample preparation procedures and/or instrument operations. The LCS or Certified Reference Material standard results outside QC limits are presented in Table 6 (if applicable). Sporadic and marginal QC failures for multiple component methods do not indicate an analytical concern. If recoveries are high and the compounds are not detected in the samples, then no data qualification is required. All recoveries should be above 10% or the non-detect results flagged “UR” as rejected.

REVIEW RESULTS

The analysis of the Certified Reference Material Sample was within control limits.

3.5 COMPOUND IDENTIFICATION AND QUANTITATION

Compound identities are assigned by comparing sample compound retention times to retention times from known (standard) compounds and identification of an acceptable mass spectrum. Compounds detected below the PQL in samples should be considered estimated and are qualified "J." The samples with compounds above the linear range were all re-analyzed at a higher dilution factor.

REVIEW RESULTS

All compound identification and quantitation criteria were achieved. As noted in Table 7, samples were reported as reanalyzed based upon laboratory blank concentrations in the batch. All reported concentrations were from batches with acceptable blanks.
Sample 0916RD08SW had a dissolved low-level lead concentration that was greater than the total low-level lead concentration. The data was “J” qualified, as this is an unrealistic scenario.

4. FIELD DUPLICATE SAMPLE RESULTS

Field duplicate samples were collected and analyzed as an indication of overall precision for both field and laboratory. Field duplicate results are summarized in Table 8 (if applicable). The results are expected to have more variability than laboratory duplicates, which measure only laboratory precision. The QC criteria used to assess field duplicate samples for this project was limits of 40% RPD for waters, or twice the general laboratory duplicate criteria. If a given compound in both the regular sample and associated field duplicate sample was below the laboratory PQL, or the compound was not detected in one of the samples, then the compound is generally not qualified due to field duplicate precision. There are no guidelines regarding data qualification based on poor field duplicate precision. Professional judgment was used to determine whether or not to qualify results.

REVIEW RESULTS

Three field duplicates analyses were performed on this SDG. The RPD ratings are listed on Tables 8a through 8c as “Good” if the RPD is less than field duplicate QC criteria of 40% and as “Poor” if the RPD exceeded the field duplicate QC criteria.

Two results show good precision in the sample pair for both total and dissolved mercury. One set of field duplicate samples had good precision for total mercury and poor precision for dissolved mercury. Results are noted on Tables 8a through 8c. Qualifiers were only added to the field duplicate results as noted.

5. OVERALL ASSESSMENT OF DATA

The data from several of the QA samples suggest the following:

- That there was a sample related problem at two locations. The lead concentrations in the filtered and unfiltered sample 1016MW55GW (duplicate of the MW19 sample) suggests that there was a filtering problem with that sample. The lead concentrations in the filtered and unfiltered sample 0916RD08 also suggest a filtering or labeling problem.
- That there was an equipment decontamination problem with the bladder pump that was used to collect some of the groundwater samples. The equipment rinsate blank indicates the potential of inadequate decontamination of the bladder pump. Since the rinsate blank sample was not field filtered, it is only associated with the total mercury concentration in unfiltered samples collected with a bladder pump. Future rinsate blanks sampling should include a filtered rinsate blanks.
- E & E notified the laboratory that the mercury (Hg) result associated with sample 1016MW19GW (1642012-54) was an outlier of what was expected. The laboratory re-analyzed the sample in duplicate and obtained a much lower result. The original Hg result was reported as 38.8 ng/L, and the re-analyses, performed in two separate sequences (analytical runs), were 3.32 ng/L and 3.38 ng/L. The result of 3.32 ng/L was reported. The value of 3.32 ng/L is consistent with the sample’s field duplicate value and with historic data for the location. The originally reported value of 38.8 ng/L was in error due to a unique instrument-related problem that was identified by the laboratory. According to the laboratory, the problem only affected that sample 1016MW19GW (1642012-54). The

laboratory has implemented a corrective action measures that will prevent the error in future analyses.

All data were reviewed and considered usable with qualification as noted in this report.

Table 1 - Sample Listing

Work Order	Matrix	Sample ID	Lab ID	Sample Date	QA/QC	Analysis
EE-IS-1601	F-GW	*0916MW32GW*	1642012-01	9/29/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW09GW*	1642012-02	10/3/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW55GW*	1642012-03	10/4/2016	FD of 1016MW19GW	EPA 1631
EE-IS-1601	F-GW	*1016MW40GW*	1642012-04	10/4/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW19GW*	1642012-05	10/4/2016	FD of 1016MW55GW MS/MSD	EPA 1631
EE-IS-1601	F-GW	*1016MW28GW*	1642012-06	10/2/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW06GW*	1642012-07	10/1/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW08GW*	1642012-08	10/1/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW42GW*	1642012-09	10/5/2016		EPA 1631
EE-IS-1601	F-GW	*0916MW01GW*	1642012-10	9/30/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW33GW*	1642012-11	10/2/2016		EPA 1631
EE-IS-1601	F-DW	*0916RD05SW*	1642012-12	9/29/2016		EPA 1631
EE-IS-1601	F-DW	*0916RD06SW*	1642012-13	9/28/2016		EPA 1631
EE-IS-1601	F-DW	*0916RD08SW*	1642012-14	9/28/2016		EPA 1631
EE-IS-1601	F-DW	*0916RD09SW*	1642012-15	9/29/2016		EPA 1631
EE-IS-1601	F-DW	*0916RD10SW*	1642012-16	9/29/2016		EPA 1631
EE-IS-1601	F-DW	*0916RD14SW*	1642012-17	9/29/2016	FD of 0916RD50SW	EPA 1631
EE-IS-1601	F-DW	*0916RD15SW*	1642012-18	9/29/2016		EPA 1631
EE-IS-1601	F-DW	*0916RD50SW*	1642012-19	9/29/2016	FD of 0916RD14SW	EPA 1631
EE-IS-1601	F-GW	*0916MW50GW*	1642012-20	9/30/2016	FD of 0916MW17GW	EPA 1631
EE-IS-1601	F-GW	*1016MW16GW*	1642012-21	10/3/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW43GW*	1642012-22	10/2/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW10GW*	1642012-23	10/2/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW27GW*	1642012-24	10/5/2016		EPA 1631
EE-IS-1601	F-GW	*0916MW17GW*	1642012-25	9/30/2016	FD of 0916MW50GW	EPA 1631
EE-IS-1601	F-GW	*1016MW31GW*	1642012-26	10/1/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW26GW*	1642012-27	10/5/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW29GW*	1642012-28	10/3/2016		EPA 1631
EE-IS-1601	F-GW	*1016MW22GW*	1642012-29	10/5/2016		EPA 1631
EE-IS-1601	GW	*1016MW16GW*	1642012-30	10/3/2016	MS/MSD	EPA 1631
EE-IS-1601	GW	*1016MW43GW*	1642012-31	10/2/2016		EPA 1631
EE-IS-1601	GW	*0916MW32GW*	1642012-32	9/29/2016	MS/MSD	EPA 1631
EE-IS-1601	Blank	*0916FB02*	1642012-33	9/29/2016	Field Blank	EPA 1631
EE-IS-1601	SW	*0916RD05SW*	1642012-34	9/29/2016		EPA 1631
EE-IS-1601	GW	*1016MW27GW*	1642012-35	10/5/2016	MS/MSD	EPA 1631
EE-IS-1601	SW	*0916RD06SW*	1642012-36	9/28/2016		EPA 1631
EE-IS-1601	SW	*0916RD09SW*	1642012-37	9/29/2016		EPA 1631
EE-IS-1601	SW	*0916RD08SW*	1642012-38	9/28/2016		EPA 1631
EE-IS-1601	SW	*0916RD15SW*	1642012-39	9/29/2016		EPA 1631
EE-IS-1601	GW	*0916MW01GW*	1642012-40	9/30/2016		EPA 1631
EE-IS-1601	SW	*0916RD50SW*	1642012-41	9/29/2016	FD of 0916RD14SW	EPA 1631
EE-IS-1601	Blank	1016RB01	1642012-42	10/6/2016	Rinse Blank	EPA 1631

Table 1 - Sample Listing

Work Order	Matrix	Sample ID	Lab ID	Sample Date	QA/QC	Analysis
EE-IS-1601	SW	0916RD10SW	1642012-43	9/29/2016		EPA 1631
EE-IS-1601	GW	1016MW26GW	1642012-44	10/5/2016		EPA 1631
EE-IS-1601	SW	0916RD14SW	1642012-45	9/29/2016	FD of 0916RD50SW	EPA 1631
EE-IS-1601	Blank	0916FB03	1642012-46	9/30/2016	Field Blank	EPA 1631
EE-IS-1601	Blank	0916TB02	1642012-47	9/22/2016	Trip Blank	EPA 1631
EE-IS-1601	GW	1016MW42GW	1642012-48	10/5/2016		EPA 1631
EE-IS-1601	GW	1016MW09GW	1642012-49	10/3/2016		EPA 1631
EE-IS-1601	GW	1016MW29GW	1642012-50	10/3/2016		EPA 1631
EE-IS-1601	GW	1016MW55GW	1642012-51	10/4/2016	FD of 1016MW19GW	EPA 1631
EE-IS-1601	GW	1016MW40GW	1642012-52	10/4/2016		EPA 1631
EE-IS-1601	GW	0916MW17GW	1642012-53	9/30/2016	FD of 0916MW17GW	EPA 1631
EE-IS-1601	GW	1016MW19GW	1642012-54	10/4/2016	FD of 1016MW55GW	EPA 1631
EE-IS-1601	Blank	1016FB08	1642012-55	10/5/2016	Field Blank	EPA 1631
EE-IS-1601	GW	0916MW50GW	1642012-56	9/30/2016	FD of 0916MW17GW	EPA 1631
EE-IS-1601	Blank	1016FB06	1642012-57	10/30/2016	Field Blank	EPA 1631
EE-IS-1601		1016MW33GW	1642012-58	10/2/2016		EPA 1631
EE-IS-1601	Blank	0916FB01	1642012-59	9/28/2016	Field Blank	EPA 1631
EE-IS-1601	GW	1016MW28GW	1642012-60	10/2/2016		EPA 1631
EE-IS-1601	GW	1016MW10GW	1642012-61	10/2/2016		EPA 1631
EE-IS-1601	GW	1016MW06GW	1642012-62	10/1/2016		EPA 1631
EE-IS-1601	GW	1016MW08GW	1642012-63	10/1/2016		EPA 1631
EE-IS-1601	Blank	1016FB05	1642012-64	10/2/2016	Field Blank	EPA 1631
EE-IS-1601	Blank	1016FB04	1642012-65	10/1/2016	Field Blank	EPA 1631
EE-IS-1601	GW	1016MW22GW	1642012-66	10/5/2016	MS/MSD	EPA 1631
EE-IS-1601	GW	1016MW31GW	1642012-67	10/1/2016		EPA 1631
EE-IS-1601	GW	1016FB07	1642012-68	10/4/2016	Field Blank	EPA 1631
EE-IS-1601		SGS Reagent Water Blank	1642012-69	10/4/2016		EPA 1631
EE-IS-1601	Blank	Filter Blank	1642012-70	10/4/2016	Rinse Blank	EPA 1631
F-SW = Filtered surface water F-GW =Filtered ground water FD = Field duplicate sample					SW = Surface water GW = Ground water	

Table 2 - List of Samples Qualified for Holding Time Exceedance

Method	Analyte	Sample IDs	HT	Sampling Date	Analysis Date	Qual
None						

Table 3a - List of Positive Results for Blank Samples

Method	Sample ID	Sample Type	Analyte	Result**	Analysis Type	Units	PQL
EPA1631	B162578-BLK1	AQ	Lead	0.07	MB	ng/L	0.40
EPA1631	B162578-BLK2	AQ	Lead	0.05	MB	ng/L	0.40
EPA1631	B162578-BLK3	AQ	Lead	0.10	MB	ng/L	0.40
EPA1631	B162578-BLK4	AQ	Lead	0.10	MB	ng/L	0.40
EPA1631	B162579-BLK5	AQ	Lead	0.23	MB	ng/L	0.40
EPA1631	B162579-BLK6	AQ	Lead	0.14	MB	ng/L	0.40
EPA1631	B162579-BLK7	AQ	Lead	0.15	MB	ng/L	0.40
EPA1631	B162579-BLK8	AQ	Lead	0.16	MB	ng/L	0.40
EPA1631	1016FB02	AQ	Lead	0.17	FB	ng/L	0.40
EPA1631	1016FB03	AQ	Lead	0.13	FB	ng/L	0.40
EPA1631	1016FB06	AQ	Lead	0.16	FB	ng/L	0.40
EPA1631	1016FB07	AQ	Lead	0.18	FB	ng/L	0.40
EPA1631	1016FB08	AQ	Lead	0.21	FB	ng/L	0.40
EPA1631	1016RB01	AQ	Lead	1.98	RB	ng/L	0.40

Table 3b - List of Samples Qualified for Method Blank Contamination

Method	Sample ID	Analyte	Blank Result	Sample Result	Sample Qual	PQL
None *						

*EPA 1631 method monitors laboratory blank concentration and uses blank concentration to correct reported sample data. Detected values less than the quantitation limit are normal.
** Field blanks (FB) and Rinsate blank (RB) value are laboratory blank corrected.

Table 3c - List of Samples Qualified for Field or Equipment Rinsate Blank Contamination

Method	Sample ID	Analyte	Blank Result ng/L	Sample Result ng/L	Sample Qual	PQL ng/L
EPA 1631	1016MW19GW	Dissolved Mercury	0.18	0.61	U	0.61*
EPA1631	1016MW43GW	Total Mercury	1.98	6.77	U	6.77*
* Adjusted from 0.5 ng/L						

Table 4 - List of Samples with Surrogates outside Control Limits

Method	Sample ID	Sample Type	Analyte	Rec.	Low Limit	High Limit	Dil Fac	Sample Qual.
None.								

Table 5a - List of MS/MSD Recoveries outside Control Limits

Method	Sample ID	Sample Type	Analyte	Orig. Result	Spike Amount	Rec.	Dil Fac.	Low Limit	High Limit	Sample Qual
None										

Table 5b - List of Lab and MS Duplicate RPDs outside Control Limits

Sample ID	Analyte	Method	RPD	RPD Limit	No. of Affected Samples	Samp Qual
None						

Table 6 - List of LCS Recoveries outside Control Limits

Method	Sample ID	Analyte	% Rec.	Low Limit	High Limit	No. of Affected Samples	Samp Qual
None							

Table 7 - Samples that were Re-analyzed

Sample ID	Lab ID	Method	Sample Type	Action
0916RD05SW	1642012-12	EPA1631	Filtered surface water	High blank with no Qualification
0916RD08SW	1642012-14	EPA1631	Filtered surface water	Confirmation with no Qualification High blank with no Qualification
0916RD09SW	1642012-15	EPA1631	Filtered surface water	High blank with no Qualification
0916RD10SW	1642012-16	EPA1631	Filtered surface water	High blank with no Qualification
0916MW50GW	1642012-20	EPA1631	Filtered ground water	High blank with no Qualification
1016MW16GW	1642012-21	EPA1631	Filtered ground water	High blank with no Qualification
1016MW43GW	1642012-22	EPA1631	Filtered ground water	High blank with no Qualification
1016MW10GW	1642012-23	EPA1631	Filtered ground water	High blank with no Qualification
1016MW31GW	1642012-26	EPA1631	Filtered ground water	High blank with no Qualification
1016MW29GW	1642012-28	EPA1631	Filtered ground water	High blank with no Qualification
1016MW22GW	1642012-29	EPA1631	Filtered ground water	High blank with no Qualification
1016MW43GW	1642012-31	EPA1631	ground water	High blank with no Qualification
0916RD06SW	1642012-36	EPA1631	Surface water	High blank with no Qualification
0916RD09SW	1642012-37	EPA1631	Surface water	High blank with no Qualification
0916RD08SW	1642012-38	EPA1631	Surface water	Confirmation with no Qualification High blank with no Qualification
1016RB01	1642012-42	EPA1631	Rinsate blank water	Per method with no Qualification
1016MW55GW	1642012-51	PA1631	ground water	Confirmation with no Qualification High blank with no Qualification
0916MW50GW	1642012-56	EPA1631	ground water	High blank with no Qualification
1016MW33GW	1642012-58	EPA1631	ground water	High blank with no Qualification
Filter Blank	1642012-70	EPA1631	Rinsate blank water	High blank with no Qualification

Table 8a - Summary of Field Duplicate Results

Method	Analyte	Units	0916RD14SW	0916RD50SW	RPD	Rating	Sample Qualifier
EPA 1631	Mercury	ng/L	28.9	27	6.8	Good	None
EPA 1631	Dissolved Mercury	ng/L	14.6	15.8	7.9	Good	None

Table 8b - Summary of Field Duplicate Results

Method	Analyte	Units	0916MW17GW	0916MW50GW	RPD	Rating	Sample Qualifier
EPA 1631	Mercury	ng/L	2,590	2,320	11.2	Good	None
EPA 1631	Dissolved Mercury	ng/L	1,100	990	10.5	Good	None

Table 8c - Summary of Field Duplicate Results

Method	Analyte	Units	1016MW19GW	1016MW55GW	RPD	Rating	Sample Qualifier
EPA 1631	Mercury	ng/L	3.32	3.94	17.0	Good	None
EPA 1631	Dissolved Mercury	ng/L	0.61	4.94	156	Poor	J

DATA REVIEW MEMORANDA

DATE: July 31, 2017
TO: Jonathan Reeve, Project Manager, Ecology and Environment, Inc., Seattle, WA
FROM: Brad Heusinkveld, Ecology and Environment, Inc., Seattle, WA
Valeriy Bizyayev, Ecology and Environment, Inc., Seattle WA

RE: Data Review, Red Devil Mine, Spring 2017

REFERENCE

PROJECT ID:	100195.0009.02
LAB WORK ORDER:	EEI-SA1601
LAB:	Brooks Applied Lab

Contents

1. Sample Identification

For the sampling activities at the Red Devil Mine site, Ecology and Environment, Inc. (E & E) collected the samples listed in Table 1. Project-specific matrix spike/matrix spike duplicates (MS/MSD) were designated in the field. All samples were sent to Brooks Applied Labs in Bothell, Washington, for low-level analyses. This report addresses only Brooks Applied Labs generated data.

The analytical report was issued by Brooks Applied Labs on June 26, 2017. The data in the analytical report were reviewed for field and laboratory precision, accuracy, and completeness in accordance with procedures and quality control (QC) limits, the current laboratory Quality Assurance Manual (QAM) and current standard operating procedures (SOPs). Any additional data review qualifiers added are noted below and listed on the tables at the end of this memorandum. Definitions of all data qualifiers are given in the report.

Work Orders and Samples Included in this Review Memo

Work Orders/ Job Number	Matrix	Test Method	Method Name	Number of Samples
EEI-SA1601	Surface Water	EPA 1631	Total Low-Level Mercury (CVAFS)	12
EEI-SA1601	Surface Water	EPA 1631	Dissolved Low-Level Mercury (CVAFS)	12
EEI-SA1601	Ground Water	EPA 1631	Total Low-Level Mercury (CVAFS)	19
EEI-SA1601	Ground Water	EPA 1631	Dissolved Low-Level Mercury (CVAFS)	19
EEI-SA1601	Rinse Blank	EPA 1631	Total Low-Level Mercury (CVAFS)	1
EEI-SA1601	Trip Blank	EPA 1631	Total Low-Level Mercury (CVAFS)	4
EEI-SA1601	Field Blank	EPA 1631	Total Low-Level Mercury (CVAFS)	7

2. Sample Procedures

All samples were collected as specified in the work plan and documented on the chain-of-custody (COC) and in field notebooks. Samples were analyzed as specified on the COC. Samples were packaged, shipped, and received as specified in the work plan. All samples for analyses must be received in good condition as documented on the Cooler Receipt Form.

Results

All samples were received by the laboratory in good condition with custody seals intact at 18 ^{o}C. Delivery temperature is not specified as a Method requirement. No qualification is given for sample procedures or delivery.

3. Laboratory Data

3.1 Holding Times

Holding times are established and monitored to ensure analytical results accurately represent analyte concentrations in a sample at the time of collection. Exceeding the holding time for a sample generally results in a loss of the analyte due to a variety of mechanisms, such as deposition on the sample container walls or precipitation.

Results

All field samples were taken between May 26 and June 2 of 2017, and received by the laboratory on June 5, 2017. All submitted Samples were analyzed between June 14 and June 17. No qualification is given for sample holding and analysis times.

3.2 Blanks

All laboratory blanks are integrated into the method and all results are corrected for blank values provided that the laboratory blank values are within method-set limits. When blanks are outside of the method limits, associated samples are re-analyzed. Method blanks are shown in Table 3a. No data was qualified due to laboratory method blanks (see Table 3b).

Field blank samples are analyzed and evaluated to determine the existence and magnitude of possible contamination during the sampling and analysis process. All field blank with reported results are also presented in Table 3a (if applicable). If the mercury is present in the sample at similar trace levels (less than 5 times the blank concentration), then the analyte is likely a common background contaminant from some phase of the sampling, extraction, or analytical procedure and associated low-level sample concentrations are not considered to be site related. Sample results in these cases are qualified as not detected, “U”.

Results

Blank results with detectable Mercury are presented in Table 3a. No result exceeds the PQL limit of 0.4 ng/L nor method limit of 0.5 ng/L. No qualification is given for Method Blank Contamination.

Five Field Blanks were submitted for analysis. Samples 0517FB01, 0517FB04, 0517FB05, 0517FB06, were assessed below the Method Detection Limit of 0.10 ng/L and qualified with U. Sample 0517FB03 is reported at 0.20 ng/L and qualified with J.

The equipment rinsate blank 0617EQ01GW was qualified with U for results below the MDL. The rinsate blank 0617RS01GW was reported at 10.8 ng/L for total recoverable Mercury. Samples qualified due to equipment rinsate blank contamination are presented in Table 3c.

3.3 Matrix Spike and Matrix Duplicate Analysis

The MS/MSD analyses are intended to provide information about the effects that the sample matrix exerts on the digestion / extraction and measurement methodology. MS recovery values that do not meet laboratory QC criteria may indicate that sample analyte results are being attenuated in the analysis procedure. The potential sample bias may be estimated by noting the degree to which the MS concentration was elevated or lowered in the spike analysis. However, this estimated bias should serve only as an approximation; sample-specific problems may be the cause of the discrepancy, particularly in soil samples.

Recovery calculations are not required if the spiking concentration added is less than 25% of the sample background concentration.

Results

Seven pairs of MS/MSD samples were analyzed from the samples submitted. No samples were qualified due to MS/MSD analysis.

3.4 Laboratory Control Sample Analysis

The LCS or Certified Reference Material standard is analyzed to monitor the efficiency of the digestion/extraction procedure and analytical instrument operation. The ability of the laboratory to successfully analyze an LCS or Certified Reference Material standard demonstrates that there are no analytical problems related to the digestion/sample preparation procedures and/or instrument operations. The LCS or Certified Reference Material standard results outside QC limits are presented in Table 4 (if applicable). Sporadic and marginal QC failures for multiple component methods do not indicate an analytical concern. If recoveries are high and the compounds are not detected in the samples, then no data qualification is required. All recoveries should be above 10% or the non-detect results flagged “UR” as rejected.

Results

Two analyses of Certified Reference Material were performed. All results are within control limits.

3.5 Compound Identification and Qualification

Compound identities are assigned by comparing sample compound retention times to retention times from known (standard) compounds and identification of an acceptable mass spectrum. Compounds detected below the PQL in samples should be considered estimated and are qualified "J." The samples with compounds above the linear range were all re-analyzed at a higher dilution factor.

Results

All compound identification and quantitation criteria were achieved. As noted in Table 5, samples were reported as reanalyzed based upon laboratory blank concentrations in the batch. All reported concentrations were from batches with acceptable blanks.

4. Field Duplicate Sample Results

Field duplicate samples were collected and analyzed as an indication of overall precision for both field and laboratory. Field duplicate results are summarized in Table 5. The results are expected to have more variability than laboratory duplicates, which measure only laboratory precision. The QC criteria used to assess field duplicate samples for this project was limits of 40% RPD for waters, or twice the general laboratory duplicate criteria. If a given compound in both the regular sample and associated field duplicate sample was below the laboratory PQL, or the compound was not detected in one of the samples, then the compound is generally not qualified due to field duplicate precision. There are no guidelines regarding data qualification based on poor field duplicate precision. Professional judgment was used to determine whether to qualify results.

Results

Three field duplicates analyses were performed. The RPD ratings are listed on Table 5a through 5c as “Good” if the RPD is less than field duplicate QC criteria of 40% and as “Poor” if the RPD exceeded the field duplicate QC criteria.

Two results from Field Duplicate analysis fall within acceptable range for RPD comparison. One duplicate pair, 0571RD14SW and 0517RD50SW, qualified as “Good” for Dissolved Mercury and “Poor” for Total Mercury precision with and RPD of 112.7%. This sample was ascribed the qualifier J. Qualifiers were added to the field duplicate results only as noted.

5. Overall Assessment of Data

The data from several of the QA samples suggests the following:

- Equipment decontamination of the sampling bladder pump may be ineffective or inadequate. The rinsate sample 0517RS01GW returned a mercury designation of 10.8 ng/L. Examination of laboratory chromatograms in the same instrument run batch suggests that this value is indeed accurate. Previous positive mercury results from prior sampling events may suggest continuing or recurrent contamination of sampling equipment.

-Field Duplicate analysis of sample 0517RD14SW (Duplicate 0517RD50SW) yielded an Relative Percent Difference of 112.7% for Total Recoverable Mercury, well outside RPD control limits of 40%. Results from Sample 0517RD14SW are ascribed the qualifier J. Instrument results from these samples show no obvious errors that would indicate dramatically elevated or reduced results. No other sample results are given qualification.

Tables and Lists

Table 1 - Sample Listing

Work Order	Matrix	Sample ID	Lab ID	Sample Date	QA/QC	Analysis
EEI-SA1601	Blank	0517FB01	1723003-05	05/26/2017	Field Blank	EPA 1631
EEI-SA1601	Blank	0517FB03	1723003-22	05/28/2017	Field Blank	EPA 1631
EEI-SA1601	Blank	0517FB04	1723003-31	05/29/2017	Field Blank	EPA 1631
EEI-SA1601	Blank	0517FB05	1723003-46	05/30/2017	Field Blank	EPA 1631
EEI-SA1601	Blank	0517FB06	1723003-53	05/31/2017	Field Blank	EPA 1631
EEI-SA1601	GW	0517MW01GW	1723003-23	05/28/2017		EPA 1631
EEI-SA1601	GW	0517MW01GW	1723003-24	05/28/2017		EPA 1631
EEI-SA1601	GW	0517MW06GW	1723003-25	05/28/2017		EPA 1631
EEI-SA1601	GW	0517MW06GW	1723003-26	05/28/2017		EPA 1631
EEI-SA1601	GW	0517MW08GW	1723003-27	05/28/2017		EPA 1631
EEI-SA1601	GW	0517MW08GW	1723003-28	05/28/2017		EPA 1631
EEI-SA1601	GW	0517MW09GW	1723003-54	05/31/2017		EPA 1631
EEI-SA1601	GW	0517MW09GW	1723003-55	05/31/2017		EPA 1631
EEI-SA1601	GW	0517MW10GW	1723003-32	05/29/2017		EPA 1631
EEI-SA1601	GW	0517MW10GW	1723003-33	05/29/2017		EPA 1631
EEI-SA1601	GW	0517MW16GW	1723003-34	05/29/2017		EPA 1631
EEI-SA1601	GW	0517MW16GW	1723003-35	05/29/2017		EPA 1631
EEI-SA1601	GW	0517MW17GW	1723003-36	05/29/2017		EPA 1631
EEI-SA1601	GW	0517MW17GW	1723003-37	05/29/2017		EPA 1631
EEI-SA1601	GW	0517MW19GW	1723003-56	05/31/2017		EPA 1631
EEI-SA1601	GW	0517MW19GW	1723003-57	05/31/2017		EPA 1631
EEI-SA1601	GW	0517MW22GW	1723003-58	05/31/2017		EPA 1631
EEI-SA1601	GW	0517MW22GW	1723003-59	05/31/2017		EPA 1631
EEI-SA1601	GW	0517MW26GW	1723003-47	05/30/2017		EPA 1631
EEI-SA1601	GW	0517MW26GW	1723003-48	05/30/2017		EPA 1631
EEI-SA1601	GW	0517MW27GW	1723003-49	05/30/2017		EPA 1631
EEI-SA1601	GW	0517MW27GW	1723003-50	05/30/2017		EPA 1631
EEI-SA1601	GW	0517MW28GW	1723003-51	05/30/2017		EPA 1631
EEI-SA1601	GW	0517MW28GW	1723003-52	05/30/2017		EPA 1631
EEI-SA1601	GW	0517MW29GW	1723003-29	05/28/2017		EPA 1631
EEI-SA1601	GW	0517MW29GW	1723003-30	05/28/2017		EPA 1631
EEI-SA1601	GW	0517MW33GW	1723003-38	05/29/2017		EPA 1631
EEI-SA1601	GW	0517MW33GW	1723003-39	05/29/2017		EPA 1631
EEI-SA1601	GW	0517MW40GW	1723003-40	05/29/2017		EPA 1631
EEI-SA1601	GW	0517MW40GW	1723003-41	05/29/2017		EPA 1631
EEI-SA1601	GW	0517MW42GW	1723003-60	05/31/2017		EPA 1631

Table 1 - Sample Listing

Work Order	Matrix	Sample ID	Lab ID	Sample Date	QA/QC	Analysis
EEI-SA1601	GW	0517MW42GW	1723003-61	05/31/2017		EPA 1631
EEI-SA1601	GW	0517MW43GW	1723003-42	05/29/2017		EPA 1631
EEI-SA1601	GW	0517MW43GW	1723003-43	05/29/2017		EPA 1631
EEI-SA1601	GW	0517MW51GW	1723003-44	05/29/2017	FD of 0517MW43GW	EPA 1631
EEI-SA1601	GW	0517MW51GW	1723003-45	05/29/2017	FD of 0517MW43GW	EPA 1631
EEI-SA1601	GW	0517MW52GW	1723003-62	05/31/2017	FD of 0517MW22GW	EPA 1631
EEI-SA1601	GW	0517MW52GW	1723003-63	05/31/2017	FD of 0517MW22GW	EPA 1631
EEI-SA1601	SW	0517RD05SW	1723003-06	05/26/2017		EPA 1631
EEI-SA1601	SW	0517RD05SW	1723003-07	05/26/2017		EPA 1631
EEI-SA1601	SW	0517RD06SW	1723003-08	05/26/2017		EPA 1631
EEI-SA1601	SW	0517RD06SW	1723003-09	05/26/2017		EPA 1631
EEI-SA1601	SW	0517RD08SW	1723003-10	05/26/2017		EPA 1631
EEI-SA1601	SW	0517RD08SW	1723003-11	05/26/2017		EPA 1631
EEI-SA1601	SW	0517RD09SW	1723003-12	05/26/2017		EPA 1631
EEI-SA1601	SW	0517RD09SW	1723003-13	05/26/2017		EPA 1631
EEI-SA1601	SW	0517RD10SW	1723003-14	05/26/2017		EPA 1631
EEI-SA1601	SW	0517RD10SW	1723003-15	05/26/2017		EPA 1631
EEI-SA1601	SW	0517RD14SW	1723003-16	05/26/2017		EPA 1631
EEI-SA1601	SW	0517RD14SW	1723003-17	05/26/2017		EPA 1631
EEI-SA1601	SW	0517RD15SW	1723003-18	05/26/2017		EPA 1631
EEI-SA1601	SW	0517RD15SW	1723003-19	05/26/2017		EPA 1631
EEI-SA1601	SW	0517RD50SW	1723003-20	05/26/2017	FD of 0517RD14SW	EPA 1631
EEI-SA1601	SW	0517RD50SW	1723003-21	05/26/2017	FD of 0517RD14SW	EPA 1631
EEI-SA1601	Blank	0517TB03	1723003-01	05/09/2017	Trip Blank	EPA 1631
EEI-SA1601	Blank	0517TB04	1723003-02	05/09/2017	Trip Blank	EPA 1631
EEI-SA1601	Blank	0517TB05	1723003-03	05/09/2017	Trip Blank	EPA 1631
EEI-SA1601	Blank	0517TB06	1723003-04	05/09/2017	Trip Blank	EPA 1631
EEI-SA1601	Blank	0617EQ01GW	1723003-69	06/02/2017	Equip. Blank	EPA 1631
EEI-SA1601	Blank	0617FB07	1723003-64	06/01/2017	Field Blank	EPA 1631
EEI-SA1601	Blank	0617FB08	1723003-70	06/02/2017	Field Blank	EPA 1631
EEI-SA1601	GW	0617MW31GW	1723003-65	06/01/2017		EPA 1631
EEI-SA1601	GW	0617MW31GW	1723003-66	06/01/2017		EPA 1631
EEI-SA1601	GW	0617MW32GW	1723003-67	06/01/2017		EPA 1631

Table 1 - Sample Listing

Work Order	Matrix	Sample ID	Lab ID	Sample Date	QA/QC	Analysis
EEI-SA1601	GW	0617MW32GW	1723003-68	06/01/2017		EPA 1631
EEI-SA1601	GW	0617RS01GW	1723003-71	06/02/2017	Rinsate Blank	EPA 1631
EEI-SA1601	GW	0517MW08GW	B171380-MS1		MS/MSD	EPA 1631
EEI-SA1601	GW	0517MW08GW	B171380-MS2		MS/MSD	EPA 1631
EEI-SA1601	GW	0517MW08GW	B171380-MSD1		MS/MSD	EPA 1631
EEI-SA1601	GW	0517MW08GW	B171380-MSD2		MS/MSD	EPA 1631
EEI-SA1601	GW	0517MW09GW	B171380-MS4		MS/MSD	EPA 1631
EEI-SA1601	GW	0517MW09GW	B171380-MSD4		MS/MSD	EPA 1631
EEI-SA1601	GW	0517MW43GW	B171380-MS3		MS/MSD	EPA 1631
EEI-SA1601	GW	0517MW43GW	B171380-MSD3		MS/MSD	EPA 1631
EEI-SA1601	SW	0517RD10SW	B171379-MS4		MS/MSD	EPA 1631
EEI-SA1601	SW	0517RD10SW	B171379-MS5		MS/MSD	EPA 1631
EEI-SA1601	SW	0517RD10SW	B171379-MSD4		MS/MSD	EPA 1631
EEI-SA1601	SW	0517RD10SW	B171379-MSD5		MS/MSD	EPA 1631
EEI-SA1601	GW	0617MW31GW	B171380-MS6		MS/MSD	EPA 1631
EEI-SA1601	GW	0617MW31GW	B171380-MSD6		MS/MSD	EPA 1631

FD Field Duplicate
SW Surface Water
GW Ground Water
MS/MSD Matrix Spike/Matrix Spike Duplicate

Table 2 - Samples Qualified for Holding Time Exceedance

Method	Analyte	Sample IDs	HT	Sampling Date	Analysis Date	Qual
None						

Table 3a - Positive Results for Blank Samples

Method	Sample ID	Sample Type	Analyte	Result	Analysis Type	Units	PQL
EPA1631	B171379-BLK1	Water	Hg	0.11	MB	ng/L	0.4
EPA1631	B171379-BLK2	Water	Hg	0.06	MB	ng/L	0.4
EPA1631	B171379-BLK3	Water	Hg	0.04	MB	ng/L	0.4
EPA1631	B171379-BLK4	Water	Hg	0.02	MB	ng/L	0.4
EPA1631	B171380-BLK1	Water	Hg	0.20	MB	ng/L	0.4
EPA1631	B171380-BLK2	Water	Hg	0.23	MB	ng/L	0.4
EPA1631	B171380-BLK3	Water	Hg	0.28	MB	ng/L	0.4
EPA1631	B171380-BLK4	Water	Hg	0.19	MB	ng/L	0.4

Table 3b - Samples Qualified for Method Blank Contamination

Method	Sample ID	Analyte	Blank Result	Sample Result	Sample Qual	PQL
None *						

*EPA 1631 method monitors laboratory blank concentration and uses blank concentration to correct reported sample data. Detected values less than the quantitation limit are normal.

Table 3c - Samples Qualified for Field or Equipment Rinsate Blank Contamination

Table 4a - MS/MSD Recoveries outside Control Limits

Method	Sample ID	Sample Type	Analyte	Orig. Result	Spike Amount	Rec.	Dil Fac.	Low Limit	High Limit	Sample Qual.
None										

Table 4b - Lab and MS Duplicate PRDs outside Control Limits

Sample ID	Analyte	Method	RPD	RPD Limit	No. of Affected Samples	Samp Qual
None						

Table 5a - Samples with Surrogates outside Control Limits

Method	Sample ID	Sample Type	Analyte	Rec.	Low Limit	High Limit	Dil Fac	Sample Qual.
None.								

Table 5b - LCS Recoveries outside Control Limits

Method	Sample ID	Analyte	%Rec.	Low Limit	High Limit	No. of Affected Samples	Samp Qual
None							

Table 5c - Samples that were Re-analyzed

Sample ID	Lab ID	Method	Sample Type	Action
0517MW09GW	1723003-54	EPA 1631	Ground Water	High Blank with no Qualification
0517MW10GW	1723003-32	EPA 1631	Ground Water	High Blank with no Qualification
0517MW16GW	1723003-34	EPA 1631	Ground Water	High Blank with no Qualification
0517MW16GW	1723003-35	EPA 1631	Ground Water	High Blank with no Qualification
0517MW17GW	1723003-36	EPA 1631	Ground Water	High Blank with no Qualification
0517MW17GW	1723003-37	EPA 1631	Ground Water	Confirmation with no Qualification
0517MW22GW	1723003-58	EPA 1631	Ground Water	High Blank with no Qualification
0517MW22GW	1723003-59	EPA 1631	Ground Water	High Blank with no Qualification
0517MW26GW	1723003-47	EPA 1631	Ground Water	High Blank with no Qualification
0517MW26GW	1723003-48	EPA 1631	Ground Water	High Blank with no Qualification
0517MW27GW	1723003-49	EPA 1631	Ground Water	High Blank with no Qualification
0517MW27GW	1723003-50	EPA 1631	Ground Water	High Blank with no Qualification
0517MW28GW	1723003-51	EPA 1631	Ground Water	High Blank with no Qualification
0517MW29GW	1723003-29	EPA 1631	Ground Water	High Blank with no Qualification
0517MW29GW	1723003-30	EPA 1631	Ground Water	Confirmation with no Qualification
0517MW33GW	1723003-38	EPA 1631	Ground Water	High Blank with no Qualification
0517MW40GW	1723003-40	EPA 1631	Ground Water	High Blank with no Qualification
0517MW42GW	1723003-60	EPA 1631	Ground Water	High Blank with no Qualification
0517MW51GW	1723003-44	EPA 1631	Ground Water	Confirmation with no Qualification
0517MW51GW	1723003-45	EPA 1631	Ground Water	Confirmation with no Qualification
0517MW52GW	1723003-62	EPA 1631	Ground Water	High Blank with no Qualification
0517MW52GW	1723003-63	EPA 1631	Ground Water	High Blank with no Qualification
0517RD06SW	1723003-08	EPA 1631	Surface Water	High Blank with no Qualification
0517RD08SW	1723003-10	EPA 1631	Surface Water	High Blank with no Qualification
0617MW31GW	1723003-65	EPA 1631	Ground Water	Confirmation with no Qualification High Blank with no Qualification
0617MW32GW	1723003-67	EPA 1631	Ground Water	High Blank with no Qualification
0617RS01GW	1723003-71	EPA 1631	Ground Water	Per Method with no Qualification

Table 6a - Summary of Field Duplicate Results

Method	Analyte	Units	0517MW43GW	0517MW51GW	RPD	Rating	Sample Qualifier
EPA 1631	Mercury	ng/L	5.77	4.49	24.95	Good	None
EPA 1631	Dissolved Mercury	ng/L	0.30	0.30	0	Good	None

Table 6b - Summary of Field Duplicate Results

Method	Analyte	Units	0517RD14SW	0517RD50SW	RPD	Rating	Sample Qualifier
EPA 1631	Mercury	ng/L	202	56.4	112.7	Poor	J
EPA 1631	Dissolved Mercury	ng/L	11.20	11.50	2.64	Good	None

Table 6c - Summary of Field Duplicate Results

Method	Analyte	Units	0517MW22GW	0517MW52GW	RPD	Rating	Sample Qualifier
EPA 1631	Mercury	ng/L	423	420	0.71	Good	None
EPA 1631	Dissolved Mercury	ng/L	262.00	269.00	2.64	Good	None

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DATA REVIEW MEMORANDUM

DATE: October 5, 2017

TO: Jonathan Reeve, Project Manager, Ecology and Environment Inc., Seattle, WA

FROM: Valeriy Bizyayev, Ecology and Environment, Inc., Seattle, WA

SUBJ: Data Review: Red Devil Mine Spring 2017

REFERENCE:

Project ID	Lab Work Order	Lab
1001095.0009.03	580-68801-1	Test America – Seattle

Validated data is attached to the end of this memorandum.

1. SAMPLE IDENTIFICATION

For the sampling activities at the Red Devil Mine site, Ecology and Environment, Inc. (E & E) collected the samples listed in Table 1. Project-specific matrix spike/matrix spike duplicates (MS/MSD) were designated in the field. All samples were sent to Test America Laboratories. This report addresses only Test America-generated data for EPA methods 6010B, 6020A, and 7470A.

The analytical report was issued by Test America on June 28, 2017. The data in the analytical report were reviewed for field and laboratory precision, accuracy, and completeness in accordance with procedures and quality control (QC) limits, the current laboratory Quality Assurance Manual (QAM), and current standard operating procedures (SOPs). Laboratory data qualifiers for identified analytes and analyte quantitation were accepted. Any additional data review qualifiers added are noted below and listed on the tables at the end of this memorandum. Definitions of all data qualifiers are given in the report.

Work Orders, Tests, and Number of Samples Included in this Data Review Memo

Work Orders/ Job Number	Matrix	Test Method	Method Name	Number of Samples
580-68801-1	Surface Water	EPA 7470A	Mercury (CVAA)	8
580-68801-1	Surface Water	EPA 6010B/6020A	Total TAL Metals by ICP	8
580-68801-1	Surface Water	EPA 6010B/6020A	Dissolved TAL Metals by ICP	8
580-68801-1	Ground Water	EPA 6010B/6020A	Total TAL Metals by ICP	21
580-68801-1	Ground Water	EPA 7470A	Mercury (CVAA)	21
580-68801-1	Rinse Blank	EPA 7470A	Mercury (CVAA)	1
580-68801-1	Rinse Blank	EPA 6010B/6020A	Total TAL Metals by ICP	1
580-68801-1	Rinse Blank	EPA 6010B/6020A	Dissolved TAL Metals by ICP	1

2. SAMPLE PROCEDURES

All samples were collected as specified in the work plan and as documented on the chain-of-custody (COC) and in field notebooks. Samples were analyzed as specified on the COC. Samples were packaged, shipped, and received as specified in the work plan. Aqueous samples for total metals (EPA 6010B and 6020A) and mercury (EPA 7470A) must be preserved to pH≤2 with HNO_3.

REVIEW RESULTS

All sample procedures were followed and the sample coolers were received at 0.0-2.2^{o}C. Samples were hand delivered and then repackaged to be analyzed at a different laboratory location. Sample preservation was verified by the laboratory. No problems with the condition of the samples upon receipt are documented.

3. LABORATORY DATA

3.1 HOLDING TIMES

Holding times are established and monitored to ensure analytical results accurately represent analyte concentrations in a sample at the time of collection. These results are presented in Table 2 (if applicable). Exceeding the holding time for a sample generally results in a loss of the analyte due to a variety of mechanisms, such as deposition on the sample container walls or precipitation.

REVIEW RESULTS

All field samples were taken between May 28 and June 2 of 2017 and received by the laboratory on June 3, 2017. All submitted Samples were analyzed between June 7 and June 9. No qualification is given for sample holding and analysis times.

3.2 BLANKS

Laboratory and field blank samples are analyzed and evaluated to determine the existence and magnitude of possible contamination during the sampling and analysis process. These results are presented in Table 3 (if applicable). If the analyte is present in the sample at similar trace levels (less than 5 times the blank concentration), then the analyte is likely a common background contaminant from some phase of the sampling, extraction, or analytical procedure and associated low-level sample concentrations are not considered to be site related. Sample results in these cases are qualified as not detected, “U”.

REVIEW RESULTS

All laboratory blanks were performed at the required frequency. All laboratory blanks for EPA methods 6010B, 6020A, and 7470A had no detections. .

Two equipment rinsate blanks (field blanks) were collected, with EPA Method 6010B and 6020A analytes detected in at concentrations less than the PQL but greater than the MDL (Table 3). All associated sample results that were detected at levels less than 5 times the blank were U-qualified as not detected. Associated samples with detection greater than 5 times the blank were not qualified. A summary of qualified data due to equipment rinsate blank contamination is presented in Table 3.

3.4 MATRIX SPIKE AND MATRIX SPIKE DUPLICATE ANALYSIS

The MS/MSD analyses are intended to provide information about the effects that the sample matrix exerts on the digestion / extraction and measurement methodology. MS recovery values that do not meet laboratory QC criteria may indicate that sample analyte results are being attenuated in the analysis procedure. The potential sample bias may be estimated by noting the degree to which the MS concentration was elevated or lowered in the spike analysis. However, this estimated bias should serve only as an

approximation; sample-specific problems may be the cause of the discrepancy, particularly in soil samples.

Recoveries of a post-digestion spike or a laboratory control sample (LCS) are used to verify that the analytical methodology is acceptable and that MS recoveries are due to matrix effects. An MSD analysis is performed to evaluate the precision of the sample results. Precision is measured as the relative percent difference (RPD) between analytical results for duplicate samples. The laboratory's failure to produce similar results for MSD samples may indicate that the samples were non-homogeneous (particularly in soil samples), or that method defects may exist in the laboratory's techniques.

Recovery calculations are not required if the spiking concentration added is less than 25% of the sample background concentration.

REVIEW RESULTS

The MS/MSD sample analyses were performed on two samples: 0517MW08GW and 0517RD10SW, at the required frequency. MS/MSD recoveries were within the control limits generated by the laboratory.

The accuracy of MS/MSD recoveries were within the control limits generated by the laboratory.

A summary of sample data qualified due to MS/MSD precision and accuracy are presented in Tables 4a and 4b.

3.5 LABORATORY CONTROL SAMPLE ANALYSIS

The LCS is analyzed to monitor the efficiency of the digestion/extraction procedure and analytical instrument operation. The ability of the laboratory to successfully analyze an LCS demonstrates that there are no analytical problems related to the digestion/sample preparation procedures and/or instrument operations. The LCS results outside QC limits are presented in Table 5 (if applicable). Sporadic and marginal QC failures for multiple component methods do not indicate an analytical concern. If recoveries are high and the compounds are not detected in the samples, then no data qualification is required. All recoveries should be above 10% or the non-detect (“U”) results flagged “R” as rejected.

REVIEW RESULTS

All LCS analyses were within control limits and performed at the required frequency for all methods.

3.6 COMPOUND IDENTIFICATION AND QUANTITATION

Compound identities are assigned by comparing sample compound retention times to retention times from known (standard) compounds and identification of an acceptable mass spectrum. Compounds detected below the PQL in samples should be considered estimated and are qualified "J." The samples with compounds above the linear range were all re-analyzed at a higher dilution factor.

REVIEW RESULTS

Compound identification and quantitation criteria were not noted for EPA methods 6010B, 6020A, and 7470A.

4. FIELD DUPLICATE SAMPLE RESULTS

Field duplicate samples were collected and analyzed as an indication of overall precision for both field and laboratory. Field duplicate results are summarized in Table 7 (if applicable). The results are expected to have more variability than laboratory duplicates, which measure only laboratory precision. It is expected also that soil field duplicates will exhibit greater variance than water field duplicates due to the difficulties associated with collecting identical field samples. The QC criteria used to assess field duplicate samples for this project was limits of 70% RPD for soils and 40% RPD for waters, or twice the general laboratory duplicate criteria. If a given compound in both the regular sample and associated field duplicate sample was below the laboratory PQL, or the compound was not detected in one of the samples, then the compound is generally not qualified due to field duplicate precision. There are no guidelines regarding data qualification based on poor field duplicate precision. Professional judgment was used to determine whether or not to qualify results.

REVIEW RESULTS

Three field duplicates analyses were performed on this SDG. The RPD ratings are listed on Tables 7a through 7c as “Good” if the RPD is less than field duplicate QC criteria of 40% and as “Poor” if the RPD exceeded the field duplicate QC criteria.

All the results show good precision in the sample pairs. No qualifiers were added to any sample results.

Serial Dilution

Serial dilution of samples were analyzed to determine whether significant physical or chemical interferences exist due to sample matrix. A serial dilution analysis shall be performed on a sample from each group of samples with a similar matrix type (e.g., water or soil) or for each Sample Delivery Group (SDG), whichever is more frequent. Samples identified as field blanks or Performance Evaluation (PE) samples cannot be used for serial dilution analysis. If the analyte concentration is sufficiently high [concentration in the original sample is > 50 times (50x) the Method Detection Limit (MDL)], the percent difference between the original determination and the serial dilution analysis (a five-fold dilution) after correction shall be less than 10. Interferences shall be analyzed and evaluated on professional judgement. If results have a percent difference greater than 10, results greater or equal to the MDL will qualified as an estimate (J) and qualify all non-detects as an estimate (UJ).

Review of Results:

Serial dilution analysis were conducted at the required frequency for EPA methods 6010B and 6020A, no qualifiers were assigned because of serial dilution issues. As exceedances do exist, none are present that imply an interference or need for qualifying any analytical data.

5. OVERALL ASSESSMENT OF DATA

All data were reviewed and considered usable with qualification as noted in this report.

Table 1 - Sample Listing

Work Order	Matrix	Sample ID	Lab ID	Sample Date	QA/QC	Analysis
580-68801-1	SW	0517RD05SW	580-66801-2	5/26/2017		6010B, 6020A, 7470A
580-68801-1	SW	0517RD06SW	580-66801-3	5/26/2017		6010B, 6020A, 7470A
580-68801-1	SW	0517RD08SW	580-66801-4	5/26/2017		6010B, 6020A, 7470A
580-68801-1	SW	0517RD09SW	580-66801-5	5/26/2017		6010B, 6020A, 7470A
580-68801-1	SW	0517RD10SW	580-66801-6	5/26/2017	MS/MSD	6010B, 6020A, 7470A
580-68801-1	SW	0517RD14SW	580-66801-7	5/26/2017		6010B, 6020A, 7470A
580-68801-1	SW	0517RD15SW	580-66801-8	5/26/2017		6010B, 6020A, 7470A
580-68801-1	SW	0517RD50SW	580-66801-9	5/26/2017	Field Duplicate	6010B, 6020A, 7470A
580-68801-1	GW	0517MW01GW	580-66801-10	5/28/2017		6010B, 6020A, 7470A
580-68801-1	GW	0517MW06GW	580-66801-11	5/28/2017		6010B, 6020A, 7470A
580-68801-1	GW	0517MW08GW	580-66801-12	5/28/2017	MS/MSD	6010B, 6020A, 7470A
580-68801-1	GW	0517MW09GW	580-68801-24	5/31/2017		6010B, 6020A, 7470A
580-68801-1	GW	0517MW10GW	580-66801-14	5/29/2017		6010B, 6020A, 7470A
580-68801-1	GW	0517MW16GW	580-66801-15	5/29/2017		6010B, 6020A, 7470A
580-68801-1	GW	0517MW17GW	580-66801-16	5/29/2017		6010B, 6020A, 7470A
580-68801-1	GW	0517MW19GW	580-68801-25	5/31/2017		6010B, 6020A, 7470A
580-68801-1	GW	0517MW22GW	580-68801-26	5/31/2017	Field Duplicate	6010B, 6020A, 7470A
580-68801-1	GW	0517MW26GW	580-66801-21	5/30/2017		6010B, 6020A, 7470A
580-68801-1	GW	0517MW27GW	580-66801-22	5/30/2017		6010B, 6020A, 7470A
580-68801-1	GW	0517MW28GW	580-66801-23	5/30/2017		6010B, 6020A, 7470A
580-68801-1	GW	0517MW29GW	580-66801-13	5/28/2017		6010B, 6020A, 7470A
580-68801-1	GW	0517MW33GW	580-66801-17	5/29/2017		6010B, 6020A, 7470A
580-68801-1	GW	0517MW40GW	580-66801-18	5/29/2017		6010B, 6020A, 7470A
580-68801-1	GW	0517MW42GW	580-66801-27	5/31/2017		6010B, 6020A, 7470A
580-68801-1	GW	0517MW43GW	580-66801-19	5/29/2017		6010B, 6020A, 7470A
580-68801-1	GW	0517MW51GW	580-66801-20	5/29/2017	Field Duplicate	6010B, 6020A, 7470A
580-68801-1	GW	0517MW52GW	580-66801-28	5/31/2017	Field Duplicate	6010B, 6020A, 7470A
580-68801-1	GW	0617MW31GW	580-66801-30	6/1/2017		6010B, 6020A, 7470A
580-68801-1	GW	0617MW32GW	580-66801-31	6/1/2017		6010B, 6020A, 7470A
580-68801-1	W	0617EQ01GW	580-68801-33	6/2/2017	Blank	6010B, 6020A, 7470A
580-68801-1	W	0617RS01GW	580-68801-34	6/2/2017	Blank	6010B, 6020A, 7470A

Table 2 - List of Samples Qualified for Holding Time Exceedance

Method	Analyte	Sample IDs	HT	Sampling Date	Analysis Date	Qual
None						

Table 3a - List of Positive Results for Blank Samples

Method	Sample ID	Sample Type	Analyte	Result	Analysis Type	Units	PQL
EPA 6020A	0617RS01GW	AQ	Barium	0.00062J	RB	mg/L	0.0060
EPA 6020A	0617RS01GW	AQ	Chromium	0.0010J	RB	mg/L	0.0020
EPA 6020A	0617RS01GW	AQ	Nickel	0.00055J	RB	mg/L	0.015

Table 3b - List of Samples Qualified for Method Blank Contamination

Method	Sample ID	Analyte	Blank Result	Sample Result	Sample Qual	PQL
None						

Table 3c - List of Samples Qualified for Equipment Rinsate Blank Contamination

Method	Sample ID	Analyte	Blank Result	Sample Result	Sample Qual	PQL
EPA 6020A	0517RD14SW	Chromium	0.0010	0.00075	U	0.002
EPA 6020A	0517RD50SW	Chromium	0.0010	0.00076	U	0.002
EPA 6020A	0517MW01GW	Chromium	0.0010	0.00098	U	0.002
EPA 6020A	0517MW29GW	Chromium	0.0010	0.0010	U	0.002
EPA 6020A	0617MW32GW	Chromium	0.0010	0.00081	U	0.002

Table 4a - List of MS/MSD Recoveries outside Control Limits

Method	Sample ID	Sample Type	Analyte	Orig. Result	Spike Amount	Rec.	Dil Fac.	Low Limit	High Limit	Sample Qual
None										

Table 4b - List of Lab and MS Duplicate RPDs outside Control Limits

Sample ID	Analyte	Method	RPD	RPD Limit	No. of Affected Samples	Samp Qual
None						

Table 5 - List of LCS Recoveries outside Control Limits

Method	Sample ID	Analyte	%Rec.	Low Limit	High Limit	No. of Affected Samples	Samp Qual
None							

Table 6 - Samples that were Re-analyzed

Sample ID	Lab ID	Method	Sample Type	Action
None				

Table 7a - Summary of Field Duplicate Results

Method	Analyte	Units	0517RD14SW	0517RD50SW	RPD	Rating	Sample Qualifier
EPA 6010B	Calcium (Dissolved)	mg/L	13	13	0%	Good	None
EPA 6010B	Iron (Dissolved)	mg/L	0.17	0.17	0%	Good	None
EPA 6010B	Magnesium (Dissolved)	mg/L	7.7	7.5	3%	Good	None
EPA 6010B	Potassium (Dissolved)	mg/L	0.51	0.51	0%	Good	None
EPA 6010B	Sodium (Dissolved)	mg/L	1.2	1.2	0%	Good	None
EPA 6020A	Antimony (Dissolved)	mg/L	0.021	0.022	5%	Good	None
EPA 6020A	Arsenic (Dissolved)	mg/L	0.0082	0.0083	1%	Good	None
EPA 6020A	Barium (Dissolved)	mg/L	0.023	0.023	0%	Good	None
EPA 6020A	Manganese (Dissolved)	mg/L	0.019	0.019	0%	Good	None
EPA 6010B	Aluminum	mg/L	0.32	0.35	9%	Good	None
EPA 6010B	Calcium	mg/L	13	14	7%	Good	None
EPA 6010B	Iron	mg/L	0.8	0.67	18%	Good	None
EPA 6010B	Magnesium	mg/L	7.6	7.7	1%	Good	None
EPA 6010B	Potassium	mg/L	0.54	0.55	2%	Good	None
EPA 6010B	Sodium	mg/L	1.2	1.2	0%	Good	None
EPA 6020A	Antimony	mg/L	0.018	0.018	0%	Good	None
EPA 6020A	Arsenic	mg/L	0.0082	0.0078	5%	Good	None
EPA 6020A	Barium	mg/L	0.031	0.031	0%	Good	None
EPA 6020A	Chromium	mg/L	0.00075	0.00076	1%	Good	None
EPA 6020A	Cobalt	mg/L	0.00029	0.00024	19%	Good	None
EPA 6020A	Manganese	mg/L	0.054	0.049	10%	Good	None
EPA 6020A	Nickel	mg/L	0.00092	0.00098	6%	Good	None

Table 7b - Summary of Field Duplicate Results

Method	Analyte	Units	0517MW43GW	0517MW51GW	RPD	Rating	Sample Qualifier
EPA 6010B	Calcium	mg/L	24	23	4%	Good	None
EPA 6010B	Iron	mg/L	2.8	2.7	4%	Good	None
EPA 6010B	Magnesium	mg/L	16	16	0%	Good	None
EPA 6010B	Potassium	mg/L	0.49	0.48	2%	Good	None
EPA 6010B	Sodium	mg/L	3.7	3.6	3%	Good	None
EPA 6020A	Antimony	mg/L	0.007	0.0068	3%	Good	None
EPA 6020A	Arsenic	mg/L	0.23	0.23	0%	Good	None
EPA 6020A	Barium	mg/L	0.1	0.1	0%	Good	None
EPA 6020A	Cobalt	mg/L	0.031	0.031	0%	Good	None
EPA 6020A	Manganese	mg/L	2.6	2.6	0%	Good	None
EPA 6020A	Nickel	mg/L	0.094	0.094	0%	Good	None

Table 7c - Summary of Field Duplicate Results

Method	Analyte	Units	1016MW19GW	1016MW55GW	RPD	Rating	Sample Qualifier
EPA 6010B	Calcium	mg/L	18	16	12%	Good	None
EPA 6010B	Magnesium	mg/L	15	14	7%	Good	None
EPA 6010B	Sodium	mg/L	2.1	1.9	10%	Good	None
EPA 6020A	Antimony	mg/L	1	0.93	7%	Good	None
EPA 6020A	Arsenic	mg/L	0.051	0.046	10%	Good	None
EPA 6020A	Barium	mg/L	0.049	0.047	4%	Good	None
EPA 6020A	Nickel	mg/L	0.001	0.001	0%	Good	None
EPA 7470A	Mercury	mg/L	0.0004	0.00036	11%	Good	None

DATA REVIEW MEMORANDUM

DATE: November 16, 2017

TO: Mark Longtine, Project Manager, E & E, Seattle, WA

FROM: Howard Edwards, E & E, San Francisco, CA

SUBJ: Data Review: Red Devil Mine 2017

Job Description: Red Devil Mine 2017 SMA GW
BAL Report: 1740001

REFERENCE:

Project ID	Lab Work Order	Lab
1001095.0015.01	EEI-SE1701	Brooks Applied Labs – Seattle

Validated data is attached to the end of this memorandum.

1. SAMPLE IDENTIFICATION

For the sampling activities at the Red Devil Mine site, Ecology and Environment, Inc. (E & E) collected the samples listed in Table 1. Project-specific matrix spike/matrix spike duplicates (MS/MSD) were designated in the field. All samples were sent to Brooks Applied Labs in Seattle, Washington, for all analyses. This report addresses only Brooks Applied Labs-generated data.

The analytical report was issued by Brooks Applied Labs on October 26, 2017. The data in the analytical report were reviewed for field and laboratory precision, accuracy, and completeness in accordance with procedures and quality control (QC) limits, the current laboratory Quality Assurance Manual (QAM) and current standard operating procedures (SOPs). Any additional data review qualifiers added are noted below and listed on the tables at the end of this memorandum. Definitions of all data qualifiers are given in the report.

Work Orders, Tests, and Number of Samples Included in this Data Review Memo

Work Orders/ Job Number	Matrix	Test Method	Method Name	Number of Samples
EEI-SE1701	Ground Water	EPA 1631	Total Low-Level Mercury (CVAFS)	13
EEI-SE1701	Ground Water	EPA 1631	Dissolved Low-Level Mercury (CVAFS)	13
EEI-SE1701	Rinse Blank	EPA 1631	Total Low-Level Mercury (CVAFS)	1
EEI-SE1701	Rinse Blank	EPA 1631	Dissolved Low-Level Mercury (CVAFS)	1
EEI-SE1701	Trip Blank	EPA 1631	Total Low-Level Mercury (CVAFS)	0
EEI-SE1701	Field Blank	EPA 1631	Total Low-Level Mercury (CVAFS)	4

2. SAMPLE PROCEDURES

All samples were collected as specified in the work plan and documented on the chain-of-custody (COC) and in field notebooks. Samples were analyzed as specified on the COC. Samples were packaged, shipped, and received as specified in the work plan. All samples for organic analyses must be received cold (4 ±2 degrees Celsius [^{o}C]) and in good condition as documented on the Cooler Receipt Form.

REVIEW RESULTS

All sampling procedures were followed and the sample coolers were received by the laboratory at 6.5^{o}C. Since the samples were acidified in the field, the Field Sampling Plan requirement indicating 4 ±2 ^{o}C requirement, did not result in qualification. Since the preservation temperature is not a method requirement.

3. LABORATORY DATA

3.1 HOLDING TIMES

Holding times are established and monitored to ensure analytical results accurately represent analyte concentrations in a sample at the time of collection. These qualified results based upon missed holding times are presented in Table 2 (if applicable). Exceeding the holding time for a sample generally results in a loss of the analyte due to a variety of mechanisms, such as deposition on the sample container walls or precipitation.

REVIEW RESULTS

All sample were analyzed within the method holding time.

3.2 BLANKS

All laboratory blanks are integrated into the method and all results are corrected for blank values provided that the laboratory blank values are within method-set limits. When blanks are outside of the method limits, associated samples are re-analyzed. Method blanks with positive results are shown in Table 3a. No data was qualified due to laboratory method blanks (see Table 3b).

Field blank and rinsate blank samples are analyzed and evaluated to determine the existence and magnitude of possible contamination during the sampling and analysis process. All field blank with reported results are also presented in Table 3a (if applicable). If the mercury is present in the sample at similar trace levels (less than 5 times the blank concentration), then the analyte is likely a common background contaminant from some phase of the sampling, extraction, or analytical procedure and associated low-level sample concentrations are not considered to be site related. Sample results in these cases are qualified as not detected, U.

REVIEW RESULTS

All laboratory (method) and field blanks were performed at the required frequencies. As noted in Table 3a, analyte concentrations in the method blanks were below the practical quantitation limit (PQL). Several field blanks were at a concentration above the detection limit. All associated reported concentration of mercury in samples that were less than 5 times the concentration found in their associated field blank were U qualified as not detected. No samples were qualified based on laboratory or field blanks. A summary of qualified data due to laboratory blank contamination is presented in Table 3b.

One set of equipment rinsate blanks (filtered and unfiltered) for the bladder pump was collected. The rinsate blank was found to contain both dissolved mercury and total mercury at a concentration above the method reporting limit. All associated sample results that were detected at levels less than 5 times the blank were U qualified as not detected. Associated samples with detection greater than 5 times the blank were not

qualified. A summary of qualified data due to equipment rinsate blank contamination is also presented in Table 3c.

3.3 MATRIX SPIKE AND MATRIX SPIKE DUPLICATE ANALYSIS

The MS/MSD analyses are intended to provide information about the effects that the sample matrix exerts on the digestion / extraction and measurement methodology. MS recovery values that do not meet laboratory QC criteria may indicate that sample analyte results are being attenuated in the analysis procedure. The potential sample bias may be estimated by noting the degree to which the MS concentration was elevated or lowered in the spike analysis. However, this estimated bias should serve only as an approximation; sample-specific problems may be the cause of the discrepancy, particularly in soil samples.

Recovery calculations are not required if the spiking concentration added is less than 25% of the sample background concentration.

REVIEW RESULTS

The MS/MSD sample analyses were performed on two filter and two unfiltered samples 0917MW48GW (filtered and unfiltered) and 0917MW51GW (filtered and unfiltered), at the required frequency. All MS/MSD recoveries and accuracies were within the control limits

A summary of sample data qualified due to MS/MSD precision and accuracy are presented in Tables 5a and 5b (if applicable).

3.4 LABORATORY CONTROL SAMPLE ANALYSIS

The LCS or Certified Reference Material standard is analyzed to monitor the efficiency of the digestion/extraction procedure and analytical instrument operation. The ability of the laboratory to successfully analyze an LCS or Certified Reference Material standard demonstrates that there are no analytical problems related to the digestion/sample preparation procedures and/or instrument operations. The LCS or Certified Reference Material standard results outside QC limits are presented in Table 6 (if applicable). Sporadic and marginal QC failures for multiple component methods do not indicate an analytical concern. If recoveries are high and the compounds are not detected in the

samples, then no data qualification is required. All recoveries should be above 10% or the non-detect results flagged “UR” as rejected.

REVIEW RESULTS

The analysis of the Certified Reference Material Sample was within control limits.

3.5 COMPOUND IDENTIFICATION AND QUANTITATION

Mercury identification is by cold-vapor atomic fluorescence spectrometer (CVAFS) at 253.7 nm for detection. The concentration of Hg based upon calibration curve done for each analysis batch. The method blank is used to correct the reported Mercury concentration detected below the PQL in samples should be considered estimated and are qualified "J." The samples with results above the linear range were all re-analyzed at a smaller aliquot.

REVIEW RESULTS

All compound identification and quantitation criteria were achieved and reported based upon the method. As noted in Table 7, three samples were reported as being reanalyzed due to the initial analysis concentration exceeding the calibration range. A smaller aliquot of all three samples were re-analyzed with the re-analysis confirming the initial analysis concentrations.

4. FIELD DUPLICATE SAMPLE RESULTS

Field duplicate samples were collected and analyzed as an indication of overall precision for both field and laboratory. Field duplicate results are summarized in Table 8 (if applicable). The results are expected to have more variability than laboratory duplicates, which measure only laboratory precision. It is expected also that soil field duplicates will exhibit greater variance than water field duplicates due to the difficulties associated with collecting identical field samples. The QC criteria used to assess field duplicate samples for this project was limits of 70% RPD for soils and 40% RPD for waters, or twice the general laboratory duplicate criteria. If a given compound in both the regular sample and associated field duplicate sample was below the laboratory PQL, or the compound was not detected in one of the samples, then the compound is generally not qualified due to field duplicate precision. There are no guidelines regarding data qualification based on

poor field duplicate precision. Professional judgment was used to determine whether or not to qualify results.

REVIEW RESULTS

One field duplicates analyses were performed on this SDG. The RPD ratings are listed on Table 8 as “Good” if the RPD is less than field duplicate QC criteria of 40% and as “Poor” if the RPD exceeded the field duplicate QC criteria.

The result for dissolved mercury showed good precision in the sample. The result for total mercury showed poor precision in the sample. Results are presented in Table 8. A qualifier was only added to the field duplicate results as noted.

5. OVERALL ASSESSMENT OF DATA

The data from the QA samples suggest the following:

- That there was an equipment decontamination problem with the bladder pump that was used to collect most of the groundwater samples. The equipment rinsate blank indicates the potential of inadequate decontamination of the bladder pump.

All data were reviewed and considered usable with qualification as noted in this report. All non-detect results were reported as “U” qualified at the PQL except where noted based upon blank contamination. All reported data at concentration less than the PQL were J qualified as estimated.

Table 1 - Sample Listing

Work Order	Matrix	Sample ID	Lab ID	Sample Date	QA/QC	Analysis
EEI-SE1701	GW	*0917MW44GW*	1740001-05	9/22/2017		EPA 1631
EEI-SE1701	F-GW	*0917MW44GW*	1740001-06	9/22/2017		EPA 1631
EEI-SE1701	GW	*0917MW45GW*	1740001-07	9/20/2017		EPA 1631
EEI-SE1701	F-GW	*0917MW45GW*	1740001-08	9/20/2017		EPA 1631
EEI-SE1701	GW	*0917MW46GW*	1740001-09	9/20/2017		EPA 1631
EEI-SE1701	F-GW	*0917MW46GW*	1740001-10	9/20/2017		EPA 1631
EEI-SE1701	GW	*0917MW47GW*	1740001-11	9/21/2017		EPA 1631
EEI-SE1701	F-GW	*0917MW47GW*	1740001-12	9/21/2017		EPA 1631
EEI-SE1701	GW	*0917MW48GW*	1740001-13	9/19/2017	MS/MSD	EPA 1631
EEI-SE1701	F-GW	*0917MW48GW*	1740001-14	9/19/2017	MS/MSD	EPA 1631
EEI-SE1701	GW	*0917MW49GW*	1740001-15	9/20/2017		EPA 1631
EEI-SE1701	F-GW	*0917MW49GW*	1740001-16	9/20/2017		EPA 1631
EEI-SE1701	GW	*0917MW50GW*	1740001-17	9/24/2017		EPA 1631
EEI-SE1701	F-GW	*0917MW50GW*	1740001-18	9/24/2017		EPA 1631
EEI-SE1701	GW	*0917MW51GW*	1740001-19	9/22/2017	MS/MSD	EPA 1631
EEI-SE1701	F-GW	*0917MW51GW*	1740001-20	9/22/2017	MS/MSD	EPA 1631
EEI-SE1701	GW	*0917MW52GW*	1740001-21	9/21/2017	Duplicate of 0917MW52GW	EPA 1631
EEI-SE1701	F-GW	*0917MW52GW*	1740001-22	9/21/2017	Duplicate of 0917MW52GW	EPA 1631
EEI-SE1701	GW	*0917MW53GW*	1740001-23	9/22/2017		EPA 1631
EEI-SE1701	F-GW	*0917MW53GW*	1740001-24	9/22/2017		EPA 1631
EEI-SE1701	GW	*0917MW54GW*	1740001-25	9/21/2017		EPA 1631
EEI-SE1701	F-GW	*0917MW54GW*	1740001-26	9/21/2017		EPA 1631
EEI-SE1701	GW	*0917MW55GW*	1740001-27	9/20/2017		EPA 1631
EEI-SE1701	F-GW	*0917MW55GW*	1740001-28	9/20/2017		EPA 1631
EEI-SE1701	GW	*0917MW56GW*	1740001-29	9/22/2017		EPA 1631
EEI-SE1701	F-GW	*0917MW56GW*	1740001-30	9/22/2017		EPA 1631
EEI-SE1701	GW	*0917MW57GW*	1740001-31	9/22/2017		EPA 1631
EEI-SE1701	F-GW	*0917MW57GW*	1740001-23	9/22/2017		EPA 1631
EEI-SE1701	GW	*0917MW58GW*	1740001-33	9/21/2017		EPA 1631
EEI-SE1701	F-GW	*0917MW58GW*	1740001-34	9/21/2017		EPA 1631
EEI-SE1701	GW	*0917MW59GW*	1740001-35	9/22/2017		EPA 1631
EEI-SE1701	F-GW	*0917MW59GW*	1740001-36	9/22/2017		EPA 1631
EEI-SE1701	GW	*0917MW92GW*	1740001-37	9/21/2017	Duplicate of 0917MW52GW	EPA 1631
EEI-SE1701	F-GW	*0917MW92GW*	1740001-38	9/21/2017	Duplicate of 0917MW52GW	EPA 1631
EEI-SE1701	Blank	*0917MW08GW*	1740001-39	9/24/2017	Rinsate Blank	EPA 1631
EEI-SE1701	F- Blk	*0917MW08GW*	1740001-40	9/24/2017	Rinsate Blank	EPA 1631
EEI-SE1701	Blank	0917FB04	1740001-01	9/19/2017	Field Blank	EPA 1631
EEI-SE1701	Blank	0917FB05	1740001-02	9/20/2017	Field Blank	EPA 1631
EEI-SE1701	Blank	0917FB06	1740001-03	9/21/2017	Field Blank	EPA 1631
EEI-SE1701	Blank	0917FB07	1740001-04	9/22/2017	Field Blank	EPA 1631

F-GW =Filtered ground water
FD = Field duplicate sample
F-blk = Filtered Blank
GW = Ground water

Table 2 - List of Samples Qualified for Holding Time Exceedance

Method	Analyte	Sample IDs	HT	Sampling Date	Analysis Date	Qual
None						

Table 3a - List of Positive Results for Blank Samples

Method	Sample ID	Sample Type	Analyte	Result**	Analysis Type	Units	PQL
EPA1631	B172645-BLK1	AQ	Total Mercury	0.07	MB	ng/L	0.40
EPA1631	B172645-BLK2	AQ	Total Mercury	0.09	MB	ng/L	0.40
EPA1631	B172645-BLK3	AQ	Total Mercury	0.07	MB	ng/L	0.40
EPA1631	B172645-BLK4	AQ	Total Mercury	0.08	MB	ng/L	0.40
EPA1631	0917FB04	AQ	Total Mercury	≤ 0.10	FB	ng/L	0.40
EPA1631	0917FB05	AQ	Total Mercury	0.18	FB	ng/L	0.40
EPA1631	0917FB06	AQ	Total Mercury	≤ 0.10	FB	ng/L	0.40
EPA1631	0917FB07	AQ	Total Mercury	≤ 0.10	FB	ng/L	0.40
EPA1631	0917RS08GW	AQ	Total Mercury	2.16	RB	ng/L	0.40
EPA1631	0917RS08GW	AQ	Dissolved Mercury	5.93	RB	ng/L	0.40

Table 3b - List of Samples Qualified for Method Blank Contamination

Method	Sample ID	Analyte	Blank Result	Sample Result	Sample Qual	PQL
None *						

*EPA 1631 method monitors laboratory blank concentration and uses blank concentration to correct reported sample data. Detected values less than the quantitation limit are normal.
** Field blanks (FB) values are laboratory blank corrected.

Table 3c - List of Samples Qualified for Field Blank or Rinsate Blank Contamination

Method	Sample ID	Analyte	Blank Result ng/L	Sample Result ng/L	Sample Qual	PQL ng/L
EPA 1631	0917MW44GW	Total Mercury	5.93	6.02	U	0.4
EPA1631	0917MW44GW	Dissolved Mercury	2.16	0.25	U	0.4
EPA 1631	0917MW45GW	Dissolved Mercury	2.16	10.1	U	0.4
EPA1631	0917MW46GW	Dissolved Mercury	2.16	2.63	U	0.4
EPA 1631	0917MW47GW	Dissolved Mercury	2.16	9.59	U	0.4
EPA1631	0917MW48GW	Dissolved Mercury	2.16	4.30	U	0.4
EPA1631	0917MW51GW	Total Mercury	5.93	27.2	U	0.4
EPA 1631	0917MW51GW	Dissolved Mercury	2.16	0.89	U	0.4
EPA1631	0917MW56GW	Total Mercury	5.93	23.9	U	0.4
EPA1631	0917MW52GW	Dissolved Mercury	2.16	2.38	U	0.4
EPA 1631	0917MW54GW	Dissolved Mercury	2.16	1.48	U	0.4

Table 3c - List of Samples Qualified for Field Blank or Rinsate Blank Contamination

Method	Sample ID	Analyte	Blank Result ng/L	Sample Result ng/L	Sample Qual	PQL ng/L
EPA1631	0917MW56GW	Total Mercury	5.93	26.3	U	0.4
EPA1631	0917MW56GW	Dissolved Mercury	2.16	0.70	U	0.4
EPA1631	0917MW58GW	Total Mercury	5.93	8.78	U	0.4
EPA1631	0917MW58GW	Dissolved Mercury	2.16	0.43	U	0.4
EPA1631	0917MW59GW	Dissolved Mercury	2.16	7.43	U	0.4
EPA1631	0917MW92GW	Dissolved Mercury	2.16	2.51	U	0.4

Table 4 - List of Samples with Surrogates outside Control Limits

There are no surrogates used by this method.

Method	Sample ID	Sample Type	Analyte	Rec.	Low Limit	High Limit	Dil Fac	Sample Qual.
None.								

Table 5a - List of MS/MSD Recoveries outside Control Limits

Method	Sample ID	Sample Type	Analyte	Orig. Result	Spike Amount	Rec.	Dil Fac.	Low Limit	High Limit	Sample Qual
None										

Table 5b - List of Lab and MS Duplicate RPDs outside Control Limits

Sample ID	Analyte	Method	RPD	RPD Limit	No. of Affected Samples	Samp Qual
None						

Table 6 - List of LCS Recoveries outside Control Limits

Method	Sample ID	Analyte	%Rec.	Low Limit	High Limit	No. of Affected Samples	Samp Qual
None							

Table 7 - Samples that Were Re-analyzed

Sample ID	Lab ID	Method	Sample Type	Action
0917MW50GW	1740001-17	EPA1631	ground water	Re-analyzed due to elevated result above calibration range. Analyzed at a lower aliquot Confirmation with no Qualification
0917MW50GW	1740001-18	EPA1631	Filtered ground water	Analyzed at a lower aliquot Confirmation with no Qualification
0917MW51GW	1740001-19	EPA1631	ground water	Analyzed at a lower aliquot Confirmation with no Qualification

Table 8 - Summary of Field Duplicate Results

Method	Analyte	Units	0917MW52GW	0917MW92GW	RPD	Rating	Sample Qualifier
EPA 1631	Mercury	ng/L	23.9 U	51.7 J	> 100	Poor	J
EPA 1631	Dissolved Mercury	ng/L	2.38 U	2.51 U	NA	Good	None

DATA REVIEW MEMORANDUM

DATE: November 29, 2017

TO: Jonathan Reeve, Project Manager, E & E, Seattle, WA

FROM: Howard Edwards, E & E, San Francisco, CA

SUBJ: Data Review: Red Devil Mine 2017 Fall

Job Description: Red Devil Mine 2017 FALL SW/GW

BAL Report: 1740002

REFERENCE:

Project ID	Lab Work Order	Lab
1001095.0009.05	EEI-SE1601	Brooks Applied Labs – Seattle

Validated data is attached to the end of this memorandum.

1. SAMPLE IDENTIFICATION

For the sampling activities at the Red Devil Mine site, Ecology and Environment, Inc. (E & E) collected the samples listed in Table 1. Project-specific matrix spike/matrix spike duplicates (MS/MSD) were designated in the field. All samples were sent to Brooks Applied Labs in Seattle, Washington, for all analyses. This report addresses only Brooks Applied Labs-generated data.

The analytical report was issued by Brooks Applied Labs on October 26, 2017. The data in the analytical report were reviewed for field and laboratory precision, accuracy, and completeness in accordance with procedures and quality control (QC) limits, the current laboratory Quality Assurance Manual (QAM) and current standard operating procedures (SOPs). Any additional data review qualifiers added are noted below and listed on the tables at the end of this memorandum. Definitions of all data qualifiers are given in the report.

Work Orders, Tests, and Number of Samples Included in this Data Review Memo

Work Orders/ Job Number	Matrix	Test Method	Method Name	Number of Samples
EEI-SA1601	Surface Water	EPA 1631	Total Low-Level Mercury (CVAFS)	8
EEI-SA1601	Surface Water	EPA 1631	Dissolved Low-Level Mercury (CVAFS)	8
EEI-SE1601	Ground Water	EPA 1631	Total Low-Level Mercury (CVAFS)	22
EEI-SE1601	Ground Water	EPA 1631	Dissolved Low-Level Mercury (CVAFS)	22
EEI-SE1601	Rinse Blank	EPA 1631	Total Low-Level Mercury (CVAFS)	2
EEI-SE1601	Rinse Blank	EPA 1631	Dissolved Low-Level Mercury (CVAFS)	2
EEI-SE1601	Trip Blank	EPA 1631	Total Low-Level Mercury (CVAFS)	0
EEI-SE1601	Field Blank	EPA 1631	Total Low-Level Mercury (CVAFS)	4

2. SAMPLE PROCEDURES

All samples were collected as specified in the work plan and documented on the chain-of-custody (COC) and in field notebooks. Samples were analyzed as specified on the COC. Samples were packaged, shipped, and received as specified in the work plan. All samples for organic analyses must be received cold (4 ±2 degrees Celsius [°C]) and in good condition as documented on the Cooler Receipt Form.

REVIEW RESULTS

All sampling procedures were followed and the sample coolers were received by the laboratory at 6.5°C and 15 °C. Since the samples were acidified in the field, the Field Sampling Plan requirement indicating 4 ±2 °C requirement, did not result in qualification. Since the preservation, temperature is not a method requirement.

3. LABORATORY DATA

3.1 HOLDING TIMES

Holding times are established and monitored to ensure analytical results accurately represent analyte concentrations in a sample at the time of collection. These qualified results based upon missed holding times are presented in Table 2 (if applicable). Exceeding the holding time for a sample generally results in a loss of the analyte due to

a variety of mechanisms, such as deposition on the sample container walls or precipitation.

REVIEW RESULTS

All sample were analyzed within the method holding time.

3.2 BLANKS

All laboratory blanks are integrated into the method and all results are corrected for blank values provided that the laboratory blank values are within method-set limits. When blanks are outside of the method limits, associated samples are re-analyzed. Method blanks with positive results are shown in Table 3a. No data was qualified due to laboratory method blanks (see Table 3b).

Field blank and rinsate blank samples are analyzed and evaluated to determine the existence and magnitude of possible contamination during the sampling and analysis process. All field blank with reported results are also presented in Table 3a (if applicable). If the mercury is present in the sample at similar trace levels (less than 5 times the blank concentration), then the analyte is likely a common background contaminant from some phase of the sampling, extraction, or analytical procedure and associated low-level sample concentrations are not considered to be site related. Sample results in these cases are qualified as not detected, U.

REVIEW RESULTS

All laboratory (method) were performed at the required frequencies. As noted in Table 3a, analyte concentrations in the method blanks were below the practical quantitation limit (PQL). No samples were qualified based on laboratory blanks. Field blanks were performed at the required frequency with one exception; there was no analysis for a field blank analyzed on September 19, 2017. All field blanks were reported at a concentration above the detection limit. All associated reported concentration of mercury in samples that were less than 5 times the concentration found in their associated field blank were U qualified as not detected. A total of18 samples were U qualified based on the field blanks. A summary of qualified data due to laboratory blank contamination is presented in Table 3b.

One set of equipment rinsate blanks (filtered and unfiltered) for the bladder pump was collected. The rinsate blank was found to contain both dissolved mercury (2.06 ng/L) and total mercury (40.4 ng/L) at a concentration above the method reporting limit. All associated sample results that were detected at levels less than 5 times the blank were U qualified as not detected. At total of 13 samples were U qualified as not detected. All but two of the 13 samples qualified by the rinsate blank were also qualified by the field blank detections. One set of equipment blanks (filtered and unfiltered) for the bailer was collected. The equipment blank was found to contain both dissolved mercury (1.02 ng/L) and total mercury (7.45 ng/L) at a concentration above the method reporting limit. There were no sample results that were detected at levels less than 5 times this equipment blank, thus, they were no associated qualifications.

Associated samples with detection greater than 5 times the blank were not qualified. A summary of qualified data due to equipment rinsate blank contamination is also presented in Table 3c.

3.3 MATRIX SPIKE AND MATRIX SPIKE DUPLICATE ANALYSIS

The MS/MSD analyses are intended to provide information about the effects that the sample matrix exerts on the digestion / extraction and measurement methodology. MS recovery values that do not meet laboratory QC criteria may indicate that sample analyte results are being attenuated in the analysis procedure. The potential sample bias may be estimated by noting the degree to which the MS concentration was elevated or lowered in the spike analysis. However, this estimated bias should serve only as an approximation; sample-specific problems may be the cause of the discrepancy, particularly in soil samples.

Recovery calculations are not required if the spiking concentration added is less than 25% of the sample background concentration.

REVIEW RESULTS

The MS/MSD sample analyses were performed at the required frequency on four unfiltered groundwater samples, two unfiltered surface water samples, and one filter surface water sample. All MS/MSD recoveries and accuracies were within the control limits.

A summary of sample data qualified due to MS/MSD precision and accuracy are presented in Tables 5a and 5b (if applicable).

3.4 LABORATORY CONTROL SAMPLE ANALYSIS

The LCS or Certified Reference Material standard is analyzed to monitor the efficiency of the digestion/extraction procedure and analytical instrument operation. The ability of the laboratory to successfully analyze an LCS or Certified Reference Material standard demonstrates that there are no analytical problems related to the digestion/sample preparation procedures and/or instrument operations. The LCS or Certified Reference Material standard results outside QC limits are presented in Table 6 (if applicable). Sporadic and marginal QC failures for multiple component methods do not indicate an analytical concern. If recoveries are high and the compounds are not detected in the samples, then no data qualification is required. All recoveries should be above 10% or the non-detect results flagged “UR” as rejected.

REVIEW RESULTS

The analysis of the Certified Reference Material Sample was within control limits.

3.5 COMPOUND IDENTIFICATION AND QUANTITATION

Mercury identification is by cold-vapor atomic fluorescence spectrometer (CVAFS) at 253.7 nanometers for detection. The concentration of Hg in each sample is based upon calibration curve done for each analysis batch. The method blank is used to correct the reported Mercury concentration detected below the PQL in samples should be considered estimated and are qualified "J." The samples with results above the linear range were all re-analyzed as a smaller aliquot.

REVIEW RESULTS

All compound identification and quantitation criteria were achieved and reported based upon the method. As noted in Table 7, three filtered samples were reported as being reanalyzed due to the initial analysis result being below the reporting limit. A larger aliquot of all three samples was re-analyzed with the re-analysis and reported. Also as noted in Table 7, two unfiltered samples were reported as being reanalyzed due to the initial analysis concentration exceeding the calibration range. A smaller aliquot of all

three samples were re-analyzed with the re-analysis confirming the initial analysis concentrations.

The four field blank samples were reported as being reanalyzed due to the initial analysis results that yielded detectable concentration of mercury. The re-analysis confirm the initial results.

4. FIELD DUPLICATE SAMPLE RESULTS

Field duplicate samples were collected and analyzed as an indication of overall precision for both field and laboratory. Field duplicate results are summarized in Table 8 (if applicable). The results are expected to have more variability than laboratory duplicates, which measure only laboratory precision. It is expected also that soil field duplicates will exhibit greater variance than water field duplicates due to the difficulties associated with collecting identical field samples. The QC criteria used to assess field duplicate samples for this project was limits of 70% RPD for soils and 40% RPD for waters, or twice the general laboratory duplicate criteria. If a given compound in both the regular sample and associated field duplicate sample was below the laboratory PQL, or the compound was not detected in one of the samples, then the compound is generally not qualified due to field duplicate precision. There are no guidelines regarding data qualification based on poor field duplicate precision. Professional judgment was used to determine whether or not to qualify results.

REVIEW RESULTS

Four field duplicates analyses were performed on this SDG. The RPD ratings are listed on Table 8a through 8d as “Good” if the RPD is less than field duplicate QC criteria of 40% and as “Poor” if the RPD exceeded the field duplicate QC criteria.

The result for total mercury and dissolved mercury showed good precision in the three groundwater sample sets. The result for dissolved mercury showed good precision in the surface water sample. The result for total mercury showed poor precision in the surface water sample. Results are presented in Tables 8a through 8d. Qualifiers were only added to the field duplicate sample pair results as noted.

5. OVERALL ASSESSMENT OF DATA

The data from the QA samples suggest the following:

- That there was elevated contamination in the field blank collected on September 17, 2017. The field blank indicates the potential that airborne mercury may be contaminating samples. The elevated field blank may also indicate that a portion of the laboratory supplied blank water was contaminated. Nineteen samples were qualified U as being not detected based upon the field blank.

- That there was an equipment decontamination problem with the bladder pump that was used to collect most of the groundwater samples. The equipment rinsate blank indicates the potential of inadequate decontamination of the bladder pump. The problem did not cause any additional qualification.

- That there was an equipment decontamination problem with the bailer that was used to collect one of the groundwater samples. The equipment rinsate blank indicates the potential of inadequate decontamination of the bailer. The equipment blank may also indicate the potential that airborne mercury may be contaminating samples. No samples were qualified.

All data were reviewed and considered usable with qualification as noted in this report. All non-detect results were reported as “U” qualified at the PQL except where noted based upon blank contamination. All reported data at concentration less than the PQL were J qualified as estimated.

Table 1 - Sample Listing

Work Order	Matrix	Sample ID	Lab ID	Sample Date	QA/QC	Analysis
EEI-SE1601	GW	*0917MW01GW*	1740002-08	9/16/2017	MS/MSD	EPA 1631
EEI-SE1601	F-GW	*0917MW01GW*	1740002-09	9/16/2017		EPA 1631
EEI-SE1601	GW	*0917MW06GW*	1740002-10	9/19/2017	field duplicate of 0917MW90GW	EPA 1631
EEI-SE1601	F-GW	*0917MW06GW*	1740002-11	9/19/2017	field duplicate of 0917MW90GW	EPA 1631
EEI-SE1601	GW	*0917MW08GW*	1740002-12	9/18/2017		EPA 1631
EEI-SE1601	F-GW	*0917MW08GW*	1740002-13	9/18/2017		EPA 1631
EEI-SE1601	GW	*0917MW09GW*	1740002-14	9/25/2017		EPA 1631
EEI-SE1601	F-GW	*0917MW09GW*	1740002-15	9/25/2017		EPA 1631
EEI-SE1601	GW	*0917MW10GW*	1740002-16	9/19/2017	MS/MSD	EPA 1631
EEI-SE1601	F-GW	*0917MW10GW*	1740002-17	9/19/2017		EPA 1631
EEI-SE1601	GW	*0917MW16GW*	1740002-18	9/18/2017		EPA 1631
EEI-SE1601	F-GW	*0917MW16GW*	1740002-19	9/18/2017		EPA 1631
EEI-SE1601	GW	*0917MW17GW*	1740002-20	9/18/2017		EPA 1631
EEI-SE1601	F-GW	*0917MW17GW*	1740002-21	9/18/2017		EPA 1631
EEI-SE1601	GW	*0917MW19GW*	1740002-22	9/25/2017		EPA 1631
EEI-SE1601	F-GW	*0917MW19GW*	1740002-23	9/25/2017		EPA 1631
EEI-SE1601	GW	*0917MW22GW*	1740002-24	9/25/2017	Duplicate of 0917MW93GW	EPA 1631
EEI-SE1601	F-GW	*0917MW22GW*	1740002-25	9/25/2017	Duplicate of 0917MW93GW	EPA 1631
EEI-SE1601	GW	*0917MW26GW*	1740002-26	9/24/2017		EPA 1631
EEI-SE1601	F-GW	*0917MW26GW*	1740002-27	9/24/2017		EPA 1631
EEI-SE1601	GW	*0917MW27GW*	1740002-28	9/19/2017		EPA 1631
EEI-SE1601	F-GW	*0917MW27GW*	1740002-29	9/19/2017		EPA 1631
EEI-SE1601	GW	*0917MW28GW*	1740002-30	9/24/2017		EPA 1631
EEI-SE1601	F-GW	*0917MW28GW*	1740002-31	9/24/2017		EPA 1631
EEI-SE1601	GW	*0917MW29GW*	1740002-32	9/18/2017		EPA 1631
EEI-SE1601	F-GW	*0917MW29GW*	1740002-33	9/18/2017		EPA 1631
EEI-SE1601	GW	*0917MW31GW*	1740002-34	9/17/2017		EPA 1631
EEI-SE1601	F-GW	*0917MW31GW*	1740002-35	9/17/2017		EPA 1631
EEI-SE1601	GW	*0917MW32GW*	1740002-36	9/17/2017	MS/MSD	EPA 1631
EEI-SE1601	F-GW	*0917MW32GW*	1740002-37	9/17/2017		EPA 1631
EEI-SE1601	GW	*0917MW33GW*	1740002-38	9/19/2017		EPA 1631
EEI-SE1601	F-GW	*0917MW33GW*	1740002-39	9/19/2017		EPA 1631
EEI-SE1601	GW	*0917MW40GW*	1740002-40	9/19/2017	Duplicate of 0917MW91GW	EPA 1631
EEI-SE1601	F-GW	*0917MW40GW*	1740002-41	9/19/2017	Duplicate of 0917MW91GW	EPA 1631
EEI-SE1601	GW	*0917MW42GW*	1740002-42	9/25/2017		EPA 1631
EEI-SE1601	F-GW	*0917MW42GW*	1740002-43	9/25/2017		EPA 1631
EEI-SE1601	GW	*0917MW43GW*	1740002-44	9/18/2017		EPA 1631
EEI-SE1601	F-GW	*0917MW43GW*	1740002-45	9/18/2017		EPA 1631
EEI-SE1601	GW	*0917MW90GW*	1740002-46	9/19/2017	field duplicate of 0917MW06GW	EPA 1631
EEI-SE1601	F-GW	*0917MW90GW*	1740002-47	9/19/2017	field duplicate of 0917MW06GW	EPA 1631

Table 1 - Sample Listing

Work Order	Matrix	Sample ID	Lab ID	Sample Date	QA/QC	Analysis
EEI-SE1601	GW	*0917MW91GW*	1740002-48	9/19/2017	field duplicate of 0917MW40GW MS/MSD	EPA 1631
EEI-SE1601	F-GW	*0917MW91GW*	1740002-49	9/19/2017	field duplicate of 0917MW40GW	EPA 1631
EEI-SE1601	GW	*0917MW93GW*	1740002-50	9/25/2017	field duplicate of 0917MW22GW	EPA 1631
EEI-SE1601	F-GW	*0917MW93GW*	1740002-51	9/25/2017	field duplicate of 0917MW22GW	EPA 1631
EEI-SE1601	SW	*0917RD05SW*	1740002-52	9/15/2017	MS/MSD	EPA 1631
EEI-SE1601	F-SW	*0917RD05SW*	1740002-53	9/15/2017		EPA 1631
EEI-SE1601	SW	*0917RD06SW*	1740002-54	9/15/2017		EPA 1631
EEI-SE1601	F-SW	*0917RD06SW*	1740002-55	9/15/2017		EPA 1631
EEI-SE1601	SW	*0917RD08SW*	1740002-56	9/15/2017		EPA 1631
EEI-SE1601	F-SW	*0917RD08SW*	1740002-57	9/15/2017		EPA 1631
EEI-SE1601	SW	*0917RD09SW*	1740002-58	9/15/2017		EPA 1631
EEI-SE1601	F-SW	*0917RD09SW*	1740002-59	9/15/2017		EPA 1631
EEI-SE1601	SW	*0917RD10SW*	1740002-60	9/15/2017	field duplicate of 0917RD50SW	EPA 1631
EEI-SE1601	F-SW	*0917RD10SW*	1740002-61	9/15/2017	field duplicate of 0917RD50SW	EPA 1631
EEI-SE1601	SW	*0917RD14SW*	1740002-62	9/15/2017	MS/MSD	EPA 1631
EEI-SE1601	F-SW	*0917RD14SW*	1740002-63	9/15/2017	MS/MSD	EPA 1631
EEI-SE1601	SW	*0917RD15SW*	1740002-64	9/15/2017		EPA 1631
EEI-SE1601	F-SW	*0917RD15SW*	1740002-65	9/15/2017		EPA 1631
EEI-SE1601	SW	*0917RD50SW*	1740002-66	9/15/2017	field duplicate of 0917RD10SW	EPA 1631
EEI-SE1601	F-SW	*0917RS50SW*	1740002-67	9/15/2017	field duplicate of 0917RD10SW	EPA 1631
EEI-SE1601	Blank	*0917RS09SW*	1740002-68	9/25/2017	Rinsate Blank (pump)	EPA 1631
EEI-SE1601	F- Blk	*0917RS09SW*	1740002-69	9/25/2017	Rinsate Blank (pump)	EPA 1631
EEI-SE1601	Blank	*0917EB03GW*	1740002-01	9/25/2017	Equipment Blank (bailer)	EPA 1631
EEI-SE1601	F- Blk	*0917EB03GW*	1740002-02	9/25/2017	Equipment Blank (bailer)	EPA 1631
EEI-SE1601	Blank	0917FB01	1740002-03	9/15/2017	Field Blank	EPA 1631
EEI-SE1601	Blank	0917FB02	1740002-04	9/17/2017	Field Blank	EPA 1631
EEI-SE1601	Blank	0917FB08	1740002-06	9/24/2017	Field Blank	EPA 1631
EEI-SE1601	Blank	0917FB09	1740002-07	9/25/2017	Field Blank	EPA 1631

F-GW =Filtered ground water
FD = Field duplicate sample
F-blk = Filtered Blank
GW = Ground water

Table 2 - List of Samples Qualified for Holding Time Exceedance

Method	Analyte	Sample IDs	HT	Sampling Date	Analysis Date	Qual
None						

Table 3a - List of Positive Results for Blank Samples

Method	Sample ID	Sample Type	Analyte	Result**	Analysis Type	Units	PQL
EPA1631	0917RS09SW	AQ	Total Mercury	40.3	RB	ng/L	0.40
EPA1631	0917RS09SW	AQ	Dissolved Mercury	2.06	RB	ng/L	0.40
EPA1631	0917EB03GW	AQ	Total Mercury	7.45	EB	ng/L	0.40
EPA1631	0917EB03GW	AQ	Dissolved Mercury	1.03	EB	ng/L	0.40
EPA1631	0917FB01	AQ	Total Mercury	0.3 J	FB	ng/L	0.40
EPA1631	0917FB02	AQ	Total Mercury	6.69	FB	ng/L	0.40
EPA1631	0917FB08	AQ	Total Mercury	0.17	FB	ng/L	0.40
EPA1631	0917FB09	AQ	Total Mercury	0.73	FB	ng/L	0.40

Table 3b - List of Samples Qualified for Method Blank Contamination

Method	Sample ID	Analyte	Blank Result	Sample Result	Sample Qual	PQL
None *						

*EPA 1631 method monitors laboratory blank concentration and uses blank concentration to correct reported sample data. Detected values less than the quantitation limit are normal.
** Field blanks (FB) values are laboratory blank corrected.

Table 3c - List of Samples Qualified for Field Blank or Rinsate Blank Contamination

Method	Sample ID	Analyte	Blank Result	Sample Result	Sample Qual	PQL
			ng/L	ng/L		ng/L
EPA 1631	0917MW08GW	Total Mercury	6.69	7.31	U	0.4
EPA1631	0917MW08GW	Dissolved Mercury	6.69	3.93	U	0.4
EPA 1631	0917MW10GW	Total Mercury	40.3	16.3	U	0.4
EPA1631	0917MW10GW	Dissolved Mercury	2.06	0.25 J	U	0.4
EPA 1631	0917MW19GW	Dissolved Mercury	0.73	1.07	U	0.4
EPA1631	0917MW29GW	Total Mercury	40.3	24.9	U	0.4
EPA1631	0917MW29GW	Dissolved Mercury	2.06	1.05	U	0.4
EPA 1631	0917MW31GW	Total Mercury	40.3	4.87	U	0.4
EPA1631	0917MW31GW	Dissolved Mercury	2.06	0.42	U	0.4
EPA1631	0917MW32GW	Total Mercury	6.69	30.9	U	0.4
EPA 1631	0917MW32GW	Dissolved Mercury	6.69	1.86	U	0.4
EPA1631	0917MW33GW	Dissolved Mercury	6.69	8.91	U	0.4
EPA1631	0917MW40GW	Total Mercury	40.3	25.9	U	0.4
EPA1631	0917MW40GW	Dissolved Mercury	2.06	0.31	U	0.4
EPA1631	0917MW42GW	Total Mercury	40.3	93.8	U	0.4
EPA1631	0917MW43GW	Total Mercury	40.3	50	U	0.4
EPA1631	0917MW43GW	Dissolved Mercury	2.06	4.04	U	0.4
EPA1631	0917MW90GW	Dissolved Mercury	1.17	0.90	U	0.4
EPA1631	0917MW91GW	Total Mercury	40.3	27.9	U	0.4
EPA1631	0917MW91GW	Dissolved Mercury	2.06	0.41	U	0.4

Table 4 - List of Samples with Surrogates outside Control Limits

There are no surrogates used by this method.

Method	Sample ID	Sample Type	Analyte	Rec.	Low Limit	High Limit	Dil Fac	Sample Qual.
None.								

Table 5a - List of MS/MSD Recoveries outside Control Limits

Method	Sample ID	Sample Type	Analyte	Orig. Result	Spike Amount	Rec.	Dil Fac.	Low Limit	High Limit	Sample Qual
None										

Table 5b - List of Lab and MS Duplicate RPDs outside Control Limits

Sample ID	Analyte	Method	RPD	RPD Limit	No. of Affected Samples	Samp Qual
None						

Table 6 - List of LCS Recoveries outside Control Limits

Method	Sample ID	Analyte	%Rec.	Low Limit	High Limit	No. of Affected Samples	Samp Qual
None							

Table 7 - Samples that were Re-analyzed

Sample ID	Lab ID	Method	Sample Type	Action
0917MW10GW	1740002-16	EPA1631	Unfiltered groundwater	Analyzed at a lower aliquot Confirmation with no Qualification
0917MW90GW	1740002-47	EPA1631	Filtered groundwater	Re-analyzed due to result below reporting limit. Analyzed at a larger aliquot Confirmation with no additional qualification
0917MW90GW	1740002-48	EPA1631	Unfiltered groundwater	Analyzed at a lower aliquot Confirmation with no Qualification
0917MW91GW	1740002-49	EPA1631	Filtered groundwater	Re-analyzed due to result below reporting limit. Analyzed at a larger aliquot Confirmation with no additional qualification
0917MW09GW	1740002-69	EPA1631	Filtered groundwater	Re-analyzed due to result below reporting limit. Analyzed at a larger aliquot Confirmation with no additional qualification
0917FB01	1740002-03	EPA1631	Field Blank	Re-analyzed due to result above detection limit. Re –analysis confirmed initial analysis result.
0917FB02	1740002-04	EPA1631	Field Blank	Re-analyzed due to result above detection limit. Re –analysis confirmed initial analysis result.
0917FB08	1740002-06	EPA1631	Field Blank	Re-analyzed due to result above detection limit. Re –analysis confirmed initial analysis result.
0917FB09	1740002-07	EPA1631	Field Blank	Re-analyzed due to result above detection limit. Re –analysis confirmed initial analysis result.

Table 8a - Summary of Field Duplicate Results

Method	Analyte	Units	0917MW06GW	0917MW90GW	RPD	Rating	Sample Qualifier
EPA 1631	Mercury	ng/L	45.7	53.7	16	Good	None
EPA 1631	Dissolved Mercury	ng/L	0.72	0.90 U	Not Applicable	Good	None

Table 8b – Summary of Field Duplicate Results

Method	Analyte	Units	0917MW22GW	0917MW93GW	RPD	Rating	Sample Qualifier
EPA 1631	Mercury	ng/L	214	223	4	Good	None
EPA 1631	Dissolved Mercury	ng/L	103	114	10	Good	None

Table 8c – Summary of Field Duplicate Results

Method	Analyte	Units	0917MW40GW	0917MW91GW	RPD	Rating	Sample Qualifier
EPA 1631	Mercury	ng/L	25.9 U	27.9 U	4	Good	None
EPA 1631	Dissolved Mercury	ng/L	0.31 U	0.41 U	10	Good	None

Table 8d – Summary of Field Duplicate Results

Method	Analyte	Units	0917RD10SW	0917RD50SW	RPD	Rating	Sample Qualifier
EPA 1631	Mercury	ng/L	40.2	7.21	> 100	Poor	J
EPA 1631	Dissolved Mercury	ng/L	3.87	4.15	6	Good	None

DATA REVIEW MEMORANDUM

DATE: November 29, 2017

TO: Jonathan Reeve, Project Manager, E & E, Seattle, WA

FROM: Howard Edwards, E & E, San Francisco, CA

SUBJ: Data Review: Red Devil Mine Fall 2017

REFERENCE:

Project ID	Lab Work Order	Lab
1001095.0009.05	580-71716-1	Test America – Seattle

1. SAMPLE IDENTIFICATION

For the sampling activities at the Red Devil Mine site, Ecology and Environment, Inc. (E & E) collected the samples listed in Table 1. Project-specific matrix spike/matrix spike duplicates (MS/MSD) were designated in the field, except where noted. All samples were sent to Test America's lab in Seattle, Washington, for all listed analyses. This report addresses only Test America-generated data.

The analytical report was issued by Test America on October 17, 2017. The data in the analytical report were reviewed for field and laboratory precision, accuracy, and completeness in accordance with procedures and quality control (QC) limits, the current laboratory Quality Assurance Manual (QAM) and current standard operating procedures (SOPs). Laboratory data qualifiers for identified analytes and analyte quantitation were accepted. Any additional data review qualifiers added are noted below and listed on the tables at the end of this memorandum. Definitions of all data qualifiers are given in the report.

Work Orders, Tests, and Number of Samples Included in this Data Review Memo

Work Orders/ Job Number	Matrix	Test Method	Method Name	Number of Samples
580-71706-1	Surface Water	EPA 7470A	Mercury (CVAA)	8
580-71706-1	Surface Water	EPA 6010B/6020A	Total TAL Metals by ICP	8
580-71706-1	Surface Water	EPA 7470A	Dissolved Mercury (CVAA)	8
580-71706-1	Surface Water	EPA 6010B/6020A	Dissolved TAL Metals by ICP	8
580-71706-1	Surface Water	EPA 9060	TOC	8
580-71706-1	Surface Water	SM2540D	TSS	8
580-71706-1	Surface Water	SM2540C	TDS	8
580-71706-1	Surface Water	EPA 300.0	Inorganic Ions (Cl, F, SO4)	8
580-71706-1	Surface Water	EPA 353.2	Nitrate-Nitrite as N	8
580-71706-1	Surface Water	SM2320B	Alkalinity as CO3/HCO3	8
580-71706-1	Ground Water	EPA 6010B/6020A	Total TAL Metals by ICP	22
580-71706-1	Ground Water	EPA 7470A	Mercury (CVAA)	22
580-71706-1	Ground Water	EPA 300.0	Inorganic Ions (Cl, F, SO4)	22
580-71706-1	Ground Water	EPA 353.2	Nitrate-Nitrite as N	22
580-71706-1	Ground Water	SM2320B	Alkalinity as CO3/HCO3	22
580-71706-1	Ground Water	EPA 8270D	SVOCs	3
580-71706-1	Ground Water	AK102/103	DRO	3
580-71706-1	Ground Water	EPA 8260C	BTEX	3
580-71706-1	Ground Water	AK101	GRO	3
580-71706-1	Ground Water	SM2540D	TSS	22
580-71706-1	Ground Water	SM2540C	TDS	22
580-71706-1	Rinsate Blank	EPA 7470A	Mercury (CVAA)	1
580-71706-1	Rinsate Blank	EPA 6010B/6020A	Total TAL Metals by ICP	1
580-71706-1	Rinsate Blank	EPA 7470A	Dissolved Mercury (CVAA)	1
580-71706-1	Rinsate Blank	EPA 6010B/6020A	Dissolved TAL Metals by ICP	1
580-71706-1	Rinsate Blank	SM2540C	TDS	1
580-71706-1	Rinsate Blank	EPA 353.2	Nitrate-Nitrite as N	1
580-71706-1	Rinsate Blank	SM2320B	Alkalinity as CO3/HCO3	1
580-71706-1	Equipment Blank	EPA 7470A	Mercury (CVAA)	1
580-71706-1	Equipment Blank	EPA 6010B/6020A	Total TAL Metals by ICP	1
580-71706-1	Equipment Blank	EPA 7470A	Dissolved Mercury (CVAA)	1
580-71706-1	Equipment Blank	EPA 6010B/6020A	Dissolved TAL Metals by ICP	1
580-71706-1	Equipment Blank	SM2540C	TDS	1
580-71706-1	Equipment Blank	EPA 353.2	Nitrate-Nitrite as N	1
580-71706-1	Equipment Blank	SM2320B	Alkalinity as CO3/HCO3	1
580-71706-1	Trip Blank	EPA 8260C	BTEX	1
580-71706-1	Trip Blank	AK101	GRO	1

2. SAMPLE PROCEDURES

All samples were collected as specified in the work plan and documented on the chain-of-custody (COC) and in field notebooks. Samples were analyzed as specified on the COC. Samples were packaged, shipped, and received as specified in the work plan. All samples must be received cold (4 ±2 degrees Celsius [^{o}C]) and in good condition as documented on the Cooler Receipt Form.

REVIEW RESULTS

All sample procedures were followed and the sample coolers were received at temperatures between 0.1 and 2.4 ^{o}C. No problems with the condition of the samples upon receipt were documented.

3. LABORATORY DATA

3.1 HOLDING TIMES

Holding times are established and monitored to ensure analytical results accurately represent analyte concentrations in a sample at the time of collection. These results are presented in Table 2 (if applicable). Exceeding the holding time for a sample generally results in a loss of the analyte due to a variety of mechanisms, such as deposition on the sample container walls or precipitation.

REVIEW RESULTS

Most samples requiring the determination of total suspended solids (TSS) and all samples requiring the determination of total dissolved solids (TDS) were received by the laboratory after the holding time had expired. The method and project specified holding time is 7 days. All associated TSS and TDS data was J qualified as estimated. Fifteen samples requiring the determination for alkalinity were received by the laboratory with less than two days of holding time and were analyzed past the holding time. The method and project specified holding time is 14 days. All other samples were analyzed within the project and method specified holding times for all analytes (see Table 2).

3.2 BLANKS

Laboratory and field blank samples are analyzed and evaluated to determine the existence and magnitude of possible contamination during the sampling and analysis

process. These results are presented in Table 3 (if applicable). If the analyte is present in the sample at similar trace levels(less than 5 times the blank concentration), then the analyte is likely a common background contaminant from some phase of the sampling, extraction, or analytical procedure and associated low-level sample concentrations are not considered to be site related. Sample results in these cases are qualified as not detected, U.

REVIEW RESULTS

All laboratory method blanks were performed at the required frequency. As noted in Table 3a, analyte concentrations in the method blanks detected for phenol, DRO, chloride, sulfate, and TOC. All method blank analytes were found at concentrations below the practical quantitation limit (PQL). All associated reported concentration of phenol, DRO, chloride, sulfate and TOC that were less than 5 times the concentration found in the preparation blank/ method blank (MB) were U qualified as not detected.

Phenol and DRO, which was found in the MB, was detected in three associated sample at a similar concentrations was U qualified as not detected. Sulfate was detected in two associated samples at less than 5 times the concentration found in the preparation blank/ method blank (MB). Chloride was U qualified in one associated sample. A summary of qualified data due to method blank contamination is presented in Table 3b.

One equipment and one rinsate blank were collected, with several EPA Method 6010, 6020, and 300.0 analytes detected in at concentrations less than the PQL. All associated sample results that were detected at levels less than 5 times the blank were U qualified as not detected. Associated samples with detection greater than 5 times the blank were not qualified. A summary of qualified data due to equipment rinsate blank contamination is presented in Table 3c.

One trip blank were submitted for analysis by EPA 8260C and AK101. Toluene by EPA 8260C was detected at 0.038 J ug/L in the trip blank. All associated sample results were detected at levels less than 5 times the blank and were U qualified as not detected.

3.3 SURROGATE SPIKE RECOVERY

Laboratory performance for individual samples analyzed for organic compounds is established by means of surrogate spiking activities. Samples are spiked with surrogate compounds prior to preparation and analysis. Unusually low or high surrogate recovery values may indicate some deficiency in the analytical system or that some matrix effects exist, resulting in low or high sample results for target compounds. Sample surrogate recoveries outside QC limits (if applicable) are presented in Table 4.

REVIEW RESULTS

All method which use surrogates were analyzed at the required frequency with no high or low surrogate recoveries noted.

3.4 MATRIX SPIKE AND MATRIX SPIKE DUPLICATE ANALYSIS

The MS/MSD analyses are intended to provide information about the effects that the sample matrix exerts on the digestion / extraction and measurement methodology. MS recovery values that do not meet laboratory QC criteria may indicate that sample analyte results are being attenuated in the analysis procedure. The potential sample bias may be estimated by noting the degree to which the MS concentration was elevated or lowered in the spike analysis. However, this estimated bias should serve only as an approximation; sample-specific problems may be the cause of the discrepancy, particularly in soil samples.

Recoveries of a post-digestion spike or a laboratory control sample (LCS) are used to verify that the analytical methodology is acceptable and that MS recoveries are due to matrix effects. An MSD analysis is performed to evaluate the precision of the sample results. Precision is measured as the relative percent difference (RPD) between analytical results for duplicate samples. The laboratory's failure to produce similar results for MSD samples may indicate that the samples were non-homogeneous (particularly in soil samples), or that method defects may exist in the laboratory's techniques.

Recovery calculations are not required if the spiking concentration added is less than 25% of the sample background concentration.

REVIEW RESULTS

The MS/MSD sample analyses were performed on three samples 0917MW01GW, 0917MW042GW, and 0917RD14SW, at the required frequency. The MS/MSD sample analyses were performed on 0917MW19GW for organic analyses. MS/MSD were performed on additional samples for EPA Method 353.2 and EPA 9060. MS/MSD recoveries were within the control limits generated by the laboratory with the following exceptions:

- For sample 0917MW19GW, the MS and MSD recoveries for DRO by AK102/103 were above laboratory control limits. The results for DRO in associated samples was previously qualified as none detect, based on blank contamination, and required no qualification.
- For sample 0917MW01GW, the EPA Methods EPA 300.0 had MS and/or MSD recoveries for chloride and fluoride that were above laboratory control limits. The detected results for chloride and fluoride in the parent sample have been qualified as estimated with a high bias, “J+“.
- For EPA method 353.2, samples 00917MW10GW, 00917MW16GW, and 00917MW16GW had low Nitrate Nitrite as N recovery. The detected results for Nitrate Nitrite as N in the parent sample have been qualified as estimated with a low bias, “J-“.

The accuracy of MS/MSD recoveries were within the control limits generated by the laboratory with the following exceptions:

- For sample 0917MW19GW, the EPA Methods EPA 8270D had MS and/or MSD RPDs for, 4,6 Dinitro-2-methylphenol, and Bis(2-ethyhexyl) Phthalate that were above laboratory control limits. 4,6 Dinitro-2-methylphenol was not detected in associated sample and required no qualification. The detected results for Bis(2-ethyhexyl) Phthalate in the parent sample have been qualified as estimated “J“.

A summary of sample data qualified due to MS/MSD precision and accuracy are presented in Tables 5a and 5b.

3.5 LABORATORY CONTROL SAMPLE ANALYSIS

The LCS is analyzed to monitor the efficiency of the digestion/extraction procedure and analytical instrument operation. The ability of the laboratory to successfully analyze an

LCS demonstrates that there are no analytical problems related to the digestion/sample preparation procedures and/or instrument operations. The LCS results outside QC limits are presented in Table 6 (if applicable). Sporadic and marginal QC failures for multiple component methods do not indicate an analytical concern. If recoveries are high and the compounds are not detected in the samples, then no data qualification is required. All recoveries should be above 10% or the non-detect results flagged “UR” as rejected.

REVIEW RESULTS

- All LCS analyses were within control limits and performed at the required frequency for all method with the exception of EPA 8270D. Most out of control analytes had high and not present in the samples and thus required no qualification. The Bis(2-ethylhexyl) phthalate had 166% recoveries of above the control limit of 150%. The results for bis(2-ethylhexyl) phthalate in the associated samples have been qualified as estimated with a high bias, “J+“.

3.6 COMPOUND IDENTIFICATION AND QUANTITATION

Compound identities are assigned by comparing sample compound retention times to retention times from known (standard) compounds and identification of an acceptable mass spectrum. Compounds detected below the PQL in samples should be considered estimated and are qualified "J." The samples with compounds above the linear range were all re-analyzed at a higher dilution factor.

REVIEW RESULTS

All compound identification and quantitation criteria were achieved. As noted in Table 7, no samples were reported as reanalyzed.

4. FIELD DUPLICATE SAMPLE RESULTS

Field duplicate samples were collected and analyzed as an indication of overall precision for both field and laboratory. Field duplicate results are summarized in Table 8 (if applicable). The results are expected to have more variability than laboratory duplicates, which measure only laboratory precision. It is expected also that soil field duplicates will exhibit greater variance than water field duplicates due to the difficulties associated with collecting identical field samples. The QC criteria used to assess field duplicate samples for this project was limits of 70% RPD for soils and 40% RPD for waters, or twice the

general laboratory duplicate criteria. If a given compound in both the regular sample and associated field duplicate sample was below the laboratory PQL, or the compound was not detected in one of the samples, then the compound is generally not qualified due to field duplicate precision. There are no guidelines regarding data qualification based on poor field duplicate precision. Professional judgment was used to determine whether or not to qualify results.

REVIEW RESULTS

Four field duplicates analyses were performed on this SDG. The RPD ratings are listed on Tables 8a through 8d as “Good” if the RPD is less than field duplicate QC criteria of 40% and as “Poor” if the RPD exceeded the field duplicate QC criteria.

All the results show good precision in the sample pair with the exceptions noted on Tables 8a through 8d. Qualifiers were only added to the field duplicate sample pair results as noted.

5. OVERALL ASSESSMENT OF DATA

All data were reviewed and considered usable with qualification as noted in this report. All non-detect results were reported as “U” qualified at the PQL except where noted based upon blank contamination. All reported data at concentration less than the PQL were J qualified as estimated.

Table 1 - Sample Listing

Work Order	Matrix	Sample ID	Lab ID	Sample Date	QA/QC	Analysis
580-71706-1	SW	0917RD05SW	580-71706-24	9/28/2016		6010B, 6020A, 7471A, 9060, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	SW	0917RD06SW	580-71706-25	9/28/2016		6010B, 6020A, 7471A, 9060, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	SW	0917RD08SW	580-71706-26	9/28/2016		6010B, 6020A, 7471A, 9060, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	SW	0917RD09SW	580-71706-27	9/29/2016		6010B, 6020A, 7471A, 9060, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	SW	0917RD10SW	580-71706-28	9/29/2016	FD of 0916RD50SW	6010B, 6020A, 7471A, 9060, 300.0' 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	SW	0917RD14SW	580-71706-29	9/29/2016	MS/MSD	6010B, 6020A, 7471A, 9060, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	SW	0917RD15SW	580-71706-30	9/29/2016		6010B, 6020A, 7471A, 9060, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	SW	0917RD50SW	580-71706-31	9/29/2016	FD of 0916RD10SW	6010B, 6020A, 7471A, 9060, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	GW	0917MW01GW	580-71706-2	9/30/2016	MS/MSD	6010B, 6020A, 7471A, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	GW	0917MW17GW	580-71706-8	9/30/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	GW	0917MW32GW	580-71706-16	9/29/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	GW	0917MW06GW	580-71706-3	10/1/2016	FD of 0917MW90GW	6010B, 6020A, 7471A, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	GW	0917MW08GW	580-71706-4	10/1/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	GW	0917MW09GW	580-71706-5	10/3/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	GW	0917MW10GW	580-71706-6	10/2/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	GW	0917MW16GW	580-71706-7	10/3/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	GW	0917MW19GW	580-71706-9	10/4/2016	MS/MSD	6010B, 6020A, 7471A, 300.0,AK102/103, AK101,8260C,8270D,353.2, SM2320B, SM2540C, SM2540D

Table 1 - Sample Listing

Work Order	Matrix	Sample ID	Lab ID	Sample Date	QA/QC	Analysis
580-71706-1	GW	0917MW22GW	580-71706-10	10/5/2016	FD of 0917MW92GW	6010B, 6020A, 7471A, 300.0,AK102/103, AK101,8260C,8270D,353.2, SM2320B, SM2540C, SM2540D
580-71706-1	GW	0917MW26GW	580-71706-11	10/5/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	GW	0917MW27GW	580-71706-12	10/5/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	GW	0917MW28GW	580-71706-13	10/2/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	GW	0917MW29GW	580-71706-14	10/3/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	GW	0917MW31GW	580-71706-15	10/1/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	GW	0917MW33GW	580-71706-17	10/2/2016		6010B, 6020A, 7471A, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	GW	0917MW40GW	580-71706-18	10/4/2016	FD of 0917MW91GW	6010B, 6020A, 7471A, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	GW	0917MW42GW	580-71706-19	10/5/2016	MS/MSD	6010B, 6020A, 7471A, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	GW	0917MW43GW	580-71706-20	10/2/2016		6010B, 6020A, 7471A, 300.0,353.2, SM2320B, SM2540C, SM2540D
580-71706-1	GW	0917MW90GW	580-71706-21	10/4/2016	FD of 0917MW06GW	6010B, 6020A, 7471A, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	GW	0917MW91GW	580-71706-22	10/4/2016	FD of 0917MW40GW	6010B, 6020A, 7471A, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	GW	0917MW93GW	580-71706-23	10/4/2016	FD of 0917MW22GW	6010B, 6020A, 7471A, 300.0,AK102/103, AK101,8260C,8270D,353.2, SM2320B, SM2540C, SM2540D
580-71706-1	GW	0917EB03GW	580-71706-01	10/6/2016	EB	6010B, 6020A, 7471A, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	GW	0917RS09GW	580-71706-32	10/6/2016	RB	6010B, 6020A, 7471A, 300.0, 353.2, SM2320B, SM2540C, SM2540D
580-71706-1	GW	Trip Blank	580-71706-33	9/22/2016	TB	8260C, AK101

EB= Equipment Blank (uncertified bailer)
RB= Rinsate Blank (non-dedicated pumps)
TB = Trip Blank
FD = Field Duplicate

Table 2 - List of Samples Qualified for Holding Time Exceedance

Method	Analyte	Sample IDs	HT	Sampling Date	Analysis Date	Qual
SM2540 D	TSS	0917MW01GW	7 day	9/16/2017	10/02/2017 & 10/11/2017	J
SM2540 D	TSS	0917MW06GW	7 day	9/19/2017	10/02/2017 & 10/11/2017	J
SM2540 D	TSS	0917MW08GW	7 day	9/18/2017	10/02/2017 & 10/11/2017	J
SM2540 D	TSS	0917MW10GW	7 day	9/19/2017	10/02/2017 & 10/11/2017	J
SM2540 D	TSS	0917MW16GW	7 day	9/18/2017	10/02/2017 & 10/11/2017	J
SM2540 D	TSS	0917MW17GW	7 day	9/18/2017	10/02/2017 & 10/11/2017	J
SM2540 D	TSS	0917MW26GW	7 day	9/24/2017	10/02/2017 & 10/11/2017	J
SM2540 D	TSS	0917MW27GW	7 day	9/19/2017	10/02/2017 & 10/11/2017	J
SM2540 D	TSS	0917MW28GW	7 day	9/24/2017	10/02/2017 & 10/11/2017	J
SM2540 D	TSS	0917MW29GW	7 day	9/18/2017	10/02/2017 & 10/11/2017	J
SM2540 D	TSS	0917MW31GW	7 day	9/17/2017	10/02/2017 & 10/11/2017	J
SM2540 D	TSS	0917MW32GW	7 day	9/17/2017	10/02/2017 & 10/11/2017	J
SM2540 D	TSS	0917MW33GW	7 day	9/19/2017	10/02/2017 & 10/11/2017	J
SM2540 D	TSS	0917MW40GW	7 day	9/19/2017	10/02/2017 & 10/11/2017	J
SM2540 D	TSS	0917MW43GW	7 day	9/18/2017	10/02/2017 & 10/11/2017	J
SM2540 D	TSS	0917MW90GW	7 day	9/19/2017	10/02/2017 & 10/11/2017	J
SM2540 D	TSS	0917MW91GW	7 day	9/19/2017	10/02/2017 & 10/11/2017	J
SM2540 C & D	TSS and TDS	0917RD05SW	7 day	9/15/2017	10/02/2017 & 10/11/2017	J
SM2540 C & D	TSS and TDS	0917RD06SW	7 day	9/15/2017	10/02/2017 & 10/11/2017	J
SM2540 C & D	TSS and TDS	0917RD08SW	7 day	9/15/2017	10/02/2017 & 10/11/2017	J
SM2540 C & D	TSS and TDS	0917RD09SW	7 day	9/15/2017	10/02/2017 & 10/11/2017	J
SM2540 C & D	TSS and TDS	0917RD10SW	7 day	9/15/2017	10/02/2017 & 10/11/2017	J
SM2540 C & D	TSS and TDS	0917RD14SW	7 day	9/15/2017	10/02/2017 & 10/11/2017	J
SM2540 C & D	TSS and TDS	0917RD15SW	7 day	9/15/2017	10/02/2017 & 10/11/2017	J
SM2540 C & D	TSS and TDS	0917RD50SW	7 day	9/15/2017	10/02/2017 & 10/11/2017	J
SM2540 C	TDS	0917RS09GW	7 day	9/25/2017	10/11/2017	J
SM 2320B	Alkalinity as CO3/HCO3	0917MW01GW	14 day	9/16/2017	10/04/2017	J
SM 2320B	Alkalinity as CO3/HCO3	0917MW08GW	14 day	9/18/2017	10/03/2017	J
SM 2320B	Alkalinity as CO3/HCO3	0917MW10GW	14 day	9/19/2017	10/03/2017	J
SM 2320B	Alkalinity as CO3/HCO3	0917MW16GW	14 day	9/18/2017	10/03/2017	J
SM 2320B	Alkalinity as CO3/HCO3	0917MW17GW	14 day	9/18/2017	10/03/2017	J
SM 2320B	Alkalinity as CO3/HCO3	0917MW31GW	14 day	9/17/2017	10/02/2017	J

Table 2 - List of Samples Qualified for Holding Time Exceedance

Method	Analyte	Sample IDs	HT	Sampling Date	Analysis Date	Qual
SM 2320B	Alkalinity as CO3/HCO3	0917MW32GW	14 day	9/17/2017	10/02/2017	J
SM 2320B	Alkalinity as CO3/HCO3	0917RD05SW	14 day	9/15/2017	10/02/2017	J
SM 2320B	Alkalinity as CO3/HCO3	0917RD06SW	14 day	9/15/2017	10/02/2017	J
SM 2320B	Alkalinity as CO3/HCO3	0917RD08SW	14 day	9/15/2017	10/02/2017	J
SM 2320B	Alkalinity as CO3/HCO3	0917RD09SW	14 day	9/15/2017	10/02/2017	J
SM 2320B	Alkalinity as CO3/HCO3	0917RD10SW	14 day	9/15/2017	10/02/2017	J
SM 2320B	Alkalinity as CO3/HCO3	0917RD14SW	14 day	9/15/2017	10/02/2017	J
SM 2320B	Alkalinity as CO3/HCO3	0917RD15SW	14 day	9/15/2017	10/02/2017	J
SM 2320B	Alkalinity as CO3/HCO3	0917RD50SW	14 day	9/15/2017	10/02/2017	J

Table 3a - List of Positive Results for Blank Samples

Method	Sample ID	Sample Type	Analyte	Result	Analysis Type	Units	PQL
AK10/103	MB 580-258381/1-A	AQ	DRO	0.0545J	MB	mg/L	0.10
EPA 8270D	MB 580-257833/1-A	AQ	Phenol	0.154 J	MB	ug/L	4.0
EPA 9060	MB 580-258885/3	AQ	TOC	0.227 J	MB	mg/L	1.0
EPA 300.0	MB 580-257887/1-A	AQ	Chloride	0.421J	MB	mg/L	0.9
EPA 300.0	MB 580-257833/1-A	AQ	Sulfate	0.282J	MB	mg/L	1.2
EPA 300.0	MB 580-257948/40	AQ	Sulfate	0.385J	MB	mg/L	1.2
EPA 300.0	0917EB03GW	AQ	Fluoride	0.54J	MB	mg/L	0.2
EPA 6020A	0917EB03GW	AQ	Barium	0.00098J	EB	mg/L	0.006
EPA 6020A	0917EB03GW	AQ	Antimony	0.00081J	EB	mg/L	0.002
EPA 6020A	0917EB03GW	AQ	Chromium	0.011J	EB	mg/L	0.002
EPA 6020A	0917EB03GW	AQ	Nickel	0.00067J	EB	mg/L	0.015
EPA 6020A	0917EB03GW	AQ	Thallium	0.00034J	EB	mg/L	0.005
EPA 300.0	0917RS09GW	AQ	Chloride	0.42J	EB	mg/L	0.9
EPA 300.0	0917RS09GW	AQ	Sulfate	0.38J	EB	mg/L	1.2
EPA 6020A	0917RS09GW	AQ	Barium	0.00047J	EB	mg/L	0.006
EPA 6020A	0917RS09GW	AQ	Antimony	0.0018J	EB	mg/L	0.002
EPA 6010B	0917RS09GW	AQ	Calcium	0.21J	EB	mg/L	1.1
EPA 8260C	Trip Blank	AQ	Toluene	0.038J	TB	ug/L	0.2

Table 3b - List of Samples Qualified for Method Blank Contamination

Method	Sample ID	Analyte	Blank Result	Sample Result	Sample Qual	Units	PQL
EPA 8270D	0917MW19GW	Phenol	0.154	0.16	U	mg/L	3.8
EPA 8270D	0917MW22GW	Phenol	0.154	0.19	U	mg/L	3.8
EPA 8270D	0917MW93GW	Phenol	0.154	0.16	U	mg/L	3.8
AK102/103	0917MW19GW	DRO	0.0545J	0.071	U	mg/L	0.10
AK102/103	0917MW22GW	DRO	0.0545J	0.045	U	mg/L	0.10
AK102/103	0917MW93GW	DRO	0.0545J	0.050	U	mg/L	0.10
EPA 300.0	0917RS09GW	Chloride	0.421J	0.42	U	mg/L	0.9
EPA 300.0	0917RS09GW	Sulfate	0.282J	0.38	U	mg/L	1.2
EPA 300.0	0917MW31GW	Sulfate	0.385J	1.3	U	mg/L	1.2

Table 3c - List of Samples Qualified for Equipment or Rinsate Blank Contamination

Method	Sample ID	Analyte	Blank Result	Sample Result	Sample Qual	Units	PQL
EPA 300.0	0917MW09GW	Fluoride	0.54J	0.073	U	mg/L	0.2
EPA 6020A	0917MW09GW	Nickel	0.00067J	0.0028	U	mg/L	0.015
EPA 6020A	0917MW31GW	Sulfate	0.38J	1.3	U	mg/L	1.2
EPA 6020A	0917MW27GW	Antimony	0.0018J	0.0076	U	mg/L	0.002
EPA 6020A	0917MW28GW	Antimony	0.0018J	0.0071	U	mg/L	0.002
EPA 6020A	0917MW29GW	Antimony	0.0018J	0.0062	U	mg/L	0.002
EPA 6020A	0917MW32GW	Antimony	0.0018J	0.0027	U	mg/L	0.002
EPA 8260C	0917MW19GW	Toluene	0.038J	0.051	U	ug/L	0.2
EPA 8260C	0917MW22GW	Toluene	0.038J	0.069	U	ug/L	0.2
EPA 8260C	0917MW93GW	Toluene	0.038J	0.064	U	ug/L	0.2

Table 4 - List of Samples with Surrogates outside Control Limits

Method	Sample ID	Sample Type	Analyte	Rec.	Low Limit	High Limit	Dil Fac	Sample Qual.
None.								

Table 5a - List of MS/MSD Recoveries outside Control Limits

Method	Sample ID	Sample Type	Analyte	Orig. Result	Spike Amount	Rec.	Dil Fac.	Low Limit	High Limit	Sample Qual
EPA 300.0	0917MW01GW	AQ	Fluoride	0.52	50	111	1.0	90	110	J+
EPA 300.0	0917MW01GW	AQ	Chloride	0.13	5.0	115	1.0	90	110	J+
AK102/103	0917MW19GW	AQ	DRO	0.071	2.01	63	1.0	75	125	None- ND
EPA 353.2	0917MW10GW	AQ	Nitrate-Nitrite as N	0.15U	0.5	77	1.0	90	110	None- ND
EPA 353.2	0917MW16GW	AQ	Nitrate-Nitrite as N	0.12J	0.5	33	1.0	90	110	J-
EPA 353.2	0917MW42GW	AQ	Nitrate-Nitrite as N	0.15U	0.5	83	1.0	90	110	None- ND

Table 5b - List of Lab and MS Duplicate RPDs outside Control Limits

Sample ID	Analyte	Method	RPD	RPD Limit	No. of Affected Samples	Samp Qual
0917MW19GW	Bis(2-ethyhexyl) Phthalate	EPA 8270D	36	35	1	J

Table 6 - List of LCS Recoveries outside Control Limits

Method	Sample ID	Analyte	%Rec.	Low Limit	High Limit	No. of Affected Samples	Samp Qual
EPA 8270D	LCS 580-229524/3-A	Bis(2-ethylhexyl) phthalate	166	22	150	2	J+

*= no qualification required

Table 7- Samples that were Re-analyzed

Sample ID	Lab ID	Method	Sample Type	Action
None.				

Table 8a – Summary of Field Duplicate Results

Method	Analyte	Units	0917MW06GW	0917MW90GW	RPD	Rating	Sample Qualifier
EPA 300.0	Chloride	mg/L	0.54 J	0.91	51%	Poor	J
EPA 300.0	Fluoride	mg/L	0.094 J	.20 U	Not Applicable	Good	None
EPA 300.0	Sulfate	mg/L	27	26	3.7%	Good	None
SM2320B	Alkalinity	mg/L	170	170	0.0%	Good	None
SM2320B	Bicarbonate Alkalinity	mg/L	170	170	0.0%	Good	None
SM2320C	TDS	mg/L	11J	8.4J	26.8%	Good	None
EPA 6010B	Calcium	mg/L	31	32	3.2%	Good	None
EPA 6010B	Iron	mg/L	2.7	2.7	0.0%	Good	None
EPA 6010B	Magnesium	mg/L	28	28	0.0%	Good	None
EPA 6010B	Potassium	mg/L	0.80	0.79	1.3%	Good	None
EPA 6010B	Sodium	mg/L	4.4	4.5	2.2%	Good	None
EPA 6020A	Antimony	mg/L	0.0076U	0.0079U	0.0%	Good	None
EPA 6020A	Arsenic	mg/L	0.042	0.043	2.4%	Good	None
EPA 6020A	Barium	mg/L	0.093	0.091	1.1%	Good	None
EPA 6020A	Cobalt	mg/L	0.0017J	0.0017J	0.0%	Good	None
EPA 6020A	Manganese	mg/L	0.63	0.64	1.6%	Good	None
EPA 6020A	Nickel	mg/L	0.0027	0.0027	0.0%	Good	None

Table 8b - Summary of Field Duplicate Results

Method	Analyte	Units	0917MW40GW	0917MW91GW	RPD	Rating	Sample Qualifier
EPA 300.0	Chloride	mg/L	0.85	0.86	1.2%	Good	None
EPA 300.0	Fluoride	mg/L	0.041J	0.17J	> 100%	Poor	No Additional
EPA 300.0	Sulfate	mg/L	23	24	4%	Good	None
SM2320B	Alkalinity	mg/L	290	310	7%	Good	None
SM2320B	Bicarbonate Alkalinity	mg/L	290	310	7%	Good	None
SM2540D	TSS	mg/L	5.8 J	5.6 J	35%	Good	None
EPA 6010B	Calcium	mg/L	49	49	0%	Good	None
EPA 6010B	Iron	mg/L	0.056	0.060	7%	Good	None
EPA 6010B	Magnesium	mg/L	48	49	2%	Good	None
EPA 6010B	Potassium	mg/L	0.89J	0.89J	0.%	Good	None
EPA 6010B	Sodium	mg/L	2.2	2.2	0%	Good	None
EPA 6020A	Antimony	mg/L	0.010	0.0094	6%	Good	None
EPA 6020A	Arsenic	mg/L	0.22	0.23	10%	Good	None
EPA 6020A	Barium	mg/L	0.13	0.14	7%	Good	None
EPA 6020A	Beryllium	mg/L	0.002U	0.00028J	Not Applicable	Good	None
EPA 6020A	Cobalt	mg/L	0.030	0.030	0%	Good	None
EPA 6020A	Manganese	mg/L	0.32	0.33	3%	Good	None
EPA 6020A	Nickel	mg/L	0.12	0.12	0%	Good	None

Table 8c + Summary of Field Duplicate Results

Method	Analyte	Units	0917MW22GW	0917MW93GW	RPD	Rating	Sample Qualifier
EPA 8260C	Toluene	ugL	0.064 J	0.051 J	22%	Good	No Additional
EPA 8270D	Benzoic acid	ugL	1.1	2.8 U	NA	Good	None
EPA 8270D	Benzyl alcohol	ugL	0.19	0.15	24%	Good	None
EPA 8270D	Bis(2-ethyhexyl) Phthalate	ugL	6.4 J	14 U	Not Applicable	Good	None
EPA 8270D	Phenol	ugL	0.19U	0.16 U	Not Applicable	Good	None
AK102/103	DRO	mg/L	0.045U	0.050U	Not Applicable	Good	None
EPA 300.0	Chloride	mg/L	0.39J	0.78J	65%	Poor	No Additional
EPA 300.0	Fluoride	mg/L	0.12J	0.03 J	> 100%	Poor	Not Applicable
EPA 300.0	Sulfate	mg/L	5.5	5.5	0.0%	Good	None
EPA 353.2	Nitrate-Nitrite as N	mg/L	0.061	0.062	1.6%	Good	None
SM2320B	Alkalinity	mg/L	68	69	1.5%	Good	None
ESM2320B	Bicarbonate Alkalinity	mg/L	68	69	1.5%	Good	None
EPA 6010B	Calcium	mg/L	12	12	0.0%	Good	None
EPA 6010B	Magnesium	mg/L	9.7	9.1	6.4%	Good	None
EPA 6010B	Sodium	mg/L	2.3	2.2	4.4%	Good	None
EPA 6010B	Antimony	mg/L	0.51	0.48	6.1%	Good	None
EPA 6010B	Arsenic	mg/L	0.13	0.12	8.0%	Good	None
EPA 6020A	Barium	mg/L	0.041	0.038	7.6%	Good	None
EPA 6020A	Beryllium	mg/L	0.0025J	0.0010U	Not Applicable	Good	None
EPA 6020A	Manganese	mg/L	0.0010U	0.0025J	Not Applicable	Good	None
EPA 6020A	Nickel	mg/L	0.0014J	0.0014J	0.0%	Good	None

Table 8d – Summary of Field Duplicate Results

Method	Analyte	Units	0917RD10SW	0917RD50SW	RPD	Rating	Sample Qualifier
EPA 9060	Total Organic Carbon	mg/L	3.5	3.5	0.0%	Good	None
SM 2540C	Total Dissolved Solids	mg/L	85	85	0.0%	Good	None
SM 2540D	Total Suspended Solids	mg/L	2.0	2.2	9.5%	Good	None
EPA 300.0	Chloride	mg/L	0.81	0.81	0.0%	Good	None
EPA 300.0	Sulfate	mg/L	7.0	7.0	0.0%	Good	None
EPA 353.2	Nitrate-Nitrite as N	mg/L	0.21	0.22	4.7%	Good	None
SM2320B	Alkalinity	mg/L	62	43	36%	Good	None
SM2320B	Bicarbonate Alkalinity	mg/L	62	43	36%	Good	None
EPA 6010B	Calcium	mg/L	15	14	6.9%	Good	None
EPA 6010B	Iron	mg/L	0.5U	0.17J	Not Applicable	Good	None
EPA 6010B	Magnesium	mg/L	7.8	7.3	6.6%	Good	None
EPA 6010B	Sodium	mg/L	1.6	1.4	4.4%	Good	None
EPA 6010B	Antimony	mg/L	0.0024	0.0017J	34%	Good	None
EPA 6020A	Barium	mg/L	0.022	0.020	9.5%	Good	None
EPA 6020A	Manganese	mg/L	0.012	0.011	33%	Good	None
EPA 6010B	Dissolved Calcium	mg/L	14	14	0.0%	Good	None
EPA 6010B	Dissolved Magnesium	mg/L	7.4	7.5	8.7%	Good	None
EPA 6010B	Dissolved Sodium	mg/L	1.5	1.5	0.0%	Good	None
EPA 6010B	Dissolved Antimony	mg/L	0.0024	0.0021	13%	Good	None
EPA 6020A	Dissolved Barium	mg/L	0.018	0.020	10.5%	Good	None
EPA 6020A	Dissolved Manganese	mg/L	0.0045 J	0.030 J	> 100%	Poor	Not Applicable

DATA REVIEW MEMORANDUM

DATE: December 7, 2017

TO: Mark Longtine, Project Manager, E & E, Seattle, WA

FROM: Howard Edwards, E & E, San Francisco, CA

SUBJ: Data Review: Red Devil Mine 2017 SMA GW

REFERENCE:

Project ID	Lab Work Order	Lab
1001095.0015.01	580-71717-1	Test America – Seattle

1. SAMPLE IDENTIFICATION

For the sampling activities at the Red Devil Mine site, Ecology and Environment, Inc. (E & E) collected the samples listed in Table 1. Project-specific matrix spike/matrix spike duplicates (MS/MSD) were designated in the field, except where noted. All samples were sent to Test America's lab in Seattle, Washington, for all listed analyses. This report addresses only Test America-generated data.

The analytical report was issued by Test America on October 17, 2017. The data in the analytical report were reviewed for field and laboratory precision, accuracy, and completeness in accordance with procedures and quality control (QC) limits, the current laboratory Quality Assurance Manual (QAM) and current standard operating procedures (SOPs). Laboratory data qualifiers for identified analytes and analyte quantitation were accepted. Any additional data review qualifiers added are noted below and listed on the tables at the end of this memorandum. Definitions of all data qualifiers are given in the report.

Work Orders, Tests, and Number of Samples Included in this Data Review Memo

Work Orders/ Job Number	Matrix	Test Method	Method Name	Number of Samples
580-71717-1	Ground Water	EPA 6010B/6020A	Total TAL Metals by ICP	17
580-71717-1	Ground Water	EPA 7470A	Mercury (CVAA)	17
580-71717-1	Ground Water	EPA 353.2	Nitrate-Nitrite as N	17
580-71717-1	Ground Water	EPA 300	Inorganic Ions (Cl, F, SO4)	17
580-71717-1	Ground Water	SM2320B	Alkalinity as CO3/HCO3	17
580-71717-1	Ground Water	SM2540D	TSS	1
580-71717-1	Rinsate Blank	SM2320B	Alkalinity as CO3/HCO3	1
580-71717-1	Equipment Blank	EPA 7470A	Mercury (CVAA)	1
580-71717-1	Equipment Blank	EPA 6010B/6020A	Total TAL Metals by ICP	1
580-71717-1	Equipment Blank	EPA 7470A	Mercury (CVAA)	1

2. SAMPLE PROCEDURES

All samples were collected as specified in the work plan and documented on the chain-of-custody (COC) and in field notebooks. Samples were analyzed as specified on the COC. Samples were packaged, shipped, and received as specified in the work plan. All samples must be received cold (4 ±2 degrees Celsius [^{o}C]) and in good condition as documented on the Cooler Receipt Form.

REVIEW RESULTS

All sample procedures were followed and the sample coolers were received at temperatures between 0.1 and 0.9 ^{o}C. No problems with the condition of the samples upon receipt were documented.

3. LABORATORY DATA

3.1 HOLDING TIMES

Holding times are established and monitored to ensure analytical results accurately represent analyte concentrations in a sample at the time of collection. These results are presented in Table 2 (if applicable). Exceeding the holding time for a sample generally results in a loss of the analyte due to a variety of mechanisms, such as deposition on the sample container walls or precipitation.

REVIEW RESULTS

A sample requiring the determination of total suspended solids (TSS) was received by the laboratory with two days of holding times but the sample was analyzed four days

after the holding time had expired. The method and project specified holding time is seven days. All associated TSS data was J qualified as estimated. All other samples were analyzed within the project and method specified holding times for all analytes (see Table 2).

3.2 BLANKS

Laboratory and field blank samples are analyzed and evaluated to determine the existence and magnitude of possible contamination during the sampling and analysis process. These results are presented in Table 3 (if applicable). If the analyte is present in the sample at similar trace levels (less than 5 times the blank concentration), then the analyte is likely a common background contaminant from some phase of the sampling, extraction, or analytical procedure and associated low-level sample concentrations are not considered to be site related. Sample results in these cases are qualified as not detected, U.

REVIEW RESULTS

All laboratory method blanks were performed at the required frequency. As noted in Table 3a, analyte concentrations in the method blanks were detected for chloride and sulfate. All method blank analytes were found at concentrations below the practical quantitation limit (PQL). All associated reported concentration of chloride and sulfate that were less than 5 times the concentration found in the preparation blank/ method blank (MB) were U qualified as not detected.

Phenol and DRO, which was found in the MB, was detected in three associated sample at a similar concentrations was U qualified as not detected. Sulfate was detected in one associated samples that had less than 5 times the concentration found in the preparation blank/ method blank (MB) and the results were U qualified. Chloride was detected in 16 associated samples at less than 5 times the concentration found in the preparation blank/ method blank (MB) and the results were U qualified. A summary of qualified data due to method blank contamination is presented in Table 3b.

One rinsate blank was collected, with several EPA Method 6020 and 300.0 analytes detected in at concentrations less than the PQL. All associated sample results that were detected at levels less than 5 times the blank were U qualified as not detected. Associated samples with detection greater than 5 times the blank were not qualified. A summary of qualified data due to equipment rinsate blank contamination is presented in Table 3c.

3.3 SURROGATE SPIKE RECOVERY

Laboratory performance for individual samples analyzed for organic compounds is established by means of surrogate spiking activities. Samples are spiked with surrogate compounds prior to preparation and analysis. Unusually low or high surrogate recovery values may indicate some deficiency in the analytical system or that some matrix effects exist, resulting in low or high sample results for target compounds. Sample surrogate recoveries outside QC limits (if applicable) are presented in Table 4.

REVIEW RESULTS

No methods that required surrogates were performed.

3.4 MATRIX SPIKE AND MATRIX SPIKE DUPLICATE ANALYSIS

The MS/MSD analyses are intended to provide information about the effects that the sample matrix exerts on the digestion / extraction and measurement methodology. MS recovery values that do not meet laboratory QC criteria may indicate that sample analyte results are being attenuated in the analysis procedure. The potential sample bias may be estimated by noting the degree to which the MS concentration was elevated or lowered in the spike analysis. However, this estimated bias should serve only as an approximation; sample-specific problems may be the cause of the discrepancy, particularly in soil samples.

Recoveries of a post-digestion spike or a laboratory control sample (LCS) are used to verify that the analytical methodology is acceptable and that MS recoveries are due to matrix effects. An MSD analysis is performed to evaluate the precision of the sample results. Precision is measured as the relative percent difference (RPD) between analytical results for duplicate samples. The laboratory's failure to produce similar results

for MSD samples may indicate that the samples were non-homogeneous (particularly in soil samples), or that method defects may exist in the laboratory's techniques.

Recovery calculations are not required if the spiking concentration added is less than 25% of the sample background concentration.

MS/MSD recoveries outside QC limits (if applicable) are presented in Table 5a. MS/MSD and sample/MD, and serial dilution recovery precision outside of control limits are presented in Table 5b. Serial dilution recovery precision outside of control limits are presented in Table 5c.

REVIEW RESULTS

The MS/MSD sample analyses were performed on two samples 0917MW48GW and 0917MW051GW at the required frequency. Matrix duplicates (MD) were also performed on these samples. MS/MSD recoveries were within the control limits generated by the laboratory with the following exceptions:

- For sample 0917MW51GW, the MS recovery (89%) for Nitrate Nitrite as N by EPA 353.2 was slightly below laboratory control limits of 90% to 110%. The results for Nitrate Nitrite as N in associated samples was not qualified since the spike duplicate was within the control limits.

The accuracy of sample/MD and MS/MSD recoveries were within the control limits generated by the laboratory with the following exceptions:

- For sample 0917MW48GW, the EPA Methods EPA 8020A had MD RPDs for chromium, cobalt, nickel, and zinc that were above laboratory control limits. The chromium, cobalt, nickel, and zinc in sample 0917MW48GW was qualified as estimated "J." Only 0917MW48GW was qualified since the MS/MSD and LCS recoveries were within acceptable laboratory control limits.

The accuracy of ICP serial dilution recoveries were within the control limits generated by the laboratory with the following exceptions:

- For sample 0917MW48GW, the EPA Methods EPA 8010C had serial dilution recovery for calcium and magnesium were significantly above the laboratory control limits of 10 % difference. The calcium and magnesium in all associated samples was qualified as estimated "J."

3.5 LABORATORY CONTROL SAMPLE ANALYSIS

The LCS is analyzed to monitor the efficiency of the digestion/extraction procedure and analytical instrument operation. The ability of the laboratory to successfully analyze an LCS demonstrates that there are no analytical problems related to the digestion/sample preparation procedures and/or instrument operations. The LCS results outside QC limits are presented in Table 6 (if applicable). Sporadic and marginal QC failures for multiple component methods do not indicate an analytical concern. If recoveries are high and the compounds are not detected in the samples, then no data qualification is required. All recoveries should be above 10% or the non-detect results flagged “UR” as rejected.

REVIEW RESULTS

- All LCS analyses were within control limits and performed at the required frequency for all method.

3.6 COMPOUND IDENTIFICATION AND QUANTITATION

Compound identities are assigned by comparing sample compound retention times to retention times from known (standard) compounds and identification of an acceptable mass spectrum. Compounds detected below the PQL in samples should be considered estimated and are qualified "J." The samples with compounds above the linear range were all re-analyzed at a higher dilution factor.

REVIEW RESULTS

All compound identification and quantitation criteria were achieved

As noted in Table 7, no samples were reported as reanalyzed.

4. FIELD DUPLICATE SAMPLE RESULTS

Field duplicate samples were collected and analyzed as an indication of overall precision for both field and laboratory. Field duplicate results are summarized in Table 8 (if applicable). The results are expected to have more variability than laboratory duplicates, which measure only laboratory precision. It is expected also that soil field duplicates will exhibit greater variance than water field duplicates due to the difficulties associated with collecting identical field samples. The QC criteria used to assess field duplicate samples for this project was limits of 70% RPD for soils and 40% RPD for waters, or twice the general laboratory duplicate criteria. If a given compound in both the regular sample and associated field duplicate sample was below the laboratory PQL, or the compound was not detected in one of the samples, then the compound is generally not qualified due to field duplicate precision. There are no guidelines regarding data qualification based on poor field duplicate precision. Professional judgment was used to determine whether or not to qualify results.

REVIEW RESULTS

Four field duplicates analyses were performed on this SDG. The RPD ratings are listed on Tables 8a through 8b as “Good” if the RPD is less than field duplicate QC criteria of 40% and as “Poor” if the RPD exceeded the field duplicate QC criteria.

All the results show good precision in the sample pair with the exceptions noted on Tables 8a through 8b. Qualifiers were only added to the field duplicate sample pair results as noted.

5. OVERALL ASSESSMENT OF DATA

All data were reviewed and considered usable with qualification as noted in this report. All non-detect results were reported as “U” qualified at the PQL except where noted based upon blank contamination. All reported data at concentration less than the PQL were J qualified as estimated.

Table 1 - Sample Listing

Work Order	Matrix	Sample ID	Lab ID	Sample Date	QA/QC	Analysis
580-71717-1	GW	0917MW44GW	580-71717-1	9/30/2016		6010B, 6020A, 7471A, SM 2320B, 353.2
580-71717-1	GW	0917MW45GW	580-71717-2	9/30/2016		6010B, 6020A, 7471A, SM 2320B, 353.2
580-71717-1	GW	0917MW46GW	580-71717-3	9/29/2016		6010B, 6020A, 7471A, SM 2320B, 353.2
580-71717-1	GW	0917MW47GW	580-71717-4	10/1/2016		6010B, 6020A, 7471A, SM 2320B, 353.2
580-71717-1	GW	0917MW48GW	580-71717-5	10/1/2016	MS/MSD	6010B, 6020A, 7471A, SM 2320B, 353.2
580-71717-1	GW	0917MW49GW	580-71717-6	10/3/2016		6010B, 6020A, 7471A, SM 2320B, 353.2
580-71717-1	GW	0917MW50GW	580-71717-7	10/2/2016		6010B, 6020A, 7471A, SM 2320B, 353.2
580-71717-1	GW	0917MW51GW	580-71717-8	10/3/2016	MS/MSD	6010B, 6020A, 7471A, SM 2320B, 353.2
580-71717-1	GW	0917MW52GW	580-71717-9	10/4/2016		6010B, 6020A, 7471A, SM 2320B, 353.2
580-71717-1	GW	0917MW53GW	580-71717-10	10/5/2016		6010B, 6020A, 7471A, SM 2320B, 353.2
580-71717-1	GW	0917MW54GW	580-71717-11	10/5/2016		6010B, 6020A, 7471A, SM 2320B, 353.2
580-71717-1	GW	0917MW55GW	580-71717-12	10/5/2016		6010B, 6020A, 7471A, SM 2320B, 353.2
580-71717-1	GW	0917MW56GW	580-71717-13	10/2/2016		6010B, 6020A, 7471A, SM 2320B, 353.2
580-71717-1	GW	0917MW57GW	580-71717-14	10/3/2016		6010B, 6020A, 7471A, SM 2320B, 353.2
580-71717-1	GW	0917MW58GW	580-71717-15	10/1/2016		6010B, 6020A, 7471A, SM 2320B, 353.2
580-71717-1	GW	0917MW59GW	580-71717-16	10/2/2016		6010B, 6020A, 7471A, SM 2320B, 353.2
580-71717-1	GW	0917RS92GW	580-71717-17	10/4/2016	FD of 0917MW52GW	6010B, 6020A, 7471A, SM 2320B, 353.2
580-71717-1	GW	0917RS08GW	580-71717-18	10/5/2016	RB	6010B, 6020A, 7471A, SM 2320B, 353.2, SM2540D

RB= Rinsate Blank (non-dedicated pumps)
FD = Field Duplicate

Table 2 - List of Samples Qualified for Holding Time Exceedance

Method	Analyte	Sample IDs	HT	Sampling Date	Analysis Date	Qual
SM2540 D	TSS	0917RS08GW	7 day	9/24/2017	10/05/2017	J

Table 3a - List of Positive Results for Blank Samples

Method	Sample ID	Sample Type	Analyte	Result	Analysis Type	Units	PQL
EPA 300.0	MB 580-257887/3	AQ	Chloride	0.421J	MB	mg/L	0.9
EPA 300.0	MB 580-257833/3	AQ	Sulfate	0.282J	MB	mg/L	1.2
EPA 300.0	0917RS08GW	AQ	Chloride	0.42J	MB	mg/L	0.9
EPA 300.0	0917RS08GW	AQ	Sulfate	0.44J	MB	mg/L	1.2
EPA 6020A	0917RS08GW	AQ	Barium	0.00018J	EB	mg/L	0.0018
EPA 6020A	0917RS08GW	AQ	Chromium	0.0017J	EB	mg/L	0.0004
EPA 6020A	0917RS08GW	AQ	Copper	0.0030	EB	mg/L	0.002
EPA 6020A	0917RS08GW	AQ	Nickel	0.00018J	EB	mg/L	0.003
EPA 6020A	0917RS08GW	AQ	Vanadium	0.00093J	EB	mg/L	0.006

Table 3b - List of Samples Qualified for Method Blank Contamination

Method	Sample ID	Analyte	Blank Result	Sample Result	Sample Qual	Units	PQL
EPA 300.0	0917MW44GW	Chloride	0.421	1.3	U	mg/L	0.9
EPA 300.0	0917MW45GW	Chloride	0.421	0.95	U	mg/L	0.9
EPA 300.0	0917MW46GW	Chloride	0.421	0.76J	U	mg/L	0.9
EPA 300.0	0917MW47GW	Chloride	0.421	0.99	U	mg/L	0.9
EPA 300.0	0917MW49GW	Chloride	0.421	0.72J	U	mg/L	0.9
EPA 300.0	0917MW50GW	Chloride	0.421	0.69J	U	mg/L	0.9
EPA 300.0	0917MW51GW	Chloride	0.421	0.79J	U	mg/L	0.9
EPA 300.0	0917MW52GW	Chloride	0.421	0.65J	U	mg/L	0.9
EPA 300.0	0917MW53GW	Chloride	0.421	1.1	U	mg/L	0.9
EPA 300.0	0917MW54GW	Chloride	0.421	0.92	U	mg/L	0.9
EPA 300.0	0917MW55GW	Chloride	0.421	1.6	U	mg/L	0.9
EPA 300.0	0917MW56GW	Chloride	0.421	0.96	U	mg/L	0.9
EPA 300.0	0917MW57GW	Chloride	0.421	1.1	U	mg/L	0.9
EPA 300.0	0917MW58GW	Chloride	0.421	0.75J	U	mg/L	0.9

Table 3b - List of Samples Qualified for Method Blank Contamination

Method	Sample ID	Analyte	Blank Result	Sample Result	Sample Qual	Units	PQL
EPA 300.0	0917MW59GW	Chloride	0.421	0.1.4	U	mg/L	0.9
EPA 300.0	0917RS92GW	Chloride	0.421	0.64J	U	mg/L	0.9
EPA 300.0	0917RS08GW	Chloride	0.421J	0.42J	U	mg/L	0.9
EPA 300.0	0917RS08GW	Sulfate	0.282J	0.44J	U	mg/L	1.2

Table 3c - List of Samples Qualified for Equipment or Rinsate Blank Contamination

Method	Sample ID	Analyte	Blank Result	Sample Result	Sample Qual	Units	PQL
EPA 6020A	0917MW44GW	Chromium	0.00017J	0.00037 J	U	mg/L	0.0004
EPA 6020A	0917MW45GW	Chromium	0.00017J	0.00066	U	mg/L	0.0004
EPA 6020A	0917MW51GW	Chromium	0.00017J	0.00053	U	mg/L	0.0004
EPA 6020A	0917MW52GW	Chromium	0.00017J	0.00049	U	mg/L	0.0004
EPA 6020A	0917MW53GW	Chromium	0.00017J	0.00079	U	mg/L	0.0004
EPA 6020A	0917MW56GW	Chromium	0.00017J	0.00027 J	U	mg/L	0.0004
EPA 6020A	0917MW58GW	Chromium	0.00017J	0.00023 J	U	mg/L	0.0004
EPA 6020A	0917RS92GW	Chromium	0.00017J	0.00064	U	mg/L	0.0004
EPA 6020A	0917MW44GW	Copper	0.003	0.0042	U	mg/L	0.002
EPA 6020A	0917MW45GW	Copper	0.003	0.0041	U	mg/L	0.002
EPA 6020A	0917MW46GW	Copper	0.003	0.0049	U	mg/L	0.002
EPA 6020A	0917MW47GW	Copper	0.003	0.0049	U	mg/L	0.002
EPA 6020A	0917MW48GW	Copper	0.003	0.0050	U	mg/L	0.002
EPA 6020A	0917MW49GW	Copper	0.003	0.0042	U	mg/L	0.002
EPA 6020A	0917MW50GW	Copper	0.003	0.0063	U	mg/L	0.002
EPA 6020A	0917MW51GW	Copper	0.003	0.0043	U	mg/L	0.002
EPA 6020A	0917MW52GW	Copper	0.003	0.0032	U	mg/L	0.002
EPA 6020A	0917MW53GW	Copper	0.003	0.0034	U	mg/L	0.002
EPA 6020A	0917MW54GW	Copper	0.003	0.0043	U	mg/L	0.002
EPA 6020A	0917MW56GW	Copper	0.003	0.0043	U	mg/L	0.002
EPA 6020A	0917MW57GW	Copper	0.003	0.0039	U	mg/L	0.002

Table 3c - List of Samples Qualified for Equipment or Rinsate Blank Contamination

Method	Sample ID	Analyte	Blank Result	Sample Result	Sample Qual	Units	PQL
EPA 6020A	0917MW58GW	Copper	0.003	0.0035	U	mg/L	0.002
EPA 6020A	0917MW59GW	Copper	0.003	0.0059	U	mg/L	0.002
EPA 6020A	0917RS92GW	Copper	0.003	0.0040	U	mg/L	0.002
EPA 6020A	0917MW44GW	Vanadium	0.00093J	0.0011	U	mg/L	0.004
EPA 6020A	0917MW45GW	Vanadium	0.00093J	0.0010	U	mg/L	0.004
EPA 6020A	0917MW46GW	Vanadium	0.00093J	0.0024	U	mg/L	0.004
EPA 6020A	0917MW47GW	Vanadium	0.00093J	0.0035	U	mg/L	0.004
EPA 6020A	0917MW48GW	Vanadium	0.00093J	0.0033	U	mg/L	0.004
EPA 6020A	0917MW49GW	Vanadium	0.00093J	0.0055	U	mg/L	0.004
EPA 6020A	0917MW50GW	Vanadium	0.00093J	0.0038	U	mg/L	0.004
EPA 6020A	0917MW51GW	Vanadium	0.00093J	0.0014	U	mg/L	0.004
EPA 6020A	0917MW52GW	Vanadium	0.00093J	0.0013	U	mg/L	0.004
EPA 6020A	0917MW53GW	Vanadium	0.00093J	0.0019	U	mg/L	0.004
EPA 6020A	0917MW54GW	Vanadium	0.00093J	0.0031	U	mg/L	0.004
EPA 6020A	0917MW56GW	Vanadium	0.00093J	0.00082	U	mg/L	0.004
EPA 6020A	0917MW57GW	Vanadium	0.00093J	0.0027	U	mg/L	0.004
EPA 6020A	0917MW58GW	Vanadium	0.00093J	0.00095	U	mg/L	0.004
EPA 6020A	0917MW59GW	Vanadium	0.00093J	0.0034	U	mg/L	0.004
EPA 6020A	0917RS92GW	Vanadium	0.00093J	0.0012	U	mg/L	0.004

Table 4 - List of Samples with Surrogates outside Control Limits

Method	Sample ID	Sample Type	Analyte	Rec.	Low Limit	High Limit	Dil Fac	Sample Qual.
None.								

Table 5a - List of MS/MSD Recoveries outside Control Limits

Method	Sample ID	Sample Type	Analyte	Orig. Result	Spike Amount	Rec.	Dil Fac.	Low Limit	High Limit	Sample Qual
EPA 353.2	0917MW51GW	AQ	Nitrate-Nitrite as N	0.062 J	0.5	89	1.0	90	110	None

Table 5b - List of MD and MS Duplicate, and Serial Dilution RPDs outside Control Limits

Sample ID	Analyte	Method	RPD	RPD Limit	No. of Affected Samples	Samp Qual
0917MW48GW	Chromium	EPA 8020A	117	20	1	J
0917MW48GW	Cobalt	EPA 8020A	30	20	1	J
0917MW48GW	Nickel	EPA 8020A	42	20	1	J
0917MW48GW	Zinc	EPA 8020A	42	20	1	J

Table 5c - List of Serial Dilution RPDs outside Control Limits

Sample ID	Analyte	Method	RPD	RPD Limit	No. of Affected Samples	Samp Qual
0917MW48GW	Calcium	EPA 8010A	46	10	17	J
0917MW48GW	Magnesium	EPA 8010A	45	10	17	J

Table 6 - List of LCS Recoveries outside Control Limits

Method	Sample ID	Analyte	%Rec.	Low Limit	High Limit	No. of Affected Samples	Samp Qual
	None						

Table 7 –List of Samples that were Re-analyzed

Sample ID	Lab ID	Method	Sample Type	Action
None.				

Table 8a - Summary of Field Duplicate Results

Method	Analyte	Units	0917MW52GW	0917MW92GW	RPD	Rating	Sample Qualifier
EPA 300.0	Chloride	mg/L	0.65 U	0.64 U	Not Applicable	Good	None
EPA 300.0	Sulfate	mg/L	2.2	2.1	4.7%	Good	None
EPA 353.2	Nitrate-Nitrite as N	mg/L	0.78	0.80	2.5%	Good	None
SM2320B	Alkalinity	mg/L	70	68	2.9%	Good	None
SM2320B	Bicarbonate Alkalinity	mg/L	70	68	2.9%	Good	None
EPA 6010B	Aluminum	mg/L	1.5 U	0.11 J	Not Applicable	Good	None
EPA 6010B	Calcium	mg/L	13	13	0.0%	Good	None
EPA 6010B	Magnesium	mg/L	8.1	8.4	3.6%	Good	None
EPA 6010B	Sodium	mg/L	2.6	2.6	0.0%	Good	None
EPA 6020A	Arsenic	mg/L	0.0055	0.0057	3.6%	Good	None
EPA 6020A	Antimony	mg/L	0.00034 J	0.00032 J	6.1%	Good	None
EPA 6020A	Barium	mg/L	0.030	0.031	3.3%	Good	None
EPA 6020A	Chromium	mg/L	0.00049	0.00064	27%	Good	None
EPA 6020A	Cobalt	mg/L	0.00043	0.00048	9.0%	Good	None
EPA 6020A	Copper	mg/L	0.0032	0.0040	22%	Good	None
EPA 6020A	Manganese	mg/L	0.12	0.13	8.0%	Good	None
EPA 6020A	Nickel	mg/L	0.0017J	0.0018J	5.7%	Good	None
EPA 6020A	Vanadium	mg/L	0.0013J	0.0012J	8.0%	Good	None
EPA 6020A	Zinc	mg/L	0.0020J	0.0029J	37%	Good	None

Table 8b Summary of Field Duplicate Results

Method	Analyte	Units	0917MW40GW	0917MW91GW	RPD	Rating	Sample Qualifier
EPA 300.0	Chloride	mg/L	0.85	0.86	1.2%	Good	None
EPA 300.0	Fluoride	mg/L	0.041J	0.17J	> 100%	Poor	No Additional
EPA 300.0	Sulfate	mg/L	23	24	4%	Good	None
SM2320B	Alkalinity	mg/L	290	310	7%	Good	None
SM2320B	Bicarbonate Alkalinity	mg/L	290	310	7%	Good	None
SM2540D	TSS	mg/L	5.8 J	5.6 J	35%	Good	None
EPA 6010B	Calcium	mg/L	49	49	0%	Good	None
EPA 6010B	Iron	mg/L	0.056	0.060	7%	Good	None
EPA 6010B	Magnesium	mg/L	48	49	2%	Good	None
EPA 6010B	Potassium	mg/L	0.89J	0.89J	0.%	Good	None
EPA 6010B	Sodium	mg/L	2.2	2.2	0%	Good	None
EPA 6020A	Antimony	mg/L	0.010	0.0094	6%	Good	None
EPA 6020A	Arsenic	mg/L	0.22	0.23	10%	Good	None
EPA 6020A	Barium	mg/L	0.13	0.14	7%	Good	None
EPA 6020A	Beryllium	mg/L	0.002U	0.00028J	Not Applicable	Good	None
EPA 6020A	Cobalt	mg/L	0.030	0.030	0%	Good	None
EPA 6020A	Manganese	mg/L	0.32	0.33	3%	Good	None
EPA 6020A	Nickel	mg/L	0.12	0.12	0%	Good	None

DATA REVIEW MEMORANDUM

DATE: December 12, 2017

TO: Mark Longtine, Project Manager, E & E, Seattle, WA

FROM: Howard Edwards, E & E, San Francisco, CA

SUBJ: Data Review: Red Devil Mine 2017 SMA Soil

REFERENCE:

Project ID	Lab Work Order	Lab
1001095.0015.01	580-71114-1	Test America – Seattle

1. SAMPLE IDENTIFICATION

For the sampling activities at the Red Devil Mine site, Ecology and Environment, Inc. (E & E) collected the samples listed in Table 1. Project-specific matrix spike/matrix spike duplicates (MS/MSD) were designated in the field, except where noted. All samples were sent to Test America's lab in Seattle, Washington, for all listed analyses. This report addresses only Test America generated data.

The analytical report was issued by Test America on October 17, 2017. The data in the analytical report were reviewed for field and laboratory precision, accuracy, and completeness in accordance with procedures and quality control (QC) limits, the current laboratory Quality Assurance Manual (QAM) and current standard operating procedures (SOPs). Laboratory data qualifiers for identified analytes and analyte quantitation were accepted. Any additional data review qualifiers added are noted below and listed on the tables at the end of this memorandum. Definitions of all data qualifiers are given in the report.

Work Orders, Tests, and Number of Samples Included in this Data Review Memo

Work Orders/ Job Number	Matrix	Test Method	Method Name	Number of Samples
580-71114-1	Soil	EPA 6010B/6020A	Total TAL Metals by ICP/MS	10
580-71114-1	Soil	EPA 7470A	Mercury (CVAA)	10
580-71114-1	Soil	EPA 9060	Total Organic Carbon	10
580-71114-1	Soil	ASTM D2216	Percent Solid and Moisture	10
580-71114-1	Rinsate Blank Water	EPA 6010B/6020A	Total TAL Metals by ICP/MS	1
580-71114-1	Rinsate Blank Water	EPA 7470A	Mercury (CVAA)	1
580-71114-1	Rinsate Blank Water	EPA 9060	Total Organic Carbon	1
580-71114-1	Equipment Blank Water	EPA 6010B/6020A	Total TAL Metals by ICP/MS	1
580-71114-1	Equipment Blank Water	EPA 7470A	Mercury (CVAA)	1
580-71114-1	Equipment Blank Water	EPA 9060	Total Organic Carbon	1

2. SAMPLE PROCEDURES

All samples were collected as specified in the work plan and documented on the chain-of-custody (COC) and in field notebooks. Samples were analyzed as specified on the COC. Samples were packaged, shipped, and received as specified in the work plan. All samples must be received cold (4 ±2 degrees Celsius [^{o}C]) and in good condition as documented on the Cooler Receipt Form.

REVIEW RESULTS

All sample procedures were followed and the sample cooler was received at a temperature of -0.2^{o}C. There were no documented problems with the condition of the samples upon receipt were documented.

3. LABORATORY DATA

3.1 HOLDING TIMES

Holding times are established and monitored to ensure analytical results accurately represent analyte concentrations in a sample at the time of collection. These results are presented in Table 2 (if applicable). Exceeding the holding time for a sample generally results in a loss of the analyte due to a variety of mechanisms, such as deposition on the sample container walls or precipitation.

REVIEW RESULTS

All samples were analyzed within the project and method specified holding times for all analytes (see Table 2).

3.2 BLANKS

Laboratory and field blank samples are analyzed and evaluated to determine the existence and magnitude of possible contamination during the sampling and analysis process. These results are presented in Table 3 (if applicable). If the analyte is present in the sample at similar trace levels (less than 5 times the blank concentration), then the analyte is likely a common background contaminant from some phase of the sampling, extraction, or analytical procedure and associated low-level sample concentrations are not considered to be site related. Sample results in these cases are qualified as not detected, U.

REVIEW RESULTS

All laboratory method blanks were performed at the required frequency. As noted in Table 3a, analytes were not detected in the method blanks for any method.

One rinsate blank and one equipment were collected, with most EPA Method 6010 EPA 6020 analytes detected in at concentrations less than the PQL and several analytes detected at concentration less than twice the PQL. Chromium and manganese were present in both the rinsate and equipment blank at level up to 8 times the PQL. All associated sample results were detected at levels greater than 5 times the blank and thus no data was U qualified. All associated samples with detections greater than 5 times the blank were not qualified. A summary of qualified data due to equipment or rinsate blank contamination is presented in Table 3c.

3.3 SURROGATE SPIKE RECOVERY

Laboratory performance for individual samples analyzed for organic compounds is established by means of surrogate spiking activities. Samples are spiked with surrogate compounds prior to preparation and analysis. Unusually low or high surrogate recovery values may indicate some deficiency in the analytical system or that some matrix effects exist, resulting in low or high sample results for target compounds. Sample surrogate recoveries outside QC limits (if applicable) are presented in Table 4.

REVIEW RESULTS

No methods which required surrogates were performed.

3.4 MATRIX SPIKE AND MATRIX SPIKE DUPLICATE ANALYSIS

The MS/MSD analyses are intended to provide information about the effects that the sample matrix exerts on the digestion / extraction and measurement methodology. MS recovery values that do not meet laboratory QC criteria may indicate that sample analyte results are being attenuated in the analysis procedure. The potential sample bias may be estimated by noting the degree to which the MS concentration was elevated or lowered in the spike analysis. However, this estimated bias should serve only as an approximation; sample-specific problems may be the cause of the discrepancy, particularly in soil samples.

Recoveries of a post-digestion spike or a laboratory control sample (LCS) are used to verify that the analytical methodology is acceptable and that MS recoveries are due to matrix effects. An MSD analysis is performed to evaluate the precision of the sample results. Precision is measured as the relative percent difference (RPD) between analytical results for duplicate samples. The laboratory's failure to produce similar results for MSD samples may indicate that the samples were non-homogeneous (particularly in soil samples), or that method defects may exist in the laboratory's techniques.

Recovery calculations are not required if the spiking concentration added is less than 25% of the sample background concentration.

MS/MSD recoveries outside QC limits (if applicable) are presented in Table 5a. MS/MSD and sample duplicate, recovery precision outside of control limits are presented in Table 5b. Serial dilution recovery precision outside of control limits are presented in Table 5c.

REVIEW RESULTS

The MS/MSD sample analyses were performed on one sample 17SM79SB11 at the required frequency. Matrix spike recoveries were within the control limits generated by the laboratory with the following exceptions:

- The MS recovery for Calcium, Sodium and Potassium by EPA 6010B was above laboratory control limits of 80 % to 120%. The results for Calcium, Sodium and Potassium in associated samples were J+ qualified as high biased estimates. Since the post digestion results were within laboratory control limits, a matrix related interference is suspected.

- The MS recovery for Barium, Chromium, Selenium and Vanadium by EPA 6020A was above laboratory control limits of 80 % to 120%. The results for Barium, Chromium, Selenium and Vanadium in associated samples were J+ qualified as high biased estimates. Since the post digestion results were within laboratory control limits, a matrix related interference is suspected.

The accuracy of sample duplicate and MS/MSD recoveries were within the control limits generated by the laboratory with the following exceptions:

- For EPA Methods EPA 8020A had sample replicate RPDs for selenium that was above laboratory control limits. The selenium in all associated samples were qualified as estimated "J."

The accuracy of ICP serial dilution recoveries were within the control limits generated by the laboratory with the following exceptions:

- EPA Methods EPA 6010B and 6020A had serial dilution recovery for aluminum, calcium, magnesium, arsenic, chromium, copper, lead, vanadium, and zinc that were above the laboratory control limits of 10 % difference. Those analytes in all associated samples was qualified as estimated "J. "

3.5 LABORATORY CONTROL SAMPLE ANALYSIS

The LCS is analyzed to monitor the efficiency of the digestion/extraction procedure and analytical instrument operation. The ability of the laboratory to successfully analyze an LCS demonstrates that there are no analytical problems related to the digestion/sample preparation procedures and/or instrument operations. The LCS results outside QC limits are presented in Table 6 (if applicable). Sporadic and marginal QC failures for multiple component methods do not indicate an analytical concern. If recoveries are high and the compounds are not detected in the samples, then no data qualification is required. All recoveries should be above 10% or the non-detect results flagged “UR” as rejected.

REVIEW RESULTS

All LCS analyses were within control limits and performed at the required frequency for all method.

3.6 COMPOUND IDENTIFICATION AND QUANTITATION

Compound identities are assigned by comparing sample compound retention times to retention times from known (standard) compounds and identification of an acceptable mass spectrum. Compounds detected below the PQL in samples should be considered estimated and are qualified "J." The samples with compounds above the linear range were all re-analyzed at a higher dilution factor.

REVIEW RESULTS

All compound identification and quantitation criteria were achieved. As noted in Table 7, three sample for total mercury were reanalyzed after dilution.

4. FIELD DUPLICATE SAMPLE RESULTS

Field duplicate samples were collected and analyzed as an indication of overall precision for both field and laboratory. Field duplicate results are summarized in Table 8 (if applicable). The results are expected to have more variability than laboratory duplicates, which measure only laboratory precision. It is expected also that soil field duplicates will exhibit greater variance than water field duplicates due to the difficulties associated with collecting identical field samples. The QC criteria used to assess field duplicate samples

for this project was limits of 70% RPD for soils and 40% RPD for waters, or twice the general laboratory duplicate criteria. If a given compound in both the regular sample and associated field duplicate sample was below the laboratory PQL, or the compound was not detected in one of the samples, then the compound is generally not qualified due to field duplicate precision. There are no guidelines regarding data qualification based on poor field duplicate precision. Professional judgment was used to determine whether or not to qualify results.

REVIEW RESULTS

One field duplicates analyses were performed on this SDG. The RPD ratings are listed on Tables 8 as “Good” if the RPD is less than field duplicate QC criteria of 70% and as “Poor” if the RPD exceeded the field duplicate QC criteria.

All the results show good precision in the sample pair with the exception of mercury noted on Tables 8. Qualifiers were only added to the field duplicate sample pair results as noted.

5. OVERALL ASSESSMENT OF DATA

All data were reviewed and considered usable with qualification as noted in this report. All non-detect results were reported as “U” qualified at the PQL except where noted based upon blank contamination. All reported data at concentration less than the PQL were J qualified as estimated.

Table 1 - Sample Listing

Work Order	Matrix	Sample ID	Lab ID	Sample Date	QA/QC	Analysis
580-71114-1	Water	17EB01SB	580-71114-1	8/31/2017	Equipment Blank	6010B, 6020A, 7471A,9060 ASTM D2216
580-71114-1	Soil	17SM150SB09	580-71114-2	8/28/2017	FD of 17SM78SB09	6010B, 6020A, 7471A,9060 ASTM D2216
580-71114-1	Soil	17SM79SB05	580-71114-3	8/25/2017		6010B, 6020A, 7471A,9060 ASTM D2216
580-71114-1	Soil	17SM79SB11	580-71114-4	8/25/2017	MS/MSD	6010B, 6020A, 7471A,9060 ASTM D2216
580-71114-1	Soil	17SM81SB03	580-71114-5	8/29/2017		6010B, 6020A, 7471A,9060 ASTM D2216
580-71114-1	Soil	17SM81SB07	580-71114-6	8/29/2017		6010B, 6020A, 7471A,9060 ASTM D2216
580-71114-1	Soil	17SM82SB06	580-71114-7	8/23/2017		6010B, 6020A, 7471A,9060 ASTM D2216
580-71114-1	Soil	17SM82SB09	580-71114-8	8/23/2017		6010B, 6020A, 7471A,9060 ASTM D2216
580-71114-1	Soil	17SM86SB03	580-71114-9	8/30/2017		6010B, 6020A, 7471A,9060 ASTM D2216
580-71114-1	Water	17RS01SB	580-71114-10	8/31/2017	Rinse Blank	6010B, 6020A, 7471A,9060 ASTM D2216
580-71114-1	Soil	17SM78SB09	580-71114-11	8/28/2017	FD of 17SM150SB09	6010B, 6020A, 7471A,9060 ASTM D2216
580-71114-1	Soil	17SM78SB17	580-71114-12	8/28/2017		6010B, 6020A, 7471A,9060 ASTM D2216

Rinsate Blank =Collected from Macro-core cutting shoe.
Equipment blank =Collected from Macro-core liner.
FD = Field Duplicate

Table 2 - List of Samples Qualified for Holding Time Exceedance

Method	Analyte	Sample IDs	HT	Sampling Date	Analysis Date	Qual
None						

Table 3a - List of Positive Results for Blank Samples

Method	Sample ID	Sample Type	Analyte	Result	Analysis Type	Units	PQL
EPA 9060	17EB01SB	AQ	Total Organic Carbon	0.54J	EB	mg/L	1.0
EPA 6010B	17EB01SB	AQ	Aluminum	0.40J	EB	mg/L	1.5
EPA 6010B	17EB01SB	AQ	Calcium	0.54J	EB	mg/L	1.1
EPA 6010B	17EB01SB	AQ	Iron	0.95	EB	mg/L	0.5
EPA 6010B	17EB01SB	AQ	Magnesium	0.22J	EB	mg/L	1.12
EPA 6020A	17EB01SB	AQ	Arsenic	0.0016	EB	mg/L	0.0010
EPA 6020A	17EB01SB	AQ	Antimony	0.00063	EB	mg/L	0.0004
EPA 6020A	17EB01SB	AQ	Barium	0.013	EB	mg/L	0.0012
EPA 6020A	17EB01SB	AQ	Chromium	0.0031	EB	mg/L	0.0004
EPA 6020A	17EB01SB	AQ	Cobalt	0.00035J	EB	mg/L	0.0004
EPA 6020A	17EB01SB	AQ	Copper	0.0014J	EB	mg/L	0.002
EPA 6020A	17EB01SB	AQ	Lead	0.00031J	EB	mg/L	0.0008
EPA 6020A	17EB01SB	AQ	Manganese	0.055	EB	mg/L	0.002
EPA 6020A	17EB01SB	AQ	Nickel	0.0014J	EB	mg/L	0.003
EPA 6020A	17EB01SB	AQ	Vanadium	0.0019J	EB	mg/L	0.004
EPA 6020A	17EB01SB	AQ	Zinc	0.0066J	EB	mg/L	0.007
EPA 9060	17RS01SB	AQ	Total Organic Carbon	0.48	RB	mg/L	1.0
EPA 6010B	17RS01SB	AQ	Iron	0.51J	RB	mg/L	0.5
EPA 6020A	17RS01SB	AQ	Arsenic	0.00047J	RB	mg/L	0.0010
EPA 6020A	17RS01SB	AQ	Antimony	0.00023J	RB	mg/L	0.0004
EPA 6020A	17RS01SB	AQ	Barium	0.00031J	RB	mg/L	0.0012
EPA 6020A	17RS01SB	AQ	Chromium	0.0029	RB	mg/L	0.0004
EPA 6020A	17RS01SB	AQ	Cobalt	0.00010J	RB	mg/L	0.0004
EPA 6020A	17RS01SB	AQ	Copper	0.0011J	RB	mg/L	0.0008
EPA 6020A	17RS01SB	AQ	Manganese	0.0086	RB	mg/L	0.002
EPA 6020A	17RS01SB	AQ	Nickel	0.0018J	RB	mg/L	0.003
EPA 6020A	17RS01SB	AQ	Vanadium	0.00078J	RB	mg/L	0.004
EPA 6020A	17RS01SB	AQ	Zinc	0.0032J	RB	mg/L	0.007

RB = Rinsate Blank
EB = Equipment blank

Table 3b - List of Samples Qualified for Method Blank Contamination

Method	Sample ID	Analyte	Blank Result	Sample Result	Sample Qual	Units	PQL
	None						

Table 3c - List of Samples Qualified for Equipment or Rinsate Blank Contamination

Method	Sample ID	Analyte	Blank Result	Sample Result	Sample Qual	Units	PQL
	None						

Table 4 - List of Samples with Surrogates Outside Control Limits

Method	Sample ID	Sample Type	Analyte	Rec.	Low Limit	High Limit	Dil Fac	Sample Qual.
	None							

Table 5a - List of MS/MSD Recoveries Outside Control Limits

Method	Sample ID	Sample Type	Analyte	Orig. Result	Spike Amount	Rec.	Dil Fac.	Low Limit	High Limit	Sample Qual *
EPA 6010B	17SM79SB11	Soil	Calcium	2600	1120	182	1.0	80	120	J+
EPA 6010B	17SM79SB11	Soil	Sodium	120	1120	132	1.0	80	120	J+
EPA 6010B	17SM79SB11	Soil	Potassium	570	1120	168	1.0	80	120	J+
EPA 6020A	17SM79SB11	Soil	Barium	160	182	122	1.0	80	120	J+
EPA 6020A	17SM79SB11	Soil	Chromium	24	18.2	135	1.0	80	120	J+
EPA 6020A	17SM79SB11	Soil	Selenium	0.75	182	122	1.0	80	120	J+
EPA 6020A	17SM79SB11	Soil	Vanadium	40	45.5	126	1.0	80	120	J+

* Results less than PQL are not additionally qualified

Table 5b - List of Lab and MS Duplicate RPDs Outside Control Limits

Sample ID	Analyte	Method	RPD	RPD Limit	No. of Affected Samples	Samp Qual
17SM79SB11	Selenium	EPA 6020 A	35	20	10	J

Table 5c - List of Serial Dilution Percent Recovery Outside Control Limits

Sample ID	Analyte	Method	%D	%D Limit	No. of Affected Samples	Samp Qual
17SM79SB11	Aluminum	EPA 6010B	80	10	10	J
17SM79SB11	Calcium	EPA 6010A	80	10	10	J
17SM79SB11	Magnesium	EPA 6010B	79	10	10	J
17SM79SB11	Arsenic	EPA 6020A	12	10	10	J
17SM79SB11	Chromium	EPA 6020A	15	10	10	J
17SM79SB11	Copper	EPA 6020A	12	10	10	J
17SM79SB11	Lead	EPA 6020A	12	10	10	J
17SM79SB11	Vanadium	EPA 6020A	13	10	10	J
17SM79SB11	Zinc	EPA 6020A	19	10	10	J

Table 6 - List of LCS Recoveries Outside Control Limits

Method	Sample ID	Analyte	%Rec.	Low Limit	High Limit	No. of Affected Samples	Samp Qual
	none						

Table 7 - Samples that Were Re-analyzed

Sample ID	Lab ID	Method	Sample Type	Action
17SM150SB09	580-71114-2	EPA 7471A	Soil	None
17SM82SB09	580-71114-8	EPA 7471A	Soil	None
17SM78SB09	580-71114-11	EPA 7471A	Soil	None

Table 8 - Summary of Field Duplicate Results

Method	Analyte	Units	17SM78SB09	017SM150SB09	RPD	Rating	Sample Qualifier
EPA 9060	Total Organic Carbon	mg/kg	4,500	5,300	16 %	Good	None
D 2216	Percent Solids	%	82.7	82.9	0.2%	Good	None
D 2216	Percent Moisture	%	17.3	17.1	1.2%	Good	None
EPA 6010B	Aluminum	mg/kg	15,000	15,000	0.0%	Good	None
EPA 6010B	Calcium	mg/kg	2,200	2,300	4.4%	Good	None
EPA 6010B	Iron	mg/kg	20,000	21,000	4.9%	Good	None
EPA 6010B	Magnesium	mg/kg	4,500	4,600	2.2%	Good	None
EPA 6010B	Potassium	mg/kg	590	650	9.7%	Good	None
EPA 6010B	Sodium	mg/kg	92J	95J	3.2%	Good	None
EPA 6020A	Arsenic	mg/kg	17	18	5.7%	Good	None
EPA 6020A	Antimony	mg/kg	5.0	4.4	13%	Good	None
EPA 6020A	Barium	mg/kg	160	160	0.0%	Good	None
EPA 6020A	Beryllium	mg/kg	0.42	0.40	4.8%	Good	None
EPA 6020A	Cadmium	mg/kg	0.21	0.22	4.7%	Good	None
EPA 6020A	Chromium	mg/kg	25	25	0.0%	Good	None
EPA 6020A	Cobalt	mg/kg	9	9.5	5.4%	Good	None
EPA 6020A	Copper	mg/kg	26	27	22%	Good	None
EPA 6020A	Lead	mg/kg	7.6	8.0	3.8%	Good	None
EPA 6020A	Manganese	mg/kg	270	280	3.6%	Good	None
EPA 6020A	Nickel	mg/kg	26	27	3.8%	Good	None
EPA 6020A	Selenium	mg/kg	0.70	0.58	19%	Good	None
EPA 6020A	Silver	mg/kg	0.086	0.092	6.7%	Good	None
EPA 6020A	Thallium	mg/kg	0.089J	0.091J	2.2%	Good	None
EPA 6020A	Vanadium	mg/kg	40	42	4.9%	Good	None
EPA 6020A	Zinc	mg/kg	61	63	3.2%	Good	None
EPA 7471A	Mercury	mg/kg	3.0	1.4	73%	Poor	J

DATA REVIEW MEMORANDUM

DATE: December 13, 2017

TO: Mark Longtine, Project Manager, E & E, Seattle, WA

FROM: Howard Edwards, E & E, San Francisco, CA

SUBJ: Data Review: Red Devil Mine 2017 MPA Soil-Arsenic

REFERENCE:

Project ID	Lab Work Order	Lab
1001095.0015.03	K1709898	ALS – Kelso
1001095.0015.03	K1709904	ALS – Kelso
1001095.0015.03	K1709907	ALS – Kelso
1001095.0015.03	K1709908	ALS – Kelso
1001095.0015.03	K1709912	ALS – Kelso
1001095.0015.03	K1710523	ALS – Kelso

1. SAMPLE IDENTIFICATION

For the sampling activities at the Red Devil Mine site, Ecology and Environment, Inc. (E & E) collected the samples listed in Table 1. Project-specific matrix spike/matrix spike duplicates (MS/MSD) were designated in the field, except where noted. All samples were sent to ALS laboratory in Kelso, Washington, for all listed analyses. This report addresses only ALS-generated data.

The six analytical reports were issued by ALS on the following dates:

- October 16, 2017, for SDG: K1709904,
- October 18, 2017, for SDG: K1709898,
- October 18, 2017, for SDG: K1709907,
- October 31, 2017, for SDG: K1710523,
- November 6, 2017, for SDG: K1709908, and
- November 7, 2017, for SDG: K1709912.

The data in the analytical reports were reviewed for field and laboratory precision, accuracy, and completeness in accordance with procedures and quality control (QC) limits, the current laboratory Quality Assurance Manual (QAM), and current standard operating procedures (SOPs). Laboratory data qualifiers for identified analytes and analyte quantitation were accepted. Any additional data review qualifiers added are noted below and listed on the tables at the end of this memorandum. Definitions of all data qualifiers are given in the report.

Work Orders, Tests, and Number of Samples Included in this Data Review Memo

Work Orders/ Job Number	Matrix	Test Method	Method Name	Number of Samples
K1709898	Soil	EPA 6010C	Total Arsenic, by ICP	130
K1709898	Soil	EPA 6010C	TCLP for Arsenic s by ICP	130
K1709898	Rinsate Blank Water	EPA 6010C	Total Arsenic, by ICP	1
K1709898	Equipment Blank Water	EPA 6010C	Total Arsenic, by ICP	6

2. SAMPLE PROCEDURES

All samples were collected as specified in the work plan and documented on the chain-f-custody (COC) and in field notebooks, with the following exceptions:

- Sample 17MP107SB28 was not listed on any COC and was not received by ALS. A sample designated as 17MP107SB57, which is identified in field documentation as the field duplicate of 17MP107SB28, was received and analyzed. For this report, lab sample K1709898-007 is reported as sample 17MP107SB28.
- Rinsate blanks were not collected at the required frequency (discussed in Section 3.2), and
- Field duplicates were not collected at the required frequency (discussed in Chapter 4).

Samples were analyzed as specified on the COC. Samples were packaged, shipped, and received as specified in the work plan. All samples must be received cold (4 ±2 degrees Celsius [^{o}C]) and in good condition as documented on the Cooler Receipt Form.

REVIEW RESULTS

All sample procedures were followed and most samples (111 of 137 samples) were received at temperature of between 0.2^{o}C and 2.8 ^{o}C. There were documented problems with the condition of these samples upon receipt. Twenty-eight soil sample in SDG K1709904 were received at 15.7 ^{o}C. However, this did not result in qualification since the preservation temperature is not a method requirement.

3. LABORATORY DATA

3.1 HOLDING TIMES

Holding times are established and monitored to ensure analytical results accurately represent analyte concentrations in a sample at the time of collection. These results are presented in Table 2 (if applicable). Exceeding the holding time for a sample generally results in a loss of the analyte due to a variety of mechanisms, such as deposition on the sample container walls or precipitation.

REVIEW RESULTS

All other samples were analyzed within the project and method specified holding times for all analytes (see Table 2).

3.2 BLANKS

Laboratory and field blank samples are analyzed and evaluated to determine the existence and magnitude of possible contamination during the sampling and analysis process. These results are presented in Table 3 (if applicable). If the analyte is present in the sample at similar trace levels (less than 5 times the blank concentration), then the analyte is likely a common background contaminant from some phase of the sampling, extraction, or analytical procedure and associated low-level sample concentrations are not considered to be site related. Sample results in these cases are qualified as not detected, U.

REVIEW RESULTS

All laboratory method blanks were performed at the required frequency. As noted in Table 3a, the analyte was not detected in any of the method blanks.

One equipment blank and six rinsate blanks were collected on September 16, 2017, following a final equipment decontamination. The analyte was not detected in equipment blank or rinsate. No samples were qualified as noted in Tables 3b and 3c.

It should be noted that rinsate blanks were not collected every 20 samples as required by the sampling plan, but at the end of the sampling event after 130 samples had been collected. Thus, appropriate rinsate blanks were not generated that could be used for the evaluation of possible contamination in the first 130 samples collected during this sampling event.

3.3 SURROGATE SPIKE RECOVERY

Laboratory performance for individual samples analyzed for organic compounds is established by means of surrogate spiking activities. Samples are spiked with surrogate compounds prior to preparation and analysis. Unusually low or high surrogate recovery values may indicate some deficiency in the analytical system or that some matrix effects exist, resulting in low or high sample results for target compounds. Sample surrogate recoveries outside QC limits (if applicable) are presented in Table 4.

REVIEW RESULTS

No methods that required surrogates were performed.

3.4 MATRIX SPIKE AND MATRIX SPIKE DUPLICATE ANALYSIS

The MS/MSD analyses are intended to provide information about the effects that the sample matrix exerts on the digestion / extraction and measurement methodology. MS recovery values that do not meet laboratory QC criteria may indicate that sample analyte results are being attenuated in the analysis procedure. The potential sample bias may be estimated by noting the degree to which the MS concentration was elevated or lowered in the spike analysis. However, this estimated bias should serve only as an approximation; sample-specific problems may be the cause of the discrepancy, particularly in soil samples.

Recoveries of a post-digestion spike or a laboratory control sample (LCS) are used to verify that the analytical methodology is acceptable and that MS recoveries are due to matrix effects. An MSD analysis is performed to evaluate the precision of the sample

results. Precision is measured as the relative percent difference (RPD) between analytical results for duplicate samples. The laboratory's failure to produce similar results for MSD samples may indicate that the samples were non-homogeneous (particularly in soil samples), or that method defects may exist in the laboratory's techniques.

Recovery calculations are not required if the spiking concentration added is less than 25% of the sample background concentration.

MS/MSD recoveries outside QC limits (if applicable) are presented in Table 5a. MS/MSD and sample/MD, and serial dilution recovery precision outside of control limits are presented in Table 5b. Serial dilution recovery precision outside of control limits are presented in Table 5c.

REVIEW RESULTS

The MS sample analyses were performed on multiple samples at the required frequency. Matrix spike recoveries were within the control limits generated by the laboratory with the following exceptions:

- The MS recovery for total arsenic by EPA 6010C was above laboratory control limits of 75% to 125% for SDG K1709908. The arsenic results for that sample was J- qualified as low biased estimates. Since the SDGs had a second MS sample, which was in control, only the spiked sample was qualified.
- The MS recovery for total arsenic by EPA 6010C was above laboratory control limits of 75% to 125% for SDG K1709904. The arsenic results for that sample was J- qualified as low biased estimates. Samples in this SDG were J- qualified since the accuracy of the replicate sample was also out of control.

The accuracy of replicate samples based on recoveries were within the control limits generated by the laboratory with the following exceptions:

- The replicate RPDs for all the total arsenic replicates in SDG K1709904 were above laboratory control limits. The arsenic concentration in all associated samples were qualified as estimated "J."
- The replicate RPD for one of two replicates in SDG K1709907, 1709908 and 1709898, were above laboratory control limits. The arsenic concentration in

samples 17MP113SB28, 17MP111SB18.4, and 17MP111SB28 were qualified as estimated "J."

The accuracy of ICP serial dilution recoveries were within the control limits generated by the laboratory for all SDGs.

3.5 LABORATORY CONTROL SAMPLE ANALYSIS

The LCS is analyzed to monitor the efficiency of the digestion/extraction procedure and analytical instrument operation. The ability of the laboratory to successfully analyze an LCS demonstrates that there are no analytical problems related to the digestion/sample preparation procedures and/or instrument operations. The LCS results outside QC limits are presented in Table 6 (if applicable). Sporadic and marginal QC failures for multiple component methods do not indicate an analytical concern. If recoveries are high and the compounds are not detected in the samples, then no data qualification is required. All recoveries should be above 10% or the non-detect results flagged “UR” as rejected.

REVIEW RESULTS

All LCS analyses were within control limits and performed at the required frequency for all method.

3.6 COMPOUND IDENTIFICATION AND QUANTITATION

Compound identities are assigned by comparing sample compound retention times to retention times from known (standard) compounds and identification of an acceptable mass spectrum. Compounds detected below the PQL in samples should be considered estimated and are qualified "J." The samples with compounds above the linear range were all re-analyzed at a higher dilution factor.

REVIEW RESULTS

All compound identification and quantitation criteria were achieved. As noted in Table 7, no samples were reanalyzed.

4. FIELD DUPLICATE SAMPLE RESULTS

Field duplicate samples were collected and analyzed as an indication of overall precision for both field and laboratory. Field duplicate results are summarized in Table 8 (if

applicable). The results are expected to have more variability than laboratory duplicates, which measure only laboratory precision. It is expected also that soil field duplicates will exhibit greater variance than water field duplicates due to the difficulties associated with collecting identical field samples. The QC criteria used to assess field duplicate samples for this project was limits of 70% RPD for soils and 40% RPD for waters, or twice the general laboratory duplicate criteria. If a given compound in both the regular sample and associated field duplicate sample was below the laboratory PQL, or the compound was not detected in one of the samples, then the compound is generally not qualified due to field duplicate precision. There are no guidelines regarding data qualification based on poor field duplicate precision. Professional judgment was used to determine whether or not to qualify results.

REVIEW RESULTS

Ten field duplicates analyses were performed on these SDGs. The RPD ratings are listed on Tables 8a through 8g as “Good” if the RPD is less than field duplicate QC criteria of 70% and as “Poor” if the RPD exceeded the field duplicate QC criteria.

All the results show good precision in the sample pairs with the exception of sample pair 17MP113SB24 and 17MP113SB55 as noted on Table 8f. Qualifiers were only added to the field duplicate sample pair results as noted.

It should be noted that 10 field duplicates were collected for the 130 samples, which did not meet the 10% requirement for field duplicates as required by the sampling plan.

5. OVERALL ASSESSMENT OF DATA

All data were reviewed and considered usable with qualification as noted in this report. All non-detect results were reported as “U” qualified at the PQL except where noted based upon blank contamination. All reported data at concentration less than the PQL were J qualified as estimated.

Table 1 - Sample Listing

Work Order	Matrix	Sample ID	Lab ID	Sample Date	QA/QC	Analysis
K1709898	Soil	17MP107SB04	K1709898-001	9/14/17		6010C for arsenic, TCLP for arsenic
K1709898	Soil	17MP107SB08	K1709898-002	9/14/17		6010C for arsenic, TCLP for arsenic
K1709898	Soil	17MP107SB12	K1709898-003	9/14/17		6010C for arsenic, TCLP for arsenic
K1709898	Soil	17MP107SB20	K1709898-004	9/14/17	MS/MSD	6010C for arsenic, TCLP for arsenic
K1709898	Soil	17MP107SB24	K1709898-005	9/14/17		6010C for arsenic, TCLP for arsenic
K1709898	Soil	17MP107SB56	K1709898-006	9/14/17	FD of 17MP107SB16	6010C for arsenic, TCLP for arsenic
K1709898	Soil	17MP107SB28	K1709898-007	9/14/17	Listed as 17MP107SB57	6010C for arsenic, TCLP for arsenic
K1709898	Soil	17MP108SB04	K1709898-008	9/14/17		6010C for arsenic, TCLP for arsenic
K1709898	Soil	17MP108SB08	K1709898-009	9/14/17		6010C for arsenic, TCLP for arsenic
K1709898	Soil	17MP108SB12	K1709898-010	9/14/17		6010C for arsenic, TCLP for arsenic
K1709898	Soil	17MP108SB16	K1709898-011	9/14/17	MS/MSD	6010C for arsenic, TCLP for arsenic
K1709898	Soil	17MP108SB20	K1709898-012	9/14/17		6010C for arsenic, TCLP for arsenic
K1709898	Soil	17MP108SB24	K1709898-013	9/14/17	FD of 17MP108SB58	6010C for arsenic, TCLP for arsenic
K1709898	Soil	17MP108SB28	K1709898-014	9/14/17		6010C for arsenic, TCLP for arsenic
K1709898	Soil	17MP108SB58	K1709898-015	9/14/17	FD of 17MP108SB24	6010C for arsenic, TCLP for arsenic
K1709898	Soil	17MP108SB59	K1709898-016	9/14/17		6010C for arsenic, TCLP for arsenic
K1709898	Soil	17MP107SB16	K1709898-017	9/14/17	FD of 17MP107SB56	6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP111SB04	K1709904-001	9/12/17		6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP111SB08	K1709904-002	9/12/17		6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP111SB12	K1709904-003	9/12/17		6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP111SB16	K1709904-004	9/12/17	FD of 17MP111SB53	6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP111SB18.4	K1709904-005	9/12/17	MS/MSD	6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP111SB53	K1709904-006	9/12/17	FD of 17MP111SB16	6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP112SB04	K1709904-007	9/10/17		6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP112SB08	K1709904-008	9/10/17		6010C for arsenic, TCLP for arsenic

Table 1 - Sample Listing

Work Order	Matrix	Sample ID	Lab ID	Sample Date	QA/QC	Analysis
K1709904	Soil	17MP112SB12	K1709904-009	9/10/17		6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP112SB16	K1709904-010	9/10/17		6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP112SB20	K1709904-011	9/10/17		6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP115SB04	K1709904-012	9/8/17		6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP115SB08	K1709904-013	9/8/17	FD of 17MP115SB51	6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP115SB12	K1709904-014	9/8/17		6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP115SB16	K1709904-015	9/8/17		6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP115SB20	K1709904-016	9/8/17		6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP115SB21.1	K1709904-017	9/8/17		6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP115SB51	K1709904-018	9/8/17	FD of 17MP115SB08	6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP116SB04	K1709904-019	9/8/17		6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP116SB08	K1709904-020	9/8/17		6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP116SB12	K1709904-021	9/8/17		6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP116SB16	K1709904-022	9/8/17		6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP116SB20	K1709904-023	9/8/17		6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP116SB22.2	K1709904-024	9/8/17		6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP121SB04	K1709904-025	9/8/17		6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP121SB08	K1709904-026	9/8/17		6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP121SB12	K1709904-027	9/8/17	FD of 17MP121SB52	6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP121SB52	K1709904-028	9/8/17	FD of 17MP121SB12	6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP102SB04	K1709907-001	9/11/17		6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP102SB08	K1709907-002	9/11/17		6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP102SB12	K1709907-003	9/11/17		6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP102SB16	K1709907-004	9/11/17		6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP113SB04	K1709907-005	9/10/17		6010C for arsenic, TCLP for arsenic

Table 1 - Sample Listing

Work Order	Matrix	Sample ID	Lab ID	Sample Date	QA/QC	Analysis
K1709907	Soil	17MP113SB08	K1709907-006	9/10/17		6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP113SB12	K1709907-007	9/10/17		6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP113SB16	K1709907-008	9/10/17		6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP113SB20	K1709907-009	9/10/17		6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP113SB24	K1709907-010	9/10/17	FD of 17MP113SB55	6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP113SB28	K1709907-011	9/10/17	MS/MSD	6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP113SB29	K1709907-012	9/10/17		6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP113SB55	K1709907-013	9/10/17	FD of 17MP113SB24	6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP117SB04	K1709907-014	9/6/17		6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP117SB08	K1709907-015	9/6/17		6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP117SB12	K1709907-016	9/6/17		6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP117SB16	K1709907-017	9/6/17		6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP117SB20	K1709907-018	9/6/17		6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP117SB24	K1709907-019	9/6/17		6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP117SB28	K1709907-020	9/6/17		6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP117SB32	K1709907-021	9/6/17		6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP120SB04	K1709907-022	9/7/17	FD of 17MP120SB50	6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP120SB08	K1709907-023	9/7/17		6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP120SB12	K1709907-024	9/8/17		6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP120SB16	K1709907-025	9/8/17		6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP120SB18.3	K1709907-026	9/8/17		6010C for arsenic, TCLP for arsenic
K1709907	Soil	17MP120SB50	K1709907-027	9/7/17	FD of 17MP120SB04	6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP103SB04	K1709908-001	9/11/17		6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP103SB08	K1709908-002	9/11/17		6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP103SB12	K1709908-003	9/11/17		6010C for arsenic, TCLP for arsenic

Table 1 - Sample Listing

Work Order	Matrix	Sample ID	Lab ID	Sample Date	QA/QC	Analysis
K1709908	Soil	17MP103SB16	K1709908-004	9/11/17		6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP103SB18.4	K1709908-005	9/11/17		6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP104SB04	K1709908-006	9/11/17		6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP104SB08	K1709908-007	9/11/17		6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP104SB12	K1709908-008	9/11/17		6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP104SB16	K1709908-009	9/11/17		6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP104SB20	K1709908-010	9/11/17		6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP104SB24	K1709908-011	9/11/17		6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP104SB28	K1709908-012	9/11/17	MS/MSD	6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP104SB29.5	K1709908-013	9/11/17		6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP106SB04	K1709908-014	9/11/17		6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP106SB08	K1709908-015	9/11/17		6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP106SB12	K1709908-016	9/11/17		6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP109SB54	K1709908-017	9/12/17	FD of 17MP109SB24	6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP114SB04	K1709908-018	9/8/17		6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP114SB08	K1709908-019	9/8/17		6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP114SB12	K1709908-020	9/8/17		6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP114SB16	K1709908-021	9/8/17		6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP114SB20	K1709908-022	9/8/17	MS/MSD	6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP114SB21.2	K1709908-023	9/8/17		6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP109SB04	K1709908-024	9/12/17		6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP109SB08	K1709908-025	9/12/17		6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP109SB12	K1709908-026	9/12/17		6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP109SB16	K1709908-027	9/12/17		6010C for arsenic, TCLP for arsenic
K1709908	Soil	17MP109SB20	K1709908-028	9/12/17		6010C for arsenic, TCLP for arsenic

Table 1 - Sample Listing

Work Order	Matrix	Sample ID	Lab ID	Sample Date	QA/QC	Analysis
K1709904	Soil	17MP109SB24	K1709904-029	9/8/17	FD of 17MP109SB54	6010C for arsenic, TCLP for arsenic
K1709904	Soil	17MP109SB25.5	K1709904-030	9/8/17		6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP110SB08	K1709912-001	9/12/17		6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP110SB12	K1709912-002	9/12/17		6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP110SB16	K1709912-003	9/12/17		6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP110SB20	K1709912-004	9/12/17		6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP105SB04	K1709912-005	9/10/17		6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP105SB08	K1709912-006	9/10/17		6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP105SB12	K1709912-007	9/10/17		6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP105SB16	K1709912-008	9/10/17		6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP105SB20	K1709912-009	9/10/17	FD of 17MP105SB53	6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP105SB24	K1709912-010	9/10/17		6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP105SB28	K1709912-011	9/10/17	MS/MSD	6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP105SB53	K1709912-012	9/10/17	FD of 17MP105SB20	6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP118SB04	K1709912-013	9/7/17		6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP118SB08	K1709912-014	9/7/17		6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP118SB12	K1709912-015	9/7/17		6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP118SB16	K1709912-016	9/7/17		6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP118SB20	K1709912-017	9/7/17		6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP118SB24	K1709912-018	9/7/17		6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP118SB26	K1709912-019	9/7/17		6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP119SB04	K1709912-020	9/7/17		6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP119SB08	K1709912-021	9/7/17		6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP119SB12	K1709912-022	9/7/17		6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP119SB16	K1709912-023	9/7/17		6010C for arsenic, TCLP for arsenic

Table 1 - Sample Listing

Work Order	Matrix	Sample ID	Lab ID	Sample Date	QA/QC	Analysis
K1709912	Soil	17MP119SB20	K1709912-024	9/7/17		6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP119SB24	K1709912-025	9/7/17		6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP119SB27	K1709912-026	9/7/17	FD of 7MP119SB49	6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP119SB49	K1709912-027	9/7/17	FD of 17MP119SB27	6010C for arsenic, TCLP for arsenic
K1709912	Soil	17MP110SB04	K1709912-028	9/12/17		6010C for arsenic, TCLP for arsenic
K1710523	Soil	0917RS02SB	K1710523-001	9/15/17	Rinsate Blank	6010C for arsenic, TCLP for arsenic
K1710523	Soil	0917RS03SB	K1710523-002	9/15/17	Rinsate Blank	6010C for arsenic, TCLP for arsenic
K1710523	Soil	0917RS04SB	K1710523-003	9/15/17	Rinsate Blank	6010C for arsenic, TCLP for arsenic
K1710523	Soil	0917RS05SB	K1710523-004	9/15/17	Rinsate Blank	6010C for arsenic, TCLP for arsenic
K1710523	Soil	0917RS06SB	K1710523-005	9/15/17	Rinsate Blank	6010C for arsenic, TCLP for arsenic
K1710523	Soil	0917RS07SB	K1710523-006	9/15/17	Rinsate Blank	6010C for arsenic, TCLP for arsenic
K1710523	Soil	0917EB02SB	K1710523-007	9/15/17	Equipment blank	6010C for arsenic, TCLP for arsenic

Notes:
Rinsate Blank =Collected from Macro-core cutting shoe.
Equipment blank =Collected from Macro-core liner.
FD = Field Duplicate

Table 2 - List of Samples Qualified for Holding Time Exceedance

Method	Analyte	Sample IDs	HT	Sampling Date	Analysis Date	Qual
None						

Table 3a - List of Positive Results for Blank Samples

Method	Sample ID	Sample Type	Analyte	Result	Analysis Type	Units	PQL
	None						

Table 3b - List of Samples Qualified for Method Blank Contamination

Method	Sample ID	Analyte	Blank Result	Sample Result	Sample Qual	Units	PQL
	None						

Table 3c - List of Samples Qualified for Equipment or Rinsate Blank Contamination

Method	Sample ID	Analyte	Blank Result	Sample Result	Sample Qual	Units	PQL
	None						

Table 4 - List of Samples with Surrogates outside Control Limits

Method	Sample ID	Sample Type	Analyte	Rec.	Low Limit	High Limit	Dil Fac	Sample Qual.
	None							

Table 5a - List of Matrix Spike Recoveries outside Control Limits

Method	Sample ID	Sample Type	Analyte	Orig. Result	Spike Amount	Rec.	Dil Fac.	Low Limit	High Limit	Sample Qual
EPA 6010C	17MP114SB20	Soil	Total Arsenic	83	93.4	44	1.0	75	125	J-
EPA 6010C	17MP111SB18.4	Soil	Total Arsenic	64.2	112	73	1.0	75	125	J-

Table 5b - List of Replicate RPDs outside Control Limits

Sample ID	Analyte	Method	RPD	RPD Limit	No. of Affected Samples	Samp Qual
17MP114SB20	Total Arsenic	EPA 6010C	37	20	1	J
17MP107SB20	Total Arsenic	EPA 6010C	23	20	1	J
17MP113SB28	Total Arsenic	EPA 6010C	37	20	1	J
17MP111SB18.4	Total Arsenic	EPA 6010C	39	20	28	J

Table 5c - List of Serial Dilution Percent Recovery outside Control Limits

Sample ID	Analyte	Method	%D	%D Limit	No. of Affected Samples	Samp Qual
None						

Table 6 - List of LCS Recoveries outside Control Limits

Method	Sample ID	Analyte	%Rec.	Low Limit	High Limit	No. of Affected Samples	Samp Qual
	None						

Table 7 - Samples that Were Re-analyzed

Sample ID	Lab ID	Method	Sample Type	Action
None				

Table 8a - Summary of Field Duplicate Results

Method	Analyte	Units	17MP107SB16	17MP107SB56	RPD	Rating	Sample Qualifier
EPA 6010C	Total Arsenic	mg/kg	2,390	2,430	1.7%	Good	None
EPA 6010C	TCLP Arsenic	mg/L	2.44	2.42	8.2%	Good	None
TCLP = Toxicity Characteristic Leaching Procedure							

Table 8b - Summary of Field Duplicate Results

Method	Analyte	Units	17MP108SB24	17MP108SB58	RPD	Rating	Sample Qualifier
EPA 6010C	Total Arsenic	mg/kg	3,440	3,540	2.9%	Good	None
EPA 6010C	TCLP Arsenic	mg/L	13.6	12.0	13%	Good	None
TCLP = Toxicity Characteristic Leaching Procedure							

Table 8c - Summary of Field Duplicate Results

Method	Analyte	Units	17MP111SB16	17MP111SB53	RPD	Rating	Sample Qualifier
EPA 6010C	Total Arsenic	mg/kg	41.9 J	43.7 J	4.2%	Good	None
EPA 6010C	TCLP Arsenic	mg/L	0.05U	0.05U	0%	Good	None
TCLP = Toxicity Characteristic Leaching Procedure							

Table 8d - Summary of Field Duplicate Results

Method	Analyte	Units	17MP115SB08	17MP115SB51	RPD	Rating	Sample Qualifier
EPA 6010C	Total Arsenic	mg/kg	3,680 J	2,760 J	29%	Good	None
EPA 6010C	TCLP Arsenic	mg/L	5.76	4.51	24%	Good	None
TCLP = Toxicity Characteristic Leaching Procedure							

Table 8e - Summary of Field Duplicate Results

Method	Analyte	Units	17MP121SB12	17MP121SB52	RPD	Rating	Sample Qualifier
EPA 6010C	Total Arsenic	mg/kg	249 J	374 J	40%	Good	None
EPA 6010C	TCLP Arsenic	mg/L	0.168	0.160	4.9%	Good	None
TCLP = Toxicity Characteristic Leaching Procedure							

Table 8f - Summary of Field Duplicate Results

Method	Analyte	Units	17MP113SB24	17MP113SB55	RPD	Rating	Sample Qualifier
EPA 6010C	Total Arsenic	mg/kg	411	950	79%	Poor	J
EPA 6010C	TCLP Arsenic	mg/L	1.05	1.23	16%	Good	None
TCLP = Toxicity Characteristic Leaching Procedure							

Table 8g - Summary of Field Duplicate Results

Method	Analyte	Units	17MP120SB04	17MP120SB50	RPD	Rating	Sample Qualifier
EPA 6010C	Total Arsenic	mg/kg	3,110	3,170	1.9%	Good	None
EPA 6010C	TCLP Arsenic	mg/L	3.03	3.09	2.0%	Good	None
TCLP = Toxicity Characteristic Leaching Procedure							

Table 8h - Summary of Field Duplicate Results

Method	Analyte	Units	17MP109SB24	17MP109SB54	RPD	Rating	Sample Qualifier
EPA 6010C	Total Arsenic	mg/kg	186	146	24%	Good	None
EPA 6010C	TCLP Arsenic	mg/L	0.05 U	0.05 U	0.0%	Good	None
TCLP = Toxicity Characteristic Leaching Procedure							

Table 8i – Summary of Field Duplicate Results

Method	Analyte	Units	17MP105SB20	17MP105SB53	RPD	Rating	Sample Qualifier
EPA 6010C	Total Arsenic	mg/kg	114	109	4.5%	Good	None
EPA 6010C	TCLP Arsenic	mg/L	0.05 U	0.05 U	0.0%	Good	None
TCLP = Toxicity Characteristic Leaching Procedure							

Table 8j – Summary of Field Duplicate Results

Method	Analyte	Units	17MP119SB27	17MP119SB49	RPD	Rating	Sample Qualifier
EPA 6010C	Total Arsenic	mg/kg	148	136	8.5%	Good	None
EPA 6010C	TCLP Arsenic	mg/L	0.05 U	0.05 U	0.0%	Good	None
TCLP = Toxicity Characteristic Leaching Procedure							