

January 31, 2020

Mr. Roger Burggraf
3180 Peger Road, Suite 270
Fairbanks, Alaska 99709

RE: GROUNDWATER-QUALITY ASSESSMENT SUMMARY, GRANT MINE, ESTER DOME,
ALASKA

Dear Mr. Burggraf:

This report summarizes the results of three rounds of groundwater sampling completed at the Grant Mine located at Mile 1.2 on Saint Patrick's Road in Ester, Alaska (Figure 1). We collected groundwater samples from monitoring wells M-1 and M-2 located downgradient of the Grant Mine primary tailings impoundment (Figure 2) in September 2018, June 2019, and October 2019. The primary contaminant of potential concern (COPC) in groundwater at the site is cyanide. We have prepared this report for submittal to the Alaska Department of Environmental Conservation (ADEC) to assist their evaluation of groundwater quality at the site.

BACKGROUND

Tri-Con Mining, Inc. (Tri-Con)/Silverado operated the mill at the Grant Mine site from 1985 to 1989 using a cyanide process for gold extraction. The cyanide process involved mixing crushed ore with sodium cyanide solution and then extracting the gold, generating a tailings slurry containing waste rock, lime, and sodium cyanide-contaminated water. A tailings impoundment, lined with compacted silt and bordered by an earthen berm, was built in 1985 to contain the waste slurry.

The site came to the attention of ADEC in 1988 when Tri-Con applied for a rezone, and water samples from two wells (M-3 and M-R, both since decommissioned) contained cyanide concentrations above the federally established drinking water maximum level of 0.2 mg/L. According to Tri-Con employees, the cyanide-rich tailings slurry was accidentally discharged upslope of the impoundment, allowing the tailings to reach groundwater through the former water supply well, known as the "former Burggraf well or MW-R". Tri-Con removed the well casing and sealed the boring by pressure grouting in 1989. Two additional monitoring wells, M-1 and M-2, were installed in 1989 and 1990, respectively, to continue monitoring cyanide in groundwater. The wells were routinely sampled by Mr.

Burggraf for total cyanide and/or weak-acid-dissociable (WAD) cyanide concentrations; the results of his sampling are presented in Table 1.

ADEC established a 1.5 micrograms per liter (ug/L) groundwater cleanup level for free cyanide with the November 6, 2016 revision of the 18 AAC 75. Our groundwater assessment in 2018 and 2019 included analyzing groundwater samples for free cyanide so that analytical results could be compared with the current ADEC regulations. Previous investigations evaluated analytical groundwater results for total cyanide and/or WAD cyanide using the federally established maximum contaminant level (MCL) of 200 µg/L. Samples from M-1 and M-2 collected in 2017 and 2018 did not exceed the MCL for total or WAD cyanide.

GROUNDWATER SAMPLING SUMMARY

We collected groundwater samples from monitoring wells M-1 and M-2 using the dedicated well pumps installed in the monitoring wells. During purging we used a YSI ProPlus instrument to monitor temperature, conductivity, pH, dissolved oxygen (DO), and oxidation-reduction potential (ORP). Wells were purged until these parameters stabilized, or three well volumes were purged. Immediately after purging, we collected groundwater samples directly from the discharge tubing into laboratory-provided containers.

Investigation Derived Waste

Purge water generated during sampling was discharged into the primary tailings impoundment at Grant Mine. Other investigation derived waste (IDW) consisting of disposable sampling equipment such as nitrile gloves was disposed at the Fairbanks North Star Borough landfill.

ANALYTICAL METHODS

We submitted the groundwater samples collected from monitoring wells M-1 and M-2 for laboratory analysis of free cyanide by the Environmental Protection Agency (EPA) Method SW9016. We also requested the additional analysis of the dissolved metals antimony, arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver by EPA Method SW6020A for the groundwater samples collected in September 2018. We filtered groundwater submitted for analysis of dissolved metals through a 0.45-micron filter during sample collection.

Free cyanide analysis was performed by Alpha Analytical in Westborough, Massachusetts; dissolved metals analysis was performed by SGS North America (SGS) in Anchorage, Alaska.

ANALYTICAL RESULTS

To evaluate groundwater analytical data, we compared groundwater-sample results to the groundwater cleanup levels listed in 18 AAC 75.345 Table C. *Groundwater Cleanup Levels*. Analytical results are presented in Table 2. We have also enclosed copies of the October 2019 laboratory report and associated ADEC *Laboratory Data Review Checklist*. September 2018 and June 2019 laboratory reports were submitted in our *Revised Site Characterization Report, Grant Mine Tailings Impoundment, 1.2 Mile St. Patrick Road, Fairbanks, Alaska* dated August 2019.

The groundwater sample results were below ADEC cleanup levels for all requested metals analytes except arsenic. However, the highest arsenic result, detected in monitoring well M-2 at a concentration of 196 µg/L, was less than 20 percent of the background concentrations reported in a 1994 site investigation conducted by EPA.

Free cyanide was detected in sample MW-102 collected at monitoring well M-2 in June 2019 at an estimated concentration of 1.55 µg/L, a concentration marginally exceeding the ADEC cleanup level of 1.5 µg/L. However, the result for free cyanide in M-2 (the field duplicate of MW-102) did not exceed the ADEC cleanup level. The results for both samples were flagged as estimated values because the concentrations were below the 2.0 µg/L limit of quantitation reported by the laboratory. Free cyanide was not detected in the groundwater samples collected from either M-1 or M-2 in September 2018 or October 2019.

CONCLUSIONS

Mr. Burggraf is working with Alaska Department of Natural Resources, ADEC's Contaminated Sites Program, and ADEC's Solid Waste Program to develop a closure plan for the primary tailings impoundment at the Grant Mine. Based on the 2018 and 2019 analytical groundwater results from the Grant Mine monitoring wells, it does not appear that the 1988 cyanide release or the tailings within the primary tailings impoundment are affecting groundwater quality in the area downgradient from the impoundment. We recommend no further monitoring of groundwater contaminants so that efforts can be focused on closing the tailings impoundment. If ADEC concurs with this recommendation, we would suggest decommissioning the wells at your earliest convenience.

Sincerely,

SHANNON & WILSON



Mark S. Lockwood, CPG
Senior Associate - Geologist

- Enc. Table 1 - Historical On-Site Monitoring Well Groundwater Results
Table 2 - 2018 and 2019 Groundwater Sample Results
Figure 1 – Site Location
Figure 2 – Monitoring Well Locations
Alpha Analytical Report L1949758 and LDRC

TABLE 1
GRANT MINE IMPOUNDMENT CLOSURE
HISTORICAL ON-SITE MONITORING WELL GROUNDWATER RESULTS

Sample Date	Units	M-1		M-2		M-3	M-4	M-R
		Total CN	WAD CN	Total CN	WAD CN	Total CN	Total CN	Total CN
1/15/1988	mg/L	-	-	-	-	0.01	-	-
11/29/1988	mg/L	-	-	-	-	0.14	-	0.91
12/29/1988	mg/L	-	-	-	-	0.23	-	0.54
1/5/1989	mg/L	-	-	-	-	-	-	0.52
5/3/1989	mg/L	-	-	-	-	1.26	-	-
7/10/1989	mg/L	-	-	-	-	1.27	-	-
8/15/1989	mg/L	-	-	-	-	0.35	-	-
10/20/1989	mg/L	0.01	-	-	-	0.31	-	-
6/26/1990	mg/L	0.01	-	-	-	0.13	-	-
8/13/1990	mg/L	-	-	0.01	-	-	-	-
10/25/1990	mg/L	0.01	-	0.02	-	0.09	-	-
11/1/1990	mg/L	-	-	0.08	-	-	-	-
11/28/1990	mg/L	0.01	-	0.08	-	0.22	-	-
1/4/1991	mg/L	<MDL	-	0.12	-	0.16	-	-
2/6/1991	mg/L	<MDL	-	0.09	-	-	-	-
4/9/1991	mg/L	0.01	-	0.01	-	0.1	-	-
6/5/1991	mg/L	<MDL	-	0.09	-	0.07	-	-
8/12/1991	mg/L	<MDL	-	0.08	-	0.03	-	-
10/24/1991	mg/L	<MDL	-	0.16	-	0.04	-	-
12/17/1991	mg/L	<MDL	-	0.19	-	0.03	-	-
3/9/1992	mg/L	<MDL	-	0.06	-	0.02	-	-
6/5/1992	mg/L	<MDL	-	0.01	-	0.02	-	-
7/16/1992	mg/L	<MDL	-	0.15	-	0.02	-	-
10/14/1992	mg/L	<MDL	-	0.27	-	0.03	-	-
11/13/1992	mg/L	-	-	0.17	-	-	-	-
2/22/1993	mg/L	<MDL	-	0.2	-	-	-	-
3/8/1993	mg/L	-	-	0.16	-	-	-	-
6/23/1993	mg/L	<MDL	-	0.16	-	0.01	-	-
10/1/1993	mg/L	<MDL	-	0.17	-	0.04	-	-
2/21/1994	mg/L	<MDL	-	0.1	-	<MDL	-	-
4/5/1994	mg/L	<MDL	-	0.21	-	<MDL	-	-
7/1/1994	mg/L	<MDL	-	0.15	-	<MDL	-	-
9/8/1994	mg/L	0.02	-	0.18	-	0.01	-	-
1/11/1995	mg/L	0.02	-	0.17	-	-	-	-
3/20/1995	mg/L	<MDL	-	0.14	-	-	-	-
7/3/1995	mg/L	<MDL	-	0.09	-	<MDL	-	-
10/19/1995	mg/L	<MDL	-	0.15	-	-	-	-
1/3/1996	mg/L	0.01	-	0.15	-	-	-	-
4/4/1996	mg/L	0.01	-	0.12	-	-	-	-
7/3/1996	mg/L	<MDL	-	0.14	-	<MDL	-	-
10/17/1996	mg/L	0.02	-	0.15	-	<MDL	.1*	-
11/5/1996	mg/L	-	-	-	-	-	<MDL	-
12/18/1996	mg/L	0.03	-	0.16	-	-	<MDL	-
3/10/1997	mg/L	0.03	-	0.14	-	-	<MDL	-
7/14/1997	mg/L	0.02	-	0.1	-	<MDL	<MDL	-
10/16/1997	mg/L	0.03	-	0.14	-	<MDL	<MDL	-
11/1/2002	mg/L	0.23	-	0.07	-	-	-	-
11/1/2003	mg/L	0.17	-	0.076	-	-	-	-
4/1/2004	mg/L	0.177	-	0.072	-	-	-	-
5/1/2005	mg/L	0.26	-	0.05	-	-	-	-
4/12/2006	mg/L	0.18	-	0.049	-	-	-	-
2/2/2007	mg/L	0.3	-	0.072	-	-	-	-
6/6/2007	mg/L	0.64	-	0.09	-	-	-	-

TABLE 1
GRANT MINE IMPOUNDMENT CLOSURE
HISTORICAL ON-SITE MONITORING WELL GROUNDWATER RESULTS

Sample Date	Units	<i>M-1</i>		<i>M-2</i>		<i>M-3</i>	<i>M-4</i>	<i>M-R</i>
		Total CN	WAD CN	Total CN	WAD CN	Total CN	Total CN	Total CN
4/1/2008	mg/L	0.21	-	0.062	-	-	-	-
10/7/2008	mg/L	0.21	-	0.06	-	-	-	-
1/16/2009	mg/L	0.22	0.034	0.072	0.02	-	-	-
5/15/2009	mg/L	0.25	0.055	0.068	0.013	-	-	-
5/5/2010	mg/L	0.055	0.091	0.019	0.084	-	-	-
5/6/2011	mg/L	0.23	0.048	0.072	0.021	-	-	-
10/4/2011	mg/L	0.25	0.091	0.084	0.019	-	-	-
5/1/2012	mg/L	0.3	0.096	0.088	0.025	-	-	-
10/8/2012	mg/L	0.05	0.26	0.072	0.021	-	-	-
5/24/2013	mg/L	0.065	0.02	0.23	0.005	-	-	-
6/30/2014	mg/L	-	-	0.071	0.0025	-	-	-
11/14/2014	mg/L	0.16	0.011	0.038	0.0083	-	-	-
6/22/2015	mg/L	0.14	0.059	0.056	0.018	-	-	-
10/26/2015	mg/L	0.22	0.07	0.076	0.025	-	-	-
5/20/2016	mg/L	0.22	0.049	0.076	0.017	-	-	-
5/31/2017	mg/L	0.2	0.046	0.077	0.022	-	-	-
10/26/2017	mg/L	0.18	0.04	0.072	0.025	-	-	-
6/4/2018	mg/L	0.18	0.045	0.09	0.032	-	-	-

mg/L milligrams per liter

<MDL Analyte not reported above the minimum detection limit (MDL).

- Analytical sample not collected.

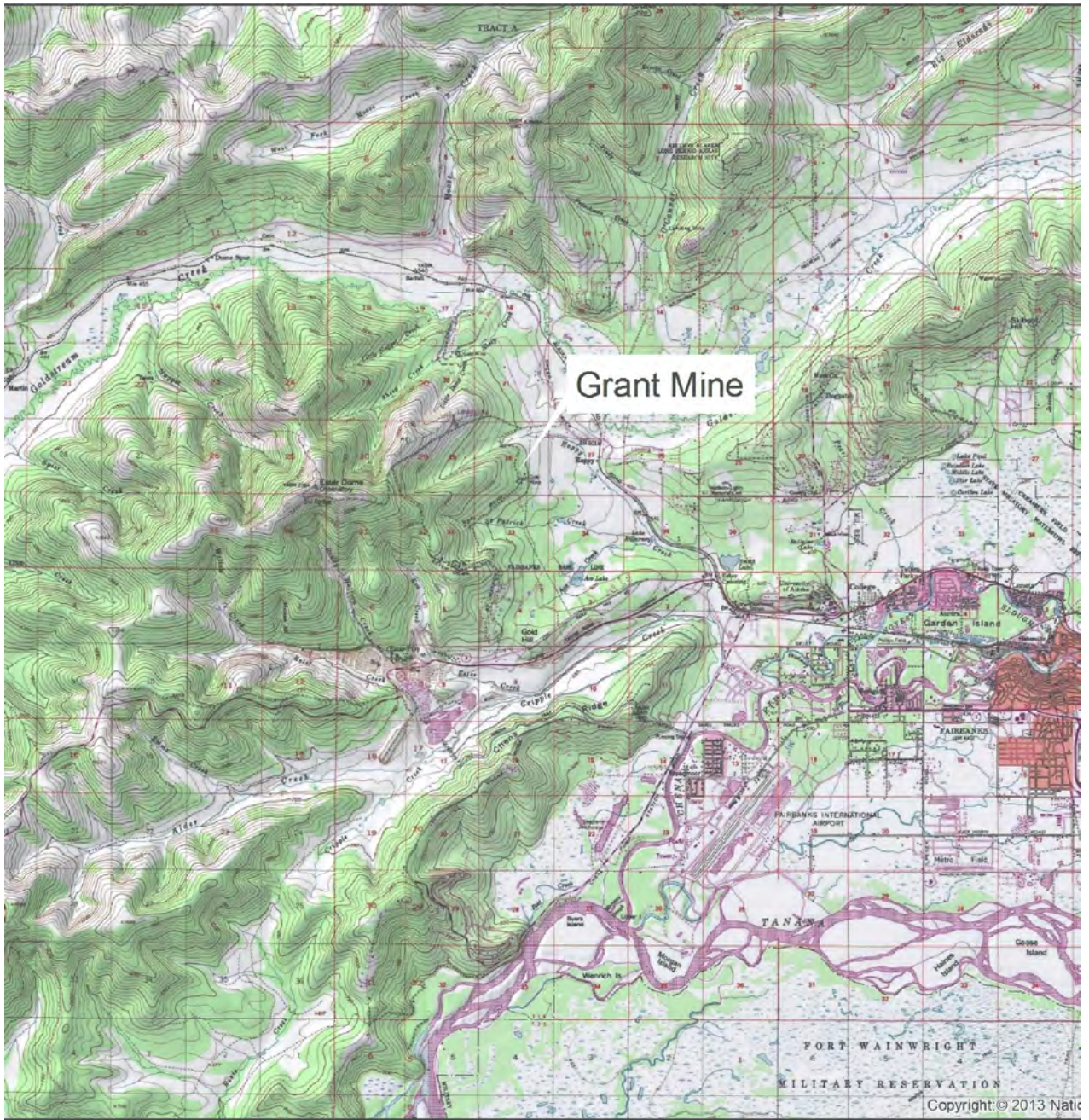
* Flag not defined

TABLE 2
GRANT MINE TAILINGS IMPOUNDMENT CLOSURE
2018 & 2019 GROUNDWATER SAMPLE RESULTS

Analytical Method	Analyte	ADEC Cleanup Level	Units	M-1	M-101	M-2	M-1	M-2	M-102	M1	M2	M202
				9/14/2018	9/14/2018	9/14/2018	6/20/2019	6/20/2019	6/20/2019	10/17/2019	10/17/2019	10/17/2019
SW9016	Cyanide (free CN-)	1.5	µg/L	<0.544	<0.544	<0.544	1.04 J	1.42 J	1.55 J	<0.544	<0.544	<0.544
SW6020A (Metals)	Antimony	7.8	µg/L	<1.50	<1.50	<1.50	—	—	—	—	—	—
	Arsenic	0.52	µg/L	61.5	65.1	196	—	—	—	—	—	—
	Barium	3,800	µg/L	42.8	44.8	12.2	—	—	—	—	—	—
	Cadmium	9.2	µg/L	<1.00	<1.00	<1.00	—	—	—	—	—	—
	Chromium	22,000	µg/L	<2.00	<2.00	<2.00	—	—	—	—	—	—
	Lead	15	µg/L	0.456 J	0.495 J	1.41	—	—	—	—	—	—
	Mercury	0.52	µg/L	0.249	0.237	<0.100	—	—	—	—	—	—
	Selenium	100	µg/L	<10.0	<10.0	<10.0	—	—	—	—	—	—
	Silver	94	µg/L	<1.00	<1.00	<1.00	—	—	—	—	—	—

Notes:

- ADEC cleanup levels from October 27, 2018 18 AAC 75.345 - Table C *Groundwater Cleanup Levels*.
- Sample *M-101* is a field-duplicate of sample *M-1*.
- Sample *M-102* is a field-duplicate of sample *M-2*.
- Sample *M202* is a field-duplicate of sample *M2*.
- µg/L micrograms per liter
- < Analyte not detected; result listed as less than the limit of detection (LOD).
- J Estimated concentration, detected greater than the LOD and less than the limit of quantitation (LOQ). Flag applied by the laboratory.
- Bold** Detected result is above the associated ADEC groundwater cleanup level.
- Analyte not requested.



1 Mile

Grant Mine Groundwater Assessment
 Ester Dome, Alaska

SITE LOCATION

January 2020

31-1-20094

SHANNON & WILSON, INC.
 GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Figure 1

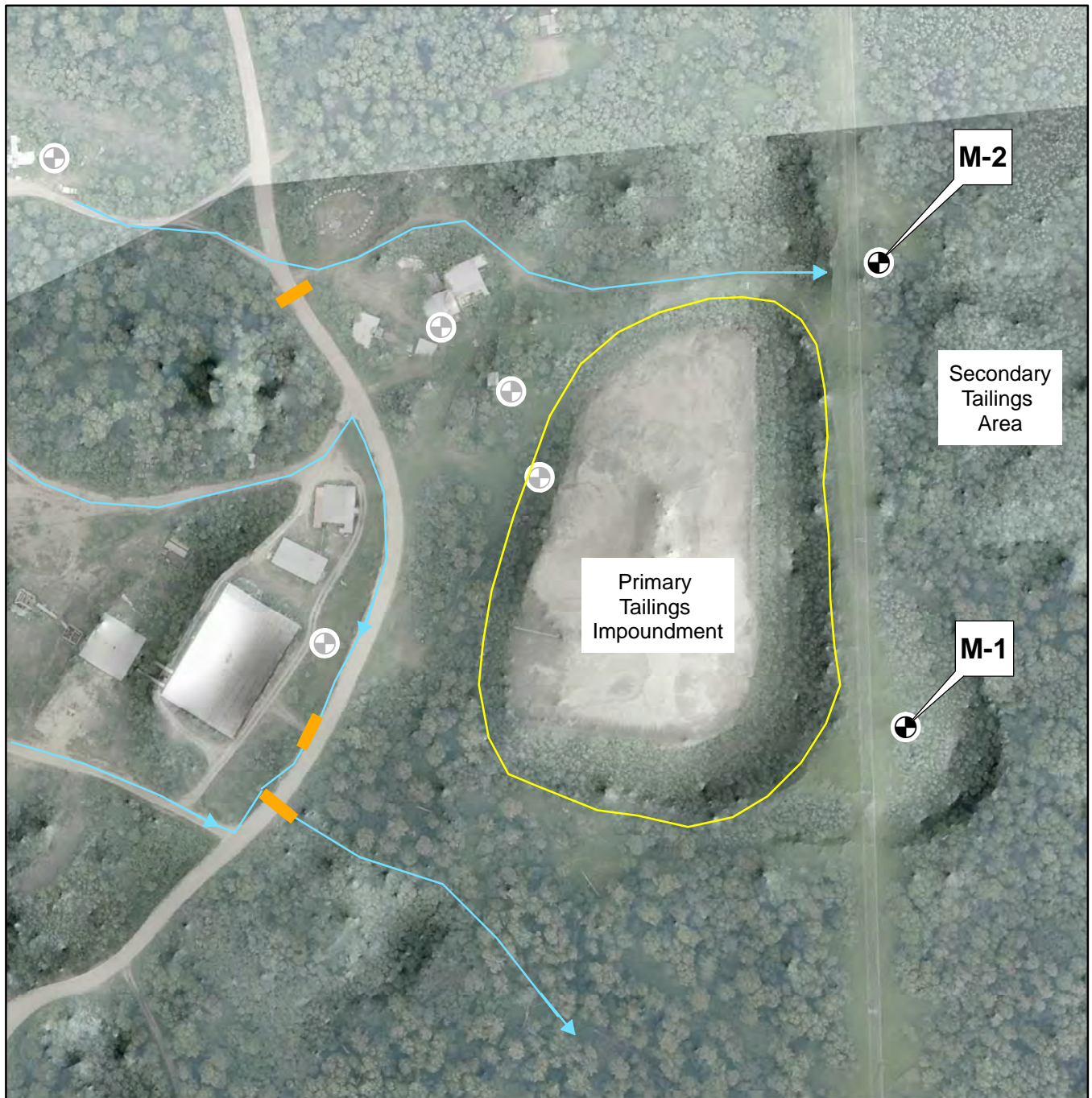
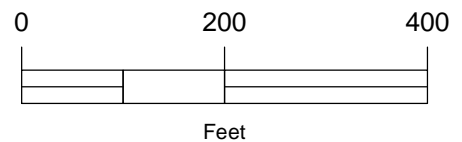






Image provided courtesy of Pictometry International 2012; hillshade courtesy of ADNOR.



LEGEND

-  Active Monitoring Well
-  Inactive Well
-  Culverts
-  Drainage



Grant Mine Groundwater Assessment
Ester Dome, Alaska

MONITORING WELL LOCATIONS

January 2020

31-1-20094

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Figure 2



ANALYTICAL REPORT

Lab Number:	L1949758
Client:	Shannon & Wilson, Inc. 2355 Hill Road Fairbanks, AK 99709
ATTN:	Mark S. Lockwood
Phone:	(907) 479-0600
Project Name:	GRANT MINE
Project Number:	20094
Report Date:	10/30/19

The original project report/data package is held by Alpha Analytical. This report/data package is paginated and should be reproduced only in its entirety. Alpha Analytical holds no responsibility for results and/or data that are not consistent with the original.

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NJ (MA935), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-17-00196).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com



Project Name: GRANT MINE
Project Number: 20094

Lab Number: L1949758
Report Date: 10/30/19

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1949758-01	M202	WATER	ESTER DOME, AK	10/17/19 16:23	10/23/19
L1949758-02	M2	WATER	ESTER DOME, AK	10/17/19 16:33	10/23/19
L1949758-03	M1	WATER	ESTER DOME, AK	10/17/19 15:14	10/23/19

Project Name: GRANT MINE
Project Number: 20094

Lab Number: L1949758
Report Date: 10/30/19

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively.

When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report, located directly after the Case Narrative. QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications.

Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

HOLD POLICY - For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Alpha Project Manager and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.

Project Name: GRANT MINE
Project Number: 20094

Lab Number: L1949758
Report Date: 10/30/19

Case Narrative (continued)

Report Submission

All non-detect (ND) or estimated concentrations (J-qualified) have been quantitated to the limit noted in the MDL column.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature:

 Caitlin Walukevich

Title: Technical Director/Representative

Date: 10/30/19

INORGANICS & MISCELLANEOUS

Project Name: GRANT MINE

Lab Number: L1949758

Project Number: 20094

Report Date: 10/30/19

SAMPLE RESULTS

Lab ID: L1949758-01

Date Collected: 10/17/19 16:23

Client ID: M202

Date Received: 10/23/19

Sample Location: ESTER DOME, AK

Field Prep: Not Specified

Sample Depth:

Matrix: Water

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Cyanide, Free	ND		ug/l	2.00	0.544	1	10/29/19 16:15	10/29/19 23:16	109,9016	AT



Project Name: GRANT MINE

Lab Number: L1949758

Project Number: 20094

Report Date: 10/30/19

SAMPLE RESULTS

Lab ID: L1949758-02

Date Collected: 10/17/19 16:33

Client ID: M2

Date Received: 10/23/19

Sample Location: ESTER DOME, AK

Field Prep: Not Specified

Sample Depth:

Matrix: Water

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Cyanide, Free	ND		ug/l	2.00	0.544	1	10/29/19 16:15	10/29/19 23:17	109,9016	AT



Project Name: GRANT MINE

Lab Number: L1949758

Project Number: 20094

Report Date: 10/30/19

SAMPLE RESULTS

Lab ID: L1949758-03

Date Collected: 10/17/19 15:14

Client ID: M1

Date Received: 10/23/19

Sample Location: ESTER DOME, AK

Field Prep: Not Specified

Sample Depth:

Matrix: Water

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Cyanide, Free	ND		ug/l	2.00	0.544	1	10/29/19 16:15	10/29/19 23:17	109,9016	AT



Project Name: GRANT MINE

Lab Number: L1949758

Project Number: 20094

Report Date: 10/30/19

Method Blank Analysis
Batch Quality Control

Parameter	Result Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab for sample(s): 01-03 Batch: WG1302055-1									
Cyanide, Free	ND	ug/l	2.00	0.544	1	10/29/19 16:15	10/29/19 23:12	109,9016	AT

Lab Control Sample Analysis

Batch Quality Control

Project Name: GRANT MINE

Lab Number: L1949758

Project Number: 20094

Report Date: 10/30/19

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-03 Batch: WG1302055-2								
Cyanide, Free	85		-		75-125	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: GRANT MINE

Lab Number: L1949758

Project Number: 20094

Report Date: 10/30/19

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	MSD Qual	MSD Found	MSD %Recovery	MSD Qual	Recovery Limits	RPD	RPD Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-03 QC Batch ID: WG1302055-3 QC Sample: L1949758-01 Client ID: M202												
Cyanide, Free	ND	50	37.9	76	-	-	-	-	70-130	-	-	20

Lab Duplicate Analysis

Batch Quality Control

Project Name: GRANT MINE

Project Number: 20094

Lab Number: L1949758

Report Date: 10/30/19

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-03 QC Batch ID: WG1302055-4 QC Sample: L1949758-01 Client ID: M202						
Cyanide, Free	ND	ND	ug/l	NC		20

Project Name: GRANT MINE

Project Number: 20094

Sample Receipt and Container Information

Were project specific reporting limits specified?

YES

Cooler Information**Cooler** **Custody Seal**

A Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L1949758-01A	Brown Plastic 120ml NaOH preserved	A	>12	>12	4.3	Y	Absent		FCN-9016(14)
L1949758-02A	Brown Plastic 120ml NaOH preserved	A	>12	>12	4.3	Y	Absent		FCN-9016(14)
L1949758-03A	Brown Plastic 120ml NaOH preserved	A	>12	>12	4.3	Y	Absent		FCN-9016(14)

Project Name: GRANT MINE
Project Number: 20094

Lab Number: L1949758
Report Date: 10/30/19

GLOSSARY

Acronyms

DL	- Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
EDL	- Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).
EMPC	- Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.
EPA	- Environmental Protection Agency.
LCS	- Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LCSD	- Laboratory Control Sample Duplicate: Refer to LCS.
LFB	- Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LOD	- Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
LOQ	- Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.) Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
MDL	- Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
MS	- Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.
MSD	- Matrix Spike Sample Duplicate: Refer to MS.
NA	- Not Applicable.
NC	- Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.
NDPA/DPA	- N-Nitrosodiphenylamine/Diphenylamine.
NI	- Not Ignitable.
NP	- Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.
RL	- Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
RPD	- Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.
SRM	- Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.
STLP	- Semi-dynamic Tank Leaching Procedure per EPA Method 1315.
TEF	- Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.
TEQ	- Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.
TIC	- Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Footnotes

Report Format: DU Report with 'J' Qualifiers



Project Name: GRANT MINE
Project Number: 20094

Lab Number: L1949758
Report Date: 10/30/19

- 1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1.8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Difference: With respect to Total Oxidizable Precursor (TOP) Assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total (5)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA and PFOS. If a 'Total' result is requested, the results of its individual components will also be reported.

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

- A** - Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.
- B** - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).
- C** - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.
- D** - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.
- E** - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.
- G** - The concentration may be biased high due to matrix interferences (i.e. co-elution) with non-target compound(s). The result should be considered estimated.
- H** - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.
- I** - The lower value for the two columns has been reported due to obvious interference.
- J** - Estimated value. The Target analyte concentration is below the quantitation limit (RL), but above the Method Detection Limit (MDL) or Estimated Detection Limit (EDL) for SPME-related analyses. This represents an estimated concentration for Tentatively Identified Compounds (TICs).
- M** - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.
- ND** - Not detected at the method detection limit (MDL) for the sample, or estimated detection limit (EDL) for SPME-related analyses.
- NJ** - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.
- P** - The RPD between the results for the two columns exceeds the method-specified criteria.
- Q** - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedances are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)
- R** - Analytical results are from sample re-analysis.
- RE** - Analytical results are from sample re-extraction.
- S** - Analytical results are from modified screening analysis.

Report Format: DU Report with 'J' Qualifiers



Project Name: GRANT MINE
Project Number: 20094

Lab Number: L1949758
Report Date: 10/30/19

REFERENCES

- 109 Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. Revision 0, June 2010.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.



Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility

EPA 624/624.1: m/p-xylene, o-xylene

EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.

EPA 8270D: NPW: Dimethylnaphthalene, 1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene, 1,4-Diphenylhydrazine.

SM4500: NPW: Amenable Cyanide; SCM: Total Phosphorus, TKN, NO₂, NO₃.

Mansfield Facility

SM 2540D: TSS

EPA 8082A: NPW: PCB: 1, 5, 31, 87, 101, 110, 141, 151, 153, 180, 183, 187.

EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene,

3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.

Biological Tissue Matrix: EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water

EPA 300.0: Chloride, Nitrate-N, Fluoride, Sulfate; **EPA 353.2:** Nitrate-N, Nitrite-N; **SM4500NO3-F:** Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE,**

EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B, SM4500NO2-B

EPA 332: Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.

Microbiology: SM9215B; SM9223-P/A, SM9223B-Colilert-QT, SM9222D.

Non-Potable Water

SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH: Ammonia-N and Kjeldahl-N, **EPA 350.1:**

Ammonia-N, **LACHAT 10-107-06-1-B:** Ammonia-N, **EPA 351.1, SM4500NO3-F, EPA 353.2:** Nitrate-N, **SM4500P-E, SM4500P-B, E, SM4500SO4-E,**

SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D, EPA 300: Chloride, Sulfate, Nitrate.

EPA 624.1: Volatile Halocarbons & Aromatics,

EPA 608.3: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs

EPA 625.1: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045:** PCB-Oil.

Microbiology: SM9223B-Colilert-QT; Enterolert-QT, SM9221E, EPA 1600, EPA 1603.

Mansfield Facility:

Drinking Water

EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn. **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1 Hg.**

EPA 522.

Non-Potable Water

EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.

EPA 200.8: Al, Sb, As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.

EPA 245.1 Hg.

SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

Laboratory Data Review Checklist

Completed By:

Ashley Jaramillo

Title:

Chemist

Date:

November 21, 2019

CS Report Name:

Grant Mine

Report Date:

October 30, 2019

Consultant Firm:

Shannon & Wilson, Inc.

Laboratory Name:

Alpha Analytical

Laboratory Report Number:

L1949758

ADEC File Number:

100.38.182

Hazard Identification Number:

731

1. Laboratory

a. Did an ADEC CS approved laboratory receive and perform all of the submitted sample analyses?

Yes No

Comments:

Analyses were performed by the Alpha Analytical laboratory in Westborough, MA. The laboratory is NELAP-certified.

b. If the samples were transferred to another “network” laboratory or sub-contracted to an alternate laboratory, was the laboratory performing the analyses ADEC CS approved?

Yes No

Comments:

N/A; the samples were not transferred to a “network” laboratory.

2. Chain of Custody (CoC)

a. CoC information completed, signed, and dated (including released/received by)?

Yes No

Comments:

The CoC was not properly relinquished prior to shipment of the samples.

b. Correct Analyses requested?

Yes No

Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (0° to 6° C)?

Yes No

Comments:

b. Sample preservation acceptable – acidified waters, Methanol preserved VOC soil (GRO, BTEX, Volatile Chlorinated Solvents, etc.)?

Yes No

Comments:

c. Sample condition documented – broken, leaking (Methanol), zero headspace (VOC vials)?

Yes No

Comments:

The sample receipt documentation notes that the samples arrived in acceptable condition.

d. If there were any discrepancies, were they documented? For example, incorrect sample containers/preservation, sample temperature outside of acceptable range, insufficient or missing samples, etc.?

Yes No

Comments:

The sample receipt form notes that there were no custody seals present on the sample cooler.

e. Data quality or usability affected?

Comments:

We reviewed the sample shipping documentation to verify that there were no irregularities regarding custody of the samples. The samples were collected by Shannon & Wilson, Inc. personnel on 10/17/2019 and remained in our custody until they were shipped to the analytical laboratory via FedEx Priority Overnight on 10/21/2019. The laboratory received the samples on the morning of 10/23/2019. The samples spent 1 full day in transit, which is the expected duration for the chosen method of shipment. For this reason, we are confident that custody was not breached.

4. Case Narrative

a. Present and understandable?

Yes No

Comments:

b. Discrepancies, errors, or QC failures identified by the lab?

Yes No

Comments:

There are no discrepancies, errors, or QC failures noted in the case narrative.

c. Were all corrective actions documented?

Yes No

Comments:

No corrective actions were required; see above.

d. What is the effect on data quality/usability according to the case narrative?

Comments:

The case narrative did not note an effect on data quality/usability.

5. Samples Results

a. Correct analyses performed/reported as requested on COC?

Yes No

Comments:

b. All applicable holding times met?

Yes No

Comments:

c. All soils reported on a dry weight basis?

Yes No

Comments:

N/A; soil samples were not submitted with this work order.

d. Are the reported LOQs less than the Cleanup Level or the minimum required detection level for the project?

Yes No

Comments:

e. Data quality or usability affected?

Yes No

Comments:

6. QC Samples

a. Method Blank

i. One method blank reported per matrix, analysis and 20 samples?

Yes No

Comments:

ii. All method blank results less than limit of quantitation (LOQ)?

Yes No

Comments:

iii. If above LOQ, what samples are affected?

Comments:

N/A; cyanide was not detected in the method blank sample.

iv. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

Yes No

Comments:

N/A; see above.

v. Data quality or usability affected?

Comments:

The data quality and/or usability is not affected; see above.

b. Laboratory Control Sample/Duplicate (LCS/LCSD)

i. Organics – One LCS/LCSD reported per matrix, analysis and 20 samples? (LCS/LCSD required per AK methods, LCS required per SW846)

 Yes No

Comments:

N/A; organics analyses were not requested for this work order.

ii. Metals/Inorganics – one LCS and one sample duplicate reported per matrix, analysis and 20 samples?

 Yes No

Comments:

An LCS, matrix spike (MS), and laboratory duplicate were reported for cyanide analysis.

iii. Accuracy – All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods: AK101 60%-120%, AK102 75%-125%, AK103 60%-120%; all other analyses see the laboratory QC pages)

 Yes No

Comments:

iv. Precision – All relative percent differences (RPD) reported and less than method or laboratory limits? And project specified DQOs, if applicable. RPD reported from LCS/LCSD, MS/MSD, and or sample/sample duplicate. (AK Petroleum methods 20%; all other analyses see the laboratory QC pages)

 Yes No

Comments:

An LCSD and an MSD were not analyzed with the sample batch. A laboratory duplicate sample was analyzed; however, the results were non-detect, therefore a RPD could not be calculated.

v. If %R or RPD is outside of acceptable limits, what samples are affected?

Comments:

Analytical accuracy was demonstrated to be within acceptable limits. The analytical precision could not be assessed because cyanide was not detected in the laboratory duplicate sample.

vi. Do the affected sample(s) have data flags? If so, are the data flags clearly defined?

 Yes No

Comments:

N/A; the sample results are not affected by analytical accuracy nor precision failures.

vii. Data quality or usability affected? (Use comment box to explain.)

Comments:

The data quality and/or usability is not affected; see above.

c. Surrogates – Organics Only

i. Are surrogate recoveries reported for organic analyses – field, QC and laboratory samples?

Yes No

Comments:

N/A; organics analyses were not requested with this work order.

ii. Accuracy – All percent recoveries (%R) reported and within method or laboratory limits? And project specified DQOs, if applicable. (AK Petroleum methods 50-150 %R; all other analyses see the laboratory report pages)

Yes No

Comments:

N/A; organics were not analyzed.

iii. Do the sample results with failed surrogate recoveries have data flags? If so, are the data flags clearly defined?

Yes No

Comments:

N/A; organics were not analyzed.

iv. Data quality or usability affected?

Comments:

The data quality and/or usability is not affected; see above.

d. Trip blank – Volatile analyses only (GRO, BTEX, Volatile Chlorinated Solvents, etc.): Water and Soil

i. One trip blank reported per matrix, analysis and for each cooler containing volatile samples? (If not, enter explanation below.)

Yes No

Comments:

Volatile analyses were not requested with this work order. A trip blank is therefore not required.

ii. Is the cooler used to transport the trip blank and VOA samples clearly indicated on the COC? (If not, a comment explaining why must be entered below)

Yes No

Comments:

N/A; volatiles were not analyzed.

iii. All results less than LOQ?

Yes No

Comments:

N/A; volatiles were not analyzed.

iv. If above LOQ, what samples are affected?

Comments:

None; see above.

v. Data quality or usability affected?

Comments:

The data quality and/or usability is not affected; see above.

e. Field Duplicate

i. One field duplicate submitted per matrix, analysis and 10 project samples?

Yes No

Comments:

ii. Submitted blind to lab?

Yes No

Comments:

The field duplicate sample samples *M-2* and *M-202* were submitted with this work order.

iii. Precision – All relative percent differences (RPD) less than specified DQOs?
(Recommended: 30% water, 50% soil)

$$\text{RPD (\%)} = \text{Absolute value of: } \frac{(R_1 - R_2)}{((R_1 + R_2)/2)} \times 100$$

Where R_1 = Sample Concentration
 R_2 = Field Duplicate Concentration

Yes No

Comments:

The RPD for the duplicate pair could not be calculated as both results were non-detect.

iv. Data quality or usability affected? (Use the comment box to explain why or why not.)

Comments:

The data quality and/or usability is not affected; see above.

f. Decontamination or Equipment Blank (If not applicable, a comment stating why must be entered below).

Yes No Not Applicable

Samples were collected with disposable equipment.

i. All results less than LOQ?

Yes No Comments:

N/A; an equipment blank was not submitted.

ii. If above LOQ, what samples are affected?

Comments:

N/A; an equipment blank was not submitted.

iii. Data quality or usability affected?

Comments:

The data quality and/or usability is not affected; see above.

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)

a. Defined and appropriate?

Yes No Comments:

Additional data flags/qualifiers are not required.