MOOSE CREEK PIPELINE RELEASE

MOOSE CREEK, ALASKA

2018 LOW GROUNDWATER MONITORING WORK PLAN

FINAL

NOVEMBER 2018

Prepared for:

Prepared by:

Signature of Qualified Environmental Professional
Responsible for Preparing the Work Plan:

Date: October 16, 2018

Contract No. SPE600-15-D-5003

Delivery Order SPE603-18-F-A0P7
ADEC Contaminated Sites Database File ID: 100.38.208

CES-AGVIQ of Alaska
1701 Shenandoah Avenue, NW
Roanoke, VA 24017

TABLE OF CONTENTS

TABLES IN TEXT

FIGURES

APPENDICES

ACRONYMS AND ABBREVIATIONS

AAC .... Alaska Administrative Code

ADEC .... Alaska Department of Environmental Conservation

AK .... Alaska Method

BTEX .... benzene, toluene, ethylbenzene, and xylenes

CES-AGVIQ ... CES-AGVIQ of Alaska

CSM .... Conceptual Site Model

DLA................. Defense Logistics Agency – Energy

DO .... dissolved oxygen

DRO .... diesel range organics

EAFB………… Eielson Air Force Base

EDB .... ethylene dibromide

GAC .... granular activated carbon

GRO .... gasoline range organics

L/min .... liters per minute

mg/L .... milligrams per liter

MNA................ Monitored Natural Attenuation

PFOA............... Perfluorooctanoic Acid

PFOS .... Perfluorooctane Sulfonate

PPE .... personal protective equipment

RRO................. residual range organic compounds

SGS.................. SGS North America, Inc.

SIM .... selective ion monitoring

USAF............... United States Air Force

VOC .... volatile organic compounds

1. INTRODUCTION

CES-AGVIQ of Alaska (CES-AGVIQ) has been contracted by the Defense Logistics Agency (DLA) – Energy (Contract Number SPE600-15-D-5003) to conduct groundwater monitoring and sampling activities at the Moose Creek Pipeline Release site (the Site) in Moose Creek, Alaska. This 2018 Low Groundwater Monitoring Work Plan presents the methods and approach for groundwater monitoring and sample analysis tasks requested by the Alaska Department of Environmental Conservation (ADEC).

1.1 Site Location and History

The Site is approximately 2 miles northwest of Eielson Air Force Base (EAFB), near the intersection of Baker Road and Moose Creek Avenue near Fairbanks, Alaska (**Figure 1).** The Site consists of approximately 5 acres that lies within a relatively flat spruce-birch forest with a thick undergrowth of vegetation between Moose Creek to the north, Garrison Slough to the east, and Piledriver Slough to the south (**Figure 2**). The Moose Creek Pipeline Release (Pipeline Milepost [MP] 20.3) is a historic fuel release that occurred in the mid-1980s that was discovered in 2003. The North Pole to EAFB pipeline was constructed in 1955 to deliver fuel from a marine port in Haines, Alaska to northern military installations throughout Alaska. The pipeline historically conveyed a variety of fuel petroleum hydrocarbons. The Site is identified on ADEC Contaminated Sites Database as Hazard ID 4327, File Number 100.38.208.

1.2 Site Background

The actual release date is unknown and was discovered during construction activities in 2003 on residential property. Initial site characterization activities were conducted in 2003 and 2004. In 2009, soil and groundwater sample analysis indicated concentrations of gasoline range organics (GRO), diesel range organics (DRO) and benzene, toluene, ethylbenzene, and xylenes (BTEX) concentrations were above ADEC applicable cleanup levels.

In 2011, eleven residential drinking water wells were sampled twice to evaluate off-site migration of dissolved petroleum hydrocarbons in groundwater. Results from the two sampling events indicated no petroleum hydrocarbon impact to adjacent residential drinking water wells above regulatory criteria. In addition, new monitoring wells were installed including sentinel wells. A soil-gas survey at one residence near the groundwater contaminant plume edge indicated no detectable concentrations.

In 2012 and 2013, additional site characterization activities were conducted along with two residential drinking water well sampling events, and further soil-gas survey of the suspected source area. In 2014, the results of a remediation feasibility study determined soil-vapor extraction and bioventing the best alternative to treat the suspected source area soil contamination. In 2015, a Decision Document was developed for the Site (DLA 2016). In July 2016, the Record of Decision for the Site was finalized by ADEC. The volume of fuel spilled was in excess of 20,000 gallons based on the volume of fuel currently estimated to be present in the unsaturated and saturated zones below the Site (DLA. 2016).

In October 2016, CES-AGVIQ conducted groundwater monitoring and sampling activities at all Site monitoring wells and collected tap water samples from three select residences. The 2016 findings and analytical results were found to be consistent with previous events (CES-AGVIQ. 2017). The estimated area of impact is approximately 3.4 acres.

In December 2017, CES-AGVIQ conducted groundwater monitoring and sampling activities at nine monitoring wells. Results were consistent, although lower concentrations of contaminants in groundwater were observed in 2017 compared to 2016 data (CES-AGVIQ. 2018).

1.3 Project Objectives

Groundwater monitoring will be conducted during low groundwater levels at nine monitoring wells. The analytical testing constituents will include the identified contaminants-of-concern. Site-specific monitored natural attenuation (MNA) parameters (sulfate, nitrate/nitrite, methane, dissolved iron and manganese, and total organic carbon) will be analyzed at four select wells.

Data quality objectives are defined as follows:

- Collecting accurate, precise and representative data for a low groundwater event
- Meeting 95% data completeness and usability goals
- Generating reproducible data
- Producing analytical results comparable to other low groundwater monitoring events (use same sampling techniques, follow same procedures)
- Achieving sensitivity necessary to support action levels
- Meeting regulatory and guidance requirements

1.4 Scope of Work

The planned 2018 field event will include groundwater monitoring and collection of groundwater samples for chemical analysis at nine wells: MW01, MW02, MW06, MW07, MW08, MW09, MW10, MW13, and MW15. Low groundwater levels, typical during the fall and persistent throughout winter, will be confirmed by gauging depth to groundwater in wells MW-01, MW-02, and MW-06 using an oil-water interface probe and downloading data from in-well Leveloggers® before implementation of field activities at Moose Creek. Groundwater samples will be submitted for analyses as stated in the *Decision Document* (DLA. 2016), and the 2017 groundwater monitoring event (CES-AGVIQ. 2018) for the Site contaminants of concern. In addition, wells

MW-01, MW-06, MW-08 and MW-10 will be analyzed for MNA parameters to evaluate naturally occurring processes at the Site that contribute to the reduction of contaminant concentrations over time.

1.5 Regulatory Framework

Based on site characterization results and previous monitoring events, the contaminants of concern include GRO, DRO, residual range organics (RRO), benzene, toluene, lead, and 1,2-dibromoethane (ethylene dibromide-[EDB]). All groundwater monitoring and sampling activities will be conducted in accordance with Title 18 of the Alaska Administrative Code (AAC), Chapter 75-*Oil and Other Hazardous Substances Pollution Control* regulations (18 AAC 75). The objectives and approach incorporate information presented in the *Decision Document* (DLA. 2016), the 2015 groundwater monitoring event (ERM. 2015), and ADEC regulations and guidance:

- Monitoring Well Guidance (ADEC. 2013)
- 18 AAC 70 *Water Quality Standards* (ADEC. 2018)
- Guidance on Developing Conceptual Site Models (ADEC. 2017a)
- Site Characterization Work Plan and Reporting Guidance for Investigation of Contaminated Sites (ADEC. 2017b)
- Technical Memorandum: Data Quality Objectives, Checklists, Quality Assurance Requirements for Laboratory Data, and Sample Handling (ADEC. 2017c)
- Underground Storage Tank Procedures Manual (ADEC. 2017d)
- Laboratory Data Review Checklist (ADEC. 2017e)
- Field Sampling Guidance (ADEC. 2017f)
- 18 AAC 75 Oil and Other Hazardous Substances Pollution Control (ADEC. 2017g)
- 18 AAC 78 Underground Storage Tanks (ADEC. 2017h)

The persons preparing and approving this work plan, assessing the data quality and overseeing the implementation of the work plan meet the ADEC definition of "Qualified Environmental Professional" (ADEC. 2017g). The persons performing the collection of field samples and field data meet the ADEC definition of "Qualified Sampler" (ADEC. 2017g). The resumes of the project staff are provided in **Appendix A**.

Analytical groundwater results will be compared against ADEC cleanup levels set forth in 18 AAC 75.345; Table C (ADEC. 2017g) and listed in **Table 1-1**.

Table 1-1: Groundwater Cleanup Levels

Chemical Name	Groundwater 18 AAC 75 milligrams per liter (mg/L)
Gasoline Range Organics (GRO)	2.2
Diesel Range Organics (DRO)	1.5
Residual Range Organics (RRO)	1.1
Benzene	0.0046
Toluene	1.1
Ethylbenzene	0.015
Xylenes	0.19
Ethylene dibromide (EDB)	0.000075
Lead	0.015

1.6 Conceptual Site Model

Conceptual site models (CSM) presented within the *2017 Moose Creek Pipeline Release Drinking Water and Groundwater Monitoring Report* (CES-AGVIQ. 2017), along with the graphical and scoping forms are included as **Appendix B**. The CSM will be updated to include changes in any site conditions noted during sampling events per ADEC *Guidance on Developing Conceptual Site Models* (ADEC. 2017a).

2. GROUNDWATER MONITORING AND SAMPLING

Groundwater monitoring and sampling activities will be conducted at nine site wells. Groundwater samples will be analyzed for GRO, DRO/RRO, BTEX, lead, and EDB. Four wells (MW-01, MW-06, MW-08, and MW-10) will also be analyzed for MNA parameters (sulfate, nitrate/nitrite, methane, total organic carbon, dissolved iron, and dissolved manganese). Groundwater monitoring will occur during the expected low groundwater elevations in order to produce results comparable to past and future sampling events. Contaminant concentrations will be evaluated against 18 AAC 75 cleanup criteria (ADEC. 2017g) to support future decisions for the Site. The nine wells selected for sampling during the 2018 low groundwater monitoring event are presented in **Figure 3**.

2.1 Groundwater Monitoring Procedure

Groundwater levels will be confirmed to be low by gauging depth to water in nine select wells and downloading accumulated data from in-well Leveloggers® in four wells. Site-wide monitoring of depth to groundwater was performed from 2011 through 2014 that indicated a northwest flow direction and relatively flat gradient to be consistent over time. Three Leveloggers® and a Barologger® for groundwater elevation monitoring are currently located in wells MW-01, MW-02, MW-06, and MW-10. The pressure transducers will be retrieved, data downloaded, and then redeployed as part of the field effort in accordance with manufacturer recommendations (**Appendix C**). The wire-line deployment technique and optical reader Personal Computer communication method will be utilized. The pressure transducers will remain in the wells year round for future monitoring events. Groundwater elevation data will continue to be collected with dedicated Leveloggers® to observe general groundwater fluctuations and to evaluate optimal timing of future groundwater monitoring events.

2.2 Monitoring Well Maintenance

CES-AGVIQ will perform well maintenance, if necessary, on frost-jacked impaired wells using a pipe-cutter or appropriate tools to allow well closure and security.

2.3 Groundwater Sampling Procedure

Analytical sample collection will be performed using a submersible pump (Proactive Mini-typhoon™) consistent with the previous low groundwater monitoring events, manufacturer recommendations, and ADEC's *Field Sampling Guidance* (ADEC. 2017f). The nine monitoring wells to be sampled include: MW-01, MW-02, MW-06, MW-07, MW-08, MW-09, MW-10, MW-13, and MW-15. A Groundwater Sampling Form will be used to document field activities at each well. Information to be noted on the Groundwater Sampling Form (**Appendix D**) include date, well identification, time of sample collection, analyses requested, depth to groundwater, and general water quality parameters (temperature, pH, conductivity, turbidity). The water quality parameters will be measured during well purging. The CES-AGVIQ project staff conducting the sampling event will include a qualified environmental professional (Chris Locke) and a qualified sampler (Brandon Maloney) in accordance with 18 AAC 75.333. Additionally, the field project will be supervised by a qualified environmental professional in the Agviq Anchorage office. The ADEC qualified environmental professionals and sampler resumes are included as **Appendix A**.

Groundwater sampling activities will be conducted by visiting wells less likely to be impacted first, then onto known impacted wells. Wells least likely to be contaminated (MW-02, MW-07, and MW-08) will be sampled first. The monitoring wells will be purged and sampled using low-flow methodology with a submersible pump. These methods involve purging at flow rates low enough (between 0.1 L/min and 0.5 L/min) to prevent well drawdown from exceeding 0.3 feet during purging and sampling. Water quality parameters will be measured using a YSI 556 multi-parameter meter and a flow-through cell. After water quality parameter stabilization the flow-through cell will be disconnected and samples will be collected directly from the pump discharge hose. The water quality parameters are considered stable when three successive readings (or four if using temperature) are within the following criteria (ADEC. 2017f):

- ± for temperature (minimum of + 0.2° C)
- ± 0.1 for pH
- ± 3% for conductivity
- ± 10 mv for redox potential
- ± 10% for dissolved oxygen (DO)
- ± 10% for turbidity

The flow rate during sampling will remain the same as the purging flow rate.

2.4 Sample Naming

Groundwater samples will be named as follows:

- Year (2 digits: 18 for 2018)
- Hyphen
- MC (Moose Creek)
- Hyphen
- MW (monitoring well)
- Hyphen
- Monitoring well ID
- Example: 18-MC-MW-01 for groundwater sample from monitoring well 01
- Duplicates will be submitted to the project laboratory blind
- Example: 18-MC-MWX-1.

2.5 Analytical Methods

Groundwater samples will be submitted to SGS North America, Inc. (SGS) analytical laboratory in Fairbanks, Alaska on a standard turnaround time basis. All samples will be secured, labeled, packed, and transported under chain of custody procedures to SGS by CES-Agviq staff.

Groundwater samples will be submitted to SGS for the following analyses:

- GRO by Alaska Method (AK) 101,
- DRO/RRO by AK102/103,
- EDB by U.S. Environmental Protection Agency (EPA) Method 8260B,
- BTEX by EPA Method 8260B, and
- Total lead by EPA Method SW6020A.

Groundwater samples from wells MW-01, MW-06, MW-08 and MW-10 will also be analyzed for MNA parameters. These samples will be submitted for the following additional analyses:

- Nitrate/Nitrite by EPA Method SN4500NO3-F,
- Dissolved Iron/Dissolved Manganese by EPA Method SW6020A,
- Sulfate by EPA 300.0,
- Methane by RSK175, and
- Total organic carbon by SM5310B.

Nine discrete groundwater samples for the specified analytes will be collected during the field event including daily field duplicates and trip blanks per each GRO, BTEX, EDB allotment and one equipment blank. Per ADEC *Field Sampling Guidance* (ADEC. 2017f), one duplicate per day is required. No duplicates will accompany the MNA samples. No matrix spike/matrix spike duplicate samples will be submitted for any analyte based on previously observed very limited matrix interference (**Table 2-1**). The dissolved phase iron and manganese sample aliquots for the MNA parameters will be filtered in the field.

2.6 Decontamination Procedures

Following sample collection, all pieces of reusable sampling equipment will be decontaminated with Alconox© and double rinsed with deionized water. Decontamination water will be containerized and treated onsite as described in Section 3.

2.7 Quality Assurance/Quality Control

The SGS laboratory will generate a Level II data report for sample delivery group to include the information as defined by ADEC's Technical Memorandum – *Data Quality Objectives, Checklists, Quality Assurance Requirements for Laboratory Data, and Sample Handling* (ADEC 2017c). A quality assurance summary will be generated after ADEC checklists are completed for the reports based on the Level II data review.

Table 2-1: Analytical Methods

Analyte	Method	Container	Pres.	Hold Time	Primary	Dup	TB	EB
DRO/RRO	AK102/AK103 SV	(2) 250 mL amber bottles	HCl	14 days	9	3		1
GRO	AK101	(3) 40 mL vials[2]	HCl	14 days	9	3	3[3]	1
BTEX	SW SW8260B	(3) 40 mL vials[2]	HCl	14 days	9	3	3[3]	1
EDB	SW SW8260B	(3) 40 mL vials[2]	HCl	14 days	9	3	3[3]	1
Total Lead[1]	SW 6020A	250 mL poly	HNO3	6 months	9	3		1
Nitrate/Nitrite	SM4500NO3-F	250 mL poly	H_2SO_4	28 days	4			
Dissolved Iron	SW6020A	250 mL poly	HNO3	6 months	4			
Dissolved Manganese		250 mL poly	HNO3	6 months	4			
Sulfate	EPA 300.0	250 mL poly		14 days	4			
Methane	RSK 175	(3) 40 mL vials[2]	HCl	14 days	4			
Total Organic Carbon	SM5310-B	250 mL amber bottles	HCl	28 days	4			

Notes:
SV = Small Volume
[1] ADEC cleanup level for lead is based on total lead. Dissolved lead (filtered) sampling is not planned.
[2] Septumated, Teflon lined lid
[3] To be determined based on number of shipments including BTEX, EDB, and GRO coolers. Assume 3 shipments.
Pres. – Preservation
Dup – Duplicate
TB –Trip Blank
EB – Equipment Blank

A review of the analytical data, focusing on usability, sample handling and chain-of-custody documentation, hold time compliance, field quality control (trip blanks and field duplicates), laboratory quality control (method blanks, laboratory control samples, laboratory control sample duplicates, surrogates), method reporting limits, and completeness will be performed. The data review will meet the requirements defined by ADEC. 2017c.

2.7.1 Analytical Reporting

The information provided with the Technical Report, will include as an appendix the analytical data reports, chain-of-custody records with all signatures, case narratives, and the completed ADEC checklists (ADEC. 2017e). The summary review of the precision, accuracy, representativeness, comparability, completeness and sensitivity parameters for each method and matrix will be included in the text of the report and the quality assurance summary. In addition, the report will also include tables that summarize the results for all samples to include the data quality flags. The laboratory will maintain the raw analytical data for 10 years and will request permission form CES-AGVIQ before any data is destroyed.

3. MANAGEMENT OF INVESTIGATION DERIVED WASTE

Investigation-derived waste will include purge and decontamination water associated with groundwater monitoring and sampling, personal protective equipment (PPE) and used sampling materials. Purge and decontamination water (approximately 50 gallons total) associated with 2018 groundwater monitoring and sampling will be temporarily placed into 5-gallon buckets. Well purge and decontamination water will be checked for sheen. Lacking sheen, purge and decontamination water will be treated with granular activated carbon (GAC) and containerized into a 55-gallon drum pending characterization. If present, sheen will be removed with sorbent material prior to GAC treatment. The spent GAC filtration unit and post treatment groundwater will be analyzed for Perfluoroctante Sulfonate (PFOS) and Perfluoroctanic Acid (PFOA) and used with analytical data collected from the monitoring wells to complete a waste characterization. Following completion of the waste characterization process, a properly executed ADEC *Authorization to Transport* form will be submitted for review and approval prior to offsite transportation and disposal by NRC Alaska. Disposable PPE, disposable sampling materials, and sorbent pads will be disposed at the Fairbanks North Star Borough Landfill.

4. TECHNICAL REPORT

The technical report will include a description of site conditions, results of the groundwater monitoring, data quality assessment, documentation and photographs, findings, assumptions and recommendations for future activities.

5. FIELD SCHEDULE

The 2018 groundwater monitoring and sampling event will commence following the review and approval of this work plan. The technical report will be prepared following receipt of all analytical data received from SGS and the data validation has been completed. The field effort is planned for late September 2018.

6. REFERENCES

Alaska Department of Environmental Conservation (ADEC). 2018. 18 Alaska Administrative Code (AAC) 70, *Water Quality Standards*. As amended through April 6, 2018.

ADEC. 2017a. Guidance on Developing Conceptual Site Models January 2017.

ADEC. 2017b. Site Characterization Work Plan and Reporting Guidance for Investigation of Contaminated Sites. March 2017.

ADEC. 2017c. Technical Memorandum. Data Quality Objectives, Checklists, Quality Assurance Requirements for Laboratory Data, and Sample Handling. March 2017.

ADEC. 2017d. Underground Storage Tank Procedures Manual. March 2017.

ADEC. 2017e. Laboratory Data Review Checklist. July 2017.

ADEC. 2017f. Field Sampling Guidance. August 2017.

ADEC. 2017g. 18 AAC 75, *Oil and Other Hazardous Substances Pollution Control*. As amended through November 2017.

ADEC. 2017h. 18 AAC 78 *Underground Storage Tanks.* As amended through November 2017.

ADEC. 2013. *Monitoring Well Guidance*. September 2013.

CES-AGVIQ. 2017. Moose Creek Pipeline Release Drinking Water and Groundwater Monitoring Report-2016. July 21, 2017.

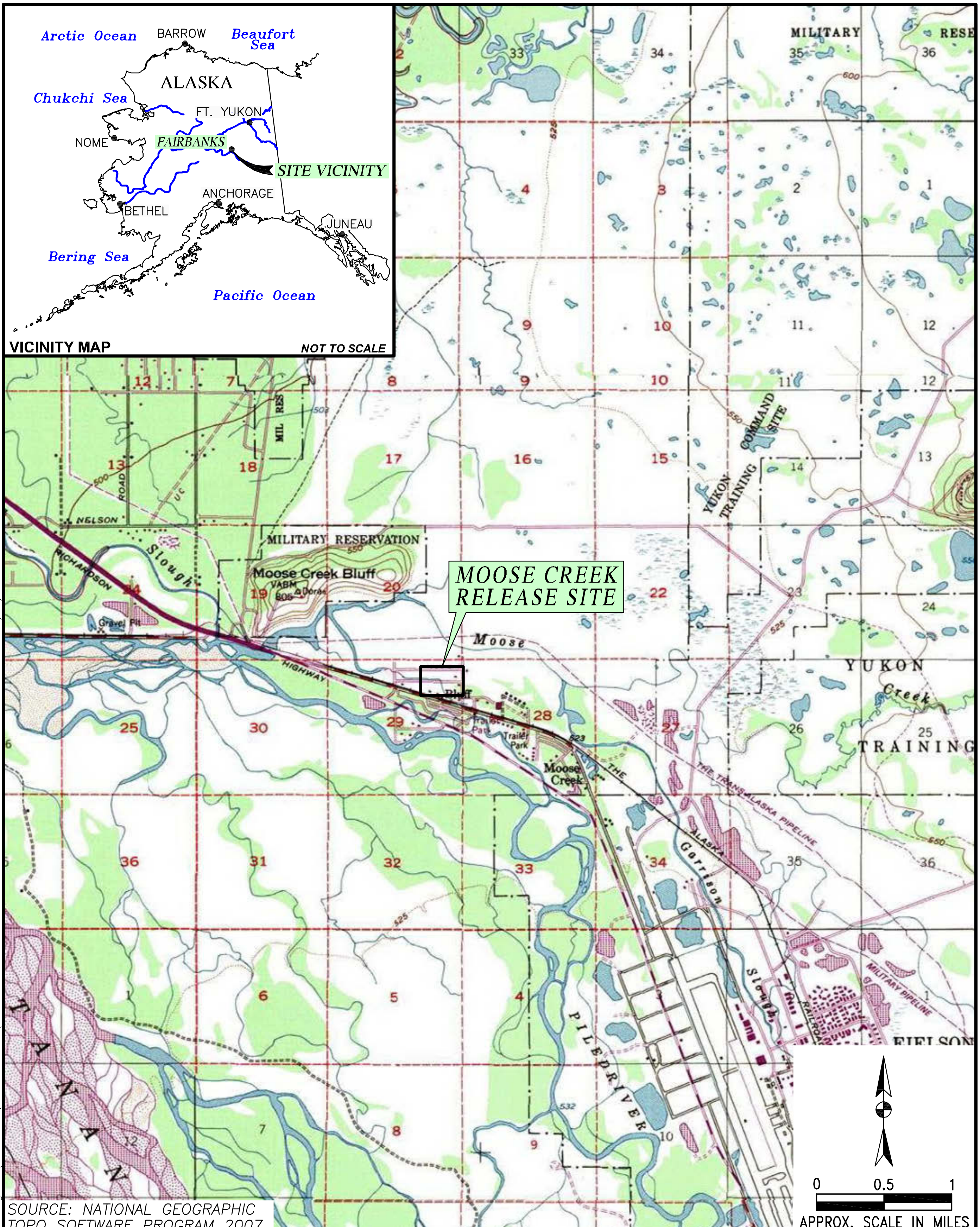
CES-AGVIQ. 2018. Moose Creek Pipeline Release Groundwater Monitoring Report-2017. April 11, 2018.

Defense Logistics Agency (DLA). 2016. Decision Document for Moose Creek Pipeline Release – Moose Creek, Alaska. ADEC File No. 100.38.208, March 15, 2016.

Environmental Resources Management (ERM). 2015. *Fiscal Year 2015 Monitoring Report, Moose Creek, Alaska*. October 2015.

OASIS. 2013. Fiscal Year 2012 Groundwater Assessment – Site Characterization Report, Moose Creek, Alaska. August 2013.

FIGURES



PATH: 18 Dwgs\18 Agvik\Eielson\18 Moose\18 MC GWM FILE: 4018-MC-GWM-F1.DWG PLOTTED: 9/1/18.

DATE: SEPTEMBER 2018 CHKD: W.L. DRAWN: C.E.H. PROJ. No.: 4118	**SITE LOCATION MAP** DEFENSE LOGISTICS AGENCY – ENERGY MOOSE CREEK PIPELINE RELEASE Eielson AFB, Alaska	CES-AGVIQ OF ALASKA	**FIGURE** **1**

DATE: SEPTEMBER 2018 CHKD: W.L. DRAWN: C.E.H. PROJ. No.: 4118	**SITE PLAN** DEFENSE LOGISTICS AGENCY – ENERGY MOOSE CREEK PIPELINE RELEASE Eielson AFB, Alaska	CES-AGVIQ OF ALASKA	**FIGURE** **2**

PATH: 18 Dwgs\18 Agvik\Eielson\18 Moose\18 MC GWM FILE: 4018-MC-GWM-F2.DWG PLOTTED: 9/1/18.

PATH: 18 Dwgs\18 Agvik\Eielson\18 Moose\18 MC GWM FILE: 4018-MC-GWM-F3.DWG PLOTTED: 9/1/18.

DATE: SEPTEMBER 2018 CHKD: W.L. DRAWN: C.E.H. PROJ. No.: 4118	**2018 GROUNDWATER SAMPLING LOCATIONS** DEFENSE LOGISTICS AGENCY – ENERGY MOOSE CREEK PIPELINE RELEASE Eielson AFB, Alaska	CES-AGVIQ OF ALASKA	FIGURE 3

APPENDIX A: RESUMES

Daniel J. Fisher — Project Manager

EDUCATION
- 2006, BS, Environmental Science – Chemical Emphasis, Northern Michigan University

TRAINING
- OSHA HAZWOPER Supervisory Training
- API Worksafe Certified
- e-Railsafe Certified
- First Aid/ CPR/ AED
- OSHA Excavation Competent Person
- Confined Space Entry
- Loss Prevention Training
- Hazard Communication

PROFESSIONAL SUMMARY
Mr. Fisher is a project manager with nearly ten years of experience in environmental consulting and contracting. Mr. Fisher's education includes a Bachelor of Science degree in Environmental Science with a Chemical Emphasis from Northern Michigan University. Mr. Fishers background includes extensive experience in the environmental consulting and construction field, particularly soil and groundwater assessment, characterization, and remediation at sites throughout the United States. Mr. Fisher has worked to characterize and remediate sites contaminated with chlorinated solvents, petroleum compounds ranging the entire carbon spectrum from heavy fuel oils to gasolines, light and dense non-aqueous phase liquids, nitrates, and metals.

Mr. Fisher has directed and managed environmental investigation at hundreds of petroleum-contaminated sites located throughout the United States. He has designed and implemented corrective actions at over 100 sites with soil and/or groundwater contamination, including Department of Defense facilities. Further, Mr. Fisher has provided reliable client support in response to emergency health and safety issues, serving as the emergency response point-of-contact to facilities on-site directives and protocol in response to petroleum discharge incidents.

Mr. Fisher is intimately familiar with the environmental regulations that govern chemical and petroleum products and routinely works closely with both State and Federal regulators to coordinate and expedite corrective action activities and pursue a "no further action" status in a judicious manner. He also is proficient with an array of methods and techniques available to address environmental assessment and remediation.

PROFESSIONAL EXPERIENCE
- **Division Manager, Crawford Environmental Services, Inc., 10/2007 - Present**
  Key Projects:
  - **Operations Manager, Defense Logistics Agency – Energy, Defense Fuels Support Points – Craney Island / Yorktown, VA, Charleston, SC, Savannah, GA**
    Mr. Fisher serves as the Operations Manager for environmental services contracts at DFSP-Craney Island / Yorktown, DFSP-Charleston, and DFSP Hunter Army Airfield. To date, the

contract duties have included management of seven independent remedial systems, remedial system optimization, manual free product recovery, quarterly / semi-annual sampling events, corrective action plan preparation and implementation, Discharge Monitoring in accordance with State Regulations, and assessment of dissolved- and free-phase petroleum plumes.

- **Lead Project Manager, URS Group - Shaw Air Force Base, In-Situ Chemical Oxidation & Ozone System Installations and Horizontal Drilling and System Trenching, Sumter, South Carolina**
  Mr. Fisher served as the lead project manager for the installation of (8) Ozone/Peroxone injection systems at (7) separate Areas of Concern (AOC) at Shaw Air Force Base. The peroxone systems were connected to 265 injection wells. Directional boring and conventional trenching was employed to install an estimated 28,000 linear feet of large-diameter HDPE piping and (30) concrete well vaults. In addition, the existing groundwater treatment plant was modified to facilitate re-injection of the treated effluent at a rate of 45-gallons per minute (GPM).

- **Project Manager, VA Department of Environmental Quality, Remediation & Assessment of Contaminated Sites, Various Sites Statewide, Virginia**
  Managed for 6.0 years the successful execution of contracts valued in excess of $2 million in various regions throughout Virginia. Responsible for work plan development, prior pre-approval package preparation and submittal, remedial system design & installation, cost control, final peer review of deliverables, regulatory correspondent and recommendations to the project stakeholders regarding the disposition of the property of concern.

- **Field Manager, URS Corporation / Shell Petroleum, Petroleum Impacted Soil Excavation and Surfactant Enhanced Product Recovery – North Charleston, South Carolina**
  Mr. Fisher served as the field manager associated with the the excavation, hauling and proper disposal of 1,600-cubic yards of impacted soil, dewatering and treatment of approximately 29,000-gallons of petroleum impacted groundwater, and installation and compaction of 1,600-cubic yards of nutrient amended native backfill. Following excavation activities, Mr. Fisher provided support to URS associated with the injection and subsequent extraction of approximately 12,000-gallons of surfactant enhanced potable water to address remaining free product thicknesses.

- **Site Superintendent, ARCADIS-U.S./Marathon Petroleum, Dissolved Oxygen Reinjection System and Soil Vapor Extraction (SVE / Air Sparging (AS) System Installation – Former Marathon Fuel Terminal, North Charleston, South Carolina**
  Mr. Fisher served as the Site Superintendent for the installation of a groundwater extraction and re-injection system at the former Marathon Bulk Petroleum Terminal in North Charleston. In addition, Mr. Fisher assisted with the design and managed the installation of a SVE and Air Sparge remedial system.

- **Lead Project Manager, SCDHEC, Performance-Based Remediation Contract(s) - Various Sites Statewide, South Carolina:**
  Mr. Fisher served as the Lead Project Manager for the investigation, assessment and remediation of various petroleum-impacted properties. Responsible for remedial design/build

and PBR-driven corrective actions to achieve milestone performance objectives at various sites across South Carolina. Remedial techniques utilized to date include; dual-phase extraction, soil vapor extraction (SVE) / Air Sparging (AS), and in-situ chemical oxidation.

- **Field Engineer, Mobile Remediation System Operation, Various CONUS Locations**
  Mr. Fisher designed and constructed a trailer-mounted remediation system to treat petroleum-impacted soils and groundwater including a dual-phase liquid-ring pump, air/water phase separator, oil/water separator, stackable tray air stripper, and granular activated carbon filtration units. Mr. Fisher managed and performed over 15 feasibility/pilot studies ranging from 36 to 240-hours in duration. Episodic, short-term events have been performed as rapid, free-product recovery measures and/or full-scale feasibility studies to assess the viability of the respective remedial techniques for remediation of the subject site. Performed all data extrapolation to estimate contaminant mass removal rates.

- **Field Manager, Portsmouth Redevelopment and Housing Authority - Soil Remediation at 1404 South Street - Portsmouth, Virginia**
  Mr. Fisher managed the excavation and proper off-site disposal of approximately 1,600-cubic yards of petroleum-impacted soil. The extents of the excavation measured approximately 5,800-square feet (SQFT) with an average depth of approximately 11.0-feet below the ground surface. Mr. Fisher designed and implemented a custom on-site dewatering system to reach the targeted excavation depth of five feet below the static water level. During excavation activities, Mr. Fisher removed four unknown USTs that were not discovered during the previous site characterization activities performed by another consultant.

- **Lead Project Manager, ARCADIS-U.S. / USACE, Joint Base McGuire-Dix-Lakehurst – SVE / AS Remedial System Installation at (3) Areas of Concern – Wrightstown, New Jersey**
  Mr. Fisher served as the Lead Project Manager for the installation of groundwater treatment systems at three areas of concern (AOCs) located at Joint Base McGuire-Dix-Lakehurst. Activities performed at each AOC are described below:
  Site TU019A – The subject AOC consists of an undeveloped parcel formerly maintaining a petroleum distribution station. Remedial system installation activities included the excavation of approximately 400 linear feet (LF) of trenchline, HDPE pipe fusion and installation of approximately 1,470 LF of 1.0" pipe and 1,100 LF of 2.0" pipe. CES completed the infrastructure to (9) SVE wells and (12) AS wells and constructed a compacted gravel staging area measuring approximately 2,700 square feet. Following construction activities, the impacted area was graded and former site conditions were restored with a native grass seed blend. Of note, Mr. Fisher initiated a "Stop Work" following the discovery of suspected Unexploded Ordnance (UXO) during trenching activities. Site work was temporarily suspended until a UXO Technician mobilized to the site for assessment prior to further excavation activities. Despite delays encountered due to the presence of munitions and explosives of concern (MEC), all construction activities were completed one week ahead of schedule and within the projected budget.
  Site TU970 – The subject AOC consists of a base recreation center formerly operated as a petroleum distribution station. Remedial system installation activities consisted of saw cutting approximately 550 LF of asphalt pavement, excavation of approximately 275 LF of

trenchline, HDPE pipe fusion and installation of approximately 890 LF of 1.0" pipe and 230 LF of 2.0" pipe. CES completed the infrastructure to (3) SVE wells and (9) AS wells and constructed a compacted gravel staging area measuring approximately 1,800 square feet. Following construction activities, former asphalt surface conditions were restored in accordance with USACE standards and the site was re-opened to the public. Remedial construction activities were completed two weeks ahead of schedule and within the projected budget.

Site NW044 – The subject AOC consists of a staging area for Army National Guard Equipment and formerly operated as a petroleum distribution station. Remedial system installation activities consisted of saw cutting approximately 950 LF of asphalt pavement, excavation of approximately 475 LF of trenchline, HDPE pipe fusion and installation of approximately 1,270 LF of 1.0" pipe and 270 LF of 2.0" pipe. CES completed the infrastructure to (3) SVE wells and (8) AS wells. Following construction activities, former asphalt surface conditions were restored in accordance with USACE standards and the site was re-opened to the National Guard. Remedial construction activities were completed one week ahead of schedule and within the projected budget.

- **Field Manager, ARCADIS-U.S., Construction and Installation of a Biosparge System Associated with the SWMU 26 area of Fort Stewart, Georgia**
  Field Manager of the design / build of a biosparge remedial enclosure to include a 20-horsepower rotary claw air compressor. The scope of work also included trenching to 17 one-inch diameter biosparge wells, installation of dedicated CPVC conduits and startup assistance.

Darrin Lawless — Senior Program Manager

EDUCATION

- M.S. Project Management, University of Alaska Anchorage, 2017
- B.S. Biological Sciences, University of Alaska Anchorage, 1992
- A.A. General Sciences, University of Alaska Anchorage, 1988

TRAINING

- OSHA HAZWOPER
- OSHA Site Supervisor
- DOT/IATA Shipping Hazmat
- RCRA Hazardous Waste Management
- First Aid/ CPR/ AED
- Contractor Management
- Subsurface Clearance
- Hazard Communication
- 16-hour UAA Health and Safety for Oil Field and Chemical Process Workers

FIELDS OF CONFIDENCE

- EPCRA SARA Title III Reporting
- Environmental training for site investigation, sample screening and analysis, laboratory methods selection, sample collection, and reporting
- Participant in ICS drill preparation, event participation, and debriefing
- ADEC Qualified Sampler since 1993, utilized regulatory methods for sample collection, analysis, and reporting from contaminated site and other environmental assessments
- Contaminated site cleanup and closure for FUDS, UST/LUST, Phase I & II ESAs

PROFESSIONAL SUMMARY

Mr. Darrin Lawless is a Senior Program Manager based in Anchorage, Alaska. He is the manager of AGVIQ LLC's environmental services team, focusing on the areas of environmental compliance and safety. His experience includes project management, environmental and biological consulting and reporting to federal, state, and local agencies, as well as environmental consultation and direct services for both private and public sector clients.

Mr. Lawless has served as project manager, task manager, and project liaison responsible for plan preparation, risk analysis, tracking schedules, coordinating regulatory approvals, cost accounting, reporting (QC/analytical/cost), and client interaction. He has served as project manager/lead and single point of contact for government agencies, oil exploration companies, and construction projects. He has worked directly with the client to execute the project scope of work; manage contractors; plan and develop permit applications; conduct discussions with regulatory managers; produce activity reports; and provide permit management for the completion of site characterization and remediation efforts.

Mr. Lawless has coordinated, managed, and reported on activities associated with obtaining approvals to operate remote water and wastewater treatment systems associated with the exploration rig camps in the Northwest National Petroleum Reserve-Alaska (NPR-A). He also has experience in the environmental services field, including petroleum hydrocarbon release investigation, assessment, and remediation; underground storage tank closure, assessment, and reporting; and hazardous waste management and reporting. Mr. Lawless holds a Project Management Professional (PMP) certification (2018), is a member of the Project Management Institute (since 2006), and is an Alaskan Certified Erosion Control Lead (AK-CESCL; #AGC-16-0066).

CES-AGVIQ
OF
ALASKA

Christopher E. Locke — Project Geologist

Education

- BS, Geology, University of Idaho

Training

- Profession Geologist - Alaska
- Certified Professional Geologist
- OSHA 40 Hour HAZWOPER
- OSHA 30-Hour Construction Safety
- First Aid/ CPR/ AED
- Hazard Communication

Professional Summary

Mr. Locke is a Certified Professional Geologist (CPG) in the State of Alaska with more than 20 years of experience in the environmental consulting and hard rock mining industries. Mr. Locke has experience as a geologist on various US Army Corps of Engineers HTRW, FUSRAP, and TERC projects as well as extensive knowledge in the following areas:

Environmental Consulting Industry

- Contaminate Geology
- Subcontractor supervision
- Geological logging (USCS)
- QA/QC inspector/manager
- ArcGIS applications
- Report writing
- Site management
- Aquifer "pump" test
- GPS surveys
- Project related planning
- Boring and monitoring well installation
- On and off-shore geotechnical investigations

Hard Rock Mining Industry

- Rock core orientation
- Short term planning
- Geological logging (Reverse Circulation)
- Geological mapping and interpretation
- Underground ore/dilution control

Professional Experience

- **Contract Geological Consultant, Agviq, LLC, 2012 - Present**

Contract Geologist *on several* environmental projects located in Alaska with responsibilities including: supervising and managing people and equipment, supervising geological drilling equipment (e.g., reverse circulation, mud rotary, hollow stem auger, geoprobe, and rock core drilling rigs), utilizing specialized computer software (e.g., ArcGIS, GPS, and Gint). Selected projects are listed below:

Company	Project
WHPacific	2015 Fort Greely Groundwater Sampling/Report
WHPacific	2015 Kotzebue Groundwater Report
Bethel Services	2014 Cold Bay Drum Removal
Bethel Services	2014 St. Paul Groundwater Sampling/Report
Flint Hills Refinery	2012-2013 Groundwater Sampling

- **Environmental Geologist/GIS Data Manager/QA Inspector, Integrate Concepts & Research Corporation, 2006-2012**

  Environmental Geologist/GIS Data Manager/QA Inspector, ICRC was the prime contractor to the US Department of Transportation Maritime Administration's Port of Anchorage Intermodal Expansion Project in Anchorage, AK.

  Environmental Geologist, ICRC preformed environmental consulting services for several US and State of Alaska governmental agencies. As an Environmental Geologist his responsibilities were the same as listed above for Contract Geologist.

- **Environmental Geologist, ENSR, 2004-2006**

  Environmental Geologist, ENSR preformed environmental consulting services for several companies within Alaska. As an Environmental Geologist his responsibilities were the same as listed above for Contract Geologist.

  Prior to 2004

- **Jacobs Engineering Corporation, AK**
  2001 - 2003
  Environmental Geologist: Jacobs was the US Army Corps of Engineers' Total Environmental Restoration Contract (TERC) consultant within Alaska. As an Environmental Geologist his responsibilities were the same as listed above for Contract Geologist.
- **Bral Environmental Corporation, MO**
  1999-2001
  Environmental Geologist: Bral was the US Army Corps of Engineers Formerly Utilized Sites Remedial Action Program (FUSRAP) contractor in St. Louis, Missouri. As an Environmental Geologist his responsibilities were the same as listed above for Contract Geologist.
- **Barrick Bullfrog Mining Corporation; Beatty, NV**
  1996-1999
  Underground Shift Geologist: Barrick Bullfrog Mine was an underground gold mining operation in Nevada. As an Underground Shift Geologist his responsibilities were the same as listed above for Contract Geologist.

CES-AGVIQ OF ALASKA

Brandon A. Maloney — Geologist

EDUCATION

- 2012, BS, Geology (cum laude), University of Alaska Anchorage
- 2008, BA, Outdoor Studies (cum laude), Alaska Pacific University
- 2013, Peace Corps Pre-Service Training, Kakata City, Liberia
    - Intensive three month field-based program consisting of 164 hours of technical training, 31 hours of cross-cultural training, 36 hours of personal health and safety training, 34 hours of Peace Corps agency initiatives, and 28 hours of Liberian English. Mr. Maloney lived and interacted with a Liberian host family during the duration of Pre-Service Training.

TRAINING

- OSHA HAZWOPER
- OSHA 30-hour
- DOT/IATA Shipping Hazmat
- First Aid/CPR/AED
- NSTC
- Hazard Communication

PROFESSIONAL SUMMARY

Mr. Maloney is a Geologist with one year of professional experience including core logging and mineral modal percentage estimates, water well sampling and installation, ground and surface water sampling, split spoon depth interval sampling, geologic mapping and sampling, GPS and compass capability, geologic and topographic map skills, microscopic analysis, lithological identification, crane operation and maintenance, rigging using nylon and wire rope slings, crane and rigging safety, electrical and mechanical work, basic carpentry, knowledge of working with and around large scale equipment, ArcGIS, and remote sensing.

Mr. Maloney's primary work location is Agviq's Anchorage, Alaska office.

PROFESSIONAL EXPERIENCE

- **Field Sampler, Agviq, LLC, 04/2015 - Present**
  Mr. Maloney supports the North Slope Borough Public Interest Determination contract and the CES-AGVIQ of Alaska Joint Venture Defense Logistics Agency – Energy contract.
  Key Projects:
    - **Field Sampler, Defense Logistics Agency – Energy, 12/2015 - Present**
      Defense Fuels Support Point – Whitter, Alaska
      Mr. Maloney performed work planning and mobilization tasks for the upcoming groundwater event and will serve as a part of the sampling team.
    - **Field Sampler, North Slope Borough, 04/2015 - Present**
      Point Hope, Point Lay, Wainwright, Barrow, Kaktovik, Alaska
      Mr. Maloney performed work planning, mobilization, soil sampling, well installation, groundwater sampling, excavation, drum sampling, consolation of waste streams, management of hazardous waste, transportation and disposal of waste, demobilizing, and reporting at many contaminated sites in several North Slope Borough villages.
- **Floorhand, Nabors Drilling USA, 12/2014-04/2015**
  Mr. Maloney assisted in the assembly, disassembly, and transportation of drilling equipment. He performed maintenance on draw works, rotary system, mud pumps, and shale shakers. He aided in

drilling operations: assembling BHA, tripping pipe, making connections, running casing, and racking pipe. He performed nipple up and nipple down procedures on BOPs. He monitored shakers, motors, and pumps during drilling operations. He mixed sack chemicals to meet the specifications of the mud engineer. He was responsible for the containment, handling, and disposal of oily waste products. He executed general rig maintenance: cleaning, organization, and inventory of materials. He inspected and maintained personal and industrial safety equipment.

- **Education Volunteer, United States Peace Corps, Salayea, Lofa County, Liberia, 06/2013-10/2014**
  Mr. Maloney developed an educational improvement plan for Salayea Central High School. He collaborated with village elders and school administration to form a functional PTA. He managed diverse and multicultural 10th and 11th grade classrooms. He developed lesson plans for and taught 10th and 11th grade students chemistry, physics, and geography. He implemented tutoring sessions for students in math and science courses. He worked with school administration and staff to initiate Teacher Training Workshops. He mentored two students participating in the first Peace Corps Liberia Science Fair.
- **Installation and Warehouse Manager, The Waterworks, 04/2006-05/2013 & 08/2014-10/2014**
  Mr. Maloney supervised the installation of spas and saunas. He performed technical work involving electrical and mechanical components. He installed, maintained, and repaired water pumps. He established strong skillsets in hydraulic crane operation and rigging technques. He trained ten new employees in installations, technical aspects, crane operation and rigging fundamentals. He executed water quality and water chemistry tests. He was responsible for inventory control, shipping/ receiving, and warehouse management. He provided efficient and effective customer service.

CES-AGVIQ OF ALASKA

Melissa Pike — Project Chemist

EDUCATION

- Master of Public Health (MPH) Epidemiology and Biostatistics, University of South Florida, Anticipated 2019
- B.S. Microbiology, Chemistry, Ohio University, 2003

TRAINING

- OSHA HAZWOPER
- Uniform Federal Policy for QA Project Plans
- Conceptual Site Models
- ADEC and US EPA Guidelines
- RCRA Waste Management
- Data Quality & Management
- Data Validation & Usability

FIELDS OF CONFIDENCE

- Writing sampling and analysis plans, work plans, quality assurance project plans (QAPP)
- Knowledge of current state and federal guidelines for data review and validation
- Experience in site investigation, sample screening and analysis, laboratory methods selection, sample collection, and reporting
- Project Lead and Quality Assurance Coordinator for North Slope projects

PROFESSIONAL SUMMARY

Ms. Melissa Pike is a Project Chemist with AGVIQ LLC based in Anchorage, Alaska. She is part of AGVIQ LLC's environmental services team, focusing on the areas of environmental chemistry, quality assurance and compliance. Her experience includes 9 years of experience in Alaska performing analytical data review, environmental monitoring, technical report writing, risk assessment, permitting and environmental compliance with state and federal agencies.

Ms. Pike has been a quality assurance coordinator (QAC) for environmental sampling and remediation projects within Alaska. Specifically, she has performed contaminated site characterization of soil and water on the North Slope, Newhalen, Illiamna, and Kotzebue. She has supported the management of RCRA waste transportation from Unalakleet for disposal in Washington state. She has provided technical guidance and works with analytical subcontractor laboratories to meet state and federal standards.

Ms. Pike collaborates with state and federal agencies, project managers, field staff, and subcontractors to meet the project goals and objectives. She has audited laboratories to evaluate their compliance with contract requirements and their corrective action plans. Ms. Pike ensures that laboratories can meet the state and federal guidelines and cleanup level requirements. She has experience in risk assessment through preparation of conceptual site models to evaluate the transport, migration and potential impacts of contamination to human and/or ecological receptors. Ms. Pike has experience in performing Level II and Level IV data validation on environmental chemistry data.

William Loskutoff, P.G. — Senior Geologist

EDUCATION

- 1982, BS, Geology, Humboldt State University

TRAINING

- Professional Geologist – Alaska
- Professional Geologist – California
- Certified Professional Geologist - AIPG
- 40 Hour HAZWOPER
- HAZWOPER Supervisor
- Excavations – Competent Person
- USACE Construction Quality Management for Contractors
- DOT/IATA 49 CFR

PROFESSIONAL SUMMARY

Mr. Loskutoff is a Senior Project Manager with 23 years of management experience involving leaking UST/AST removals/release investigations; groundwater evaluations and remediation; geologic resource assessments; and third party environmental oversight for public and private sector clients. He has 31 years of domestic and international environmental consulting experience that includes project/program management, environmental compliance, and site assessments. Mr. Loskutoff has served as field team lead, site manager, task manager, project manager, multi-office program quality assurance manager, and geologic subject matter expert responsible for development and execution of project scope; establishing and tracking budget; client interaction and contract management; plan and report preparation; coordination with regulatory agency personnel; project cost control analysis; program leadership and training staff quality management principles; and NEPA plan document geologic resources assessment and analysis.

He has served as project/program manager point of contact for government agencies, air and land transportation companies, health services and consumer beverage companies, and tribal Alaska Native village corporations. He has worked directly with clients to execute project/program objectives; select best practice methods for completing objectives; selection and management of specialty contractors; and coordinating and preparing regulatory compliance documents. He has managed and implemented environmental activities involving CERCLA remedial investigation/feasibility studies (RI/FS) and time-critical removal actions; real estate transfer Phase I and II site assessments; and soil and groundwater remediation in Alaska, California, and Nevada. He has successfully managed and negotiated closure of contaminated sites in California and Alaska utilizing source removal, thermal remediation, in-situ bioremediation, soil-vapor extraction, and risk-based corrective action methods in accordance with state and federal regulations.

Mr. Loskutoff has also supported multi-disciplinary projects involving: infrastructure construction geotechnical investigations; hydrogeological assessments and contaminant fate and transport groundwater modeling; earthquake risk evaluations for siting hazardous waste storage facilities; and geologic structural analysis to facilitate mine dewatering. Prior to environmental consulting, he provided geologic mapping, data entry, and ultra-pure sample preparation support to geological process, geothermal resource, and volcano hazard assessment studies conducted by the U.S. Geological Survey in California, Oregon, Hawaii, and Iceland.

APPENDIX B: CONCEPTUAL SITE MODEL

Print Form

Appendix A - Human Health Conceptual Site Model Scoping Form and Standardized Graphic

Site Name: Moose Creek, MP 20.3, Moose Creek, Alaska

File Number: 100.38.208

Completed by: CES-Agviq; October 2018

Introduction

The form should be used to reach agreement with the Alaska Department of Environmental Conservation (DEC) about which exposure pathways should be further investigated during site characterization. From this information, summary text about the CSM and a graphic depicting exposure pathways should be submitted with the site characterization work plan and updated as needed in later reports.

General Instructions: Follow the italicized instructions in each section below.

1. General Information:

Sources *(check potential sources at the site)*

- [ ] USTs
- [ ] ASTs
- [ ] Dispensers/fuel loading racks
- [ ] Drums
- [ ] Vehicles
- [ ] Landfills
- [ ] Transformers
- [x] Other: Fuel pipeline

Release Mechanisms *(check potential release mechanisms at the site)*

- [x] Spills
- [x] Leaks
- [ ] Direct discharge
- [ ] Burning
- [ ] Other:

Impacted Media *(check potentially-impacted media at the site)*

- [ ] Surface soil (0-2 feet bgs*)
- [x] Subsurface soil (>2 feet bgs)
- [x] Air
- [ ] Sediment
- [x] Groundwater
- [ ] Surface water
- [x] Biota
- [ ] Other:

Receptors *(check receptors that could be affected by contamination at the site)*

- [x] Residents (adult or child)
- [x] Commercial or industrial worker
- [x] Construction worker
- [x] Subsistence harvester (i.e. gathers wild foods)
- [x] Subsistence consumer (i.e. eats wild foods)
- [x] Site visitor
- [x] Trespasser
- [x] Recreational user
- [x] Farmer
- [ ] Other:

* bgs - below ground surface

2. Exposure Pathways: *(The answers to the following questions will identify complete exposure pathways at the site. Check each box where the answer to the question is "yes".)*

a) Direct Contact -

1. Incidental Soil Ingestion

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site-specific basis.) ☒

If the box is checked, label this pathway complete: Complete

Comments:

2. Dermal Absorption of Contaminants from Soil

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Can the soil contaminants permeate the skin (see Appendix B in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

b) Ingestion -

1. Ingestion of Groundwater

Have contaminants been detected or are they expected to be detected in the groundwater, or are contaminants expected to migrate to groundwater in the future? ☒

Could the potentially affected groundwater be used as a current or future drinking water source? Please note, only leave the box unchecked if DEC has determined the ground-water is not a currently or reasonably expected future source of drinking water according to 18 AAC 75.350. ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

2. Ingestion of Surface Water

Have contaminants been detected or are they expected to be detected in surface water, or are contaminants expected to migrate to surface water in the future? ☐

Could potentially affected surface water bodies be used, currently or in the future, as a drinking water source? Consider both public water systems and private use (i.e., during residential, recreational or subsistence activities). ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

3. Ingestion of Wild and Farmed Foods

Is the site in an area that is used or reasonably could be used for hunting, fishing, or harvesting of wild or farmed foods? ☒

Do the site contaminants have the potential to bioaccumulate (see Appendix C in the guidance document)? ☒

Are site contaminants located where they would have the potential to be taken up into biota? (i.e. soil within the root zone for plants or burrowing depth for animals, in groundwater that could be connected to surface water, etc.) ☒

If all of the boxes are checked, label this pathway complete: Complete

Comments:

c) Inhalation-

1. Inhalation of Outdoor Air

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Are the contaminants in soil volatile (see Appendix D in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

2. Inhalation of Indoor Air

Are occupied buildings on the site or reasonably expected to be occupied or placed on the site in an area that could be affected by contaminant vapors? (within 30 horizontal or vertical feet of petroleum contaminated soil or groundwater; within 100 feet of non-petroleum contaminted soil or groundwater; or subject to "preferential pathways," which promote easy airflow like utility conduits or rock fractures) ☒

Are volatile compounds present in soil or groundwater (see Appendix D in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

3. **Additional Exposure Pathways:** *(Although there are no definitive questions provided in this section, these exposure pathways should also be considered at each site. Use the guidelines provided below to determine if further evaluation of each pathway is warranted.)*

Dermal Exposure to Contaminants in Groundwater and Surface Water

Dermal exposure to contaminants in groundwater and surface water may be a complete pathway if:

- Climate permits recreational use of waters for swimming.
- Climate permits exposure to groundwater during activities, such as construction.
- Groundwater or surface water is used for household purposes, such as bathing or cleaning.

Generally, DEC groundwater cleanup levels in 18 AAC 75, Table C, are deemed protective of this pathway because dermal absorption is incorporated into the groundwater exposure equation for residential uses.

Check the box if further evaluation of this pathway is needed: ☒

Comments:

Inhalation of Volatile Compounds in Tap Water

Inhalation of volatile compounds in tap water may be a complete pathway if:

- The contaminated water is used for indoor household purposes such as showering, laundering, and dish washing.
- The contaminants of concern are volatile (common volatile contaminants are listed in Appendix D in the guidance document.)

DEC groundwater cleanup levels in 18 AAC 75, Table C are protective of this pathway because the inhalation of vapors during normal household activities is incorporated into the groundwater exposure equation.

Check the box if further evaluation of this pathway is needed: ☒

Comments:

Inhalation of Fugitive Dust

Inhalation of fugitive dust may be a complete pathway if:

- Nonvolatile compounds are found in the top 2 centimeters of soil. The top 2 centimeters of soil are likely to be dispersed in the wind as dust particles.
- Dust particles are less than 10 micrometers (Particulate Matter - PM_{10}). Particles of this size are called respirable particles and can reach the pulmonary parts of the lungs when inhaled.

DEC human health soil cleanup levels in Table B1 of 18 AAC 75 are protective of this pathway because the inhalation of particulates is incorporated into the soil exposure equation.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

Direct Contact with Sediment

This pathway involves people's hands being exposed to sediment, such as during some recreational, subsistence, or industrial activity. People then incidentally ingest sediment from normal hand-to-mouth activities. In addition, dermal absorption of contaminants may be of concern if the the contaminants are able to permeate the skin (see Appendix B in the guidance document). This type of exposure should be investigated if:

- Climate permits recreational activities around sediment.
- The community has identified subsistence or recreational activities that would result in exposure to the sediment, such as clam digging.

Generally, DEC direct contact soil cleanup levels in 18 AAC 75, Table B1, are assumed to be protective of direct contact with sediment.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

4. Other Comments *(Provide other comments as necessary to support the information provided in this form.)*

HUMAN HEALTH CONCEPTUAL SITE MODEL GRAPHIC FORM

Site: Moose Creek, MP 20.3
File ID: 100.38.208

Completed By: CES-Agviq
Date Completed: October 2018

***Instructions**: Follow the numbered directions below. Do not consider contaminant concentrations or engineering/land use controls when describing pathways.*

(1) *Check the media that could be directly affected by the release.*

(2) *For each medium identified in (1), follow the top arrow and check possible transport mechanisms. Check additional media under (1) if the media acts as a secondary source.*

(3) *Check all exposure media identified in (2).*

(4) *Check all pathways that could be complete. The pathways identified in this column must agree with Sections 2 and 3 of the Human Health CSM Scoping Form.*

(5) *Identify the receptors potentially affected by each exposure pathway: Enter "C" for current receptors, "F" for future receptors, "C/F" for both current and future receptors, or "I" for insignificant exposure.*

Media / Transport Mechanisms

[ ] Surface Soil (0-2 ft bgs)
- Direct release to surface soil — check soil
- [ ] Migration to subsurface — check soil
- [ ] Migration to groundwater — check groundwater
- [ ] Volatilization — check air
- [ ] Runoff or erosion — check surface water
- [ ] Uptake by plants or animals — check biota
- [ ] Other (list): ______

[x] Subsurface Soil (2-15 ft bgs)
- Direct release to subsurface soil — check soil
- [x] Migration to groundwater — check groundwater
- [x] Volatilization — check air
- [ ] Uptake by plants or animals — check biota
- [ ] Other (list): ______

[x] Ground-water
- Direct release to groundwater — check groundwater
- [x] Volatilization — check air
- [ ] Flow to surface water body — check surface water
- [ ] Flow to sediment — check sediment
- [x] Uptake by plants or animals — check biota
- [ ] Other (list): ______

[ ] Surface Water
- Direct release to surface water — check surface water
- [ ] Volatilization — check air
- [ ] Sedimentation — check sediment
- [ ] Uptake by plants or animals — check biota
- [ ] Other (list): ______

[ ] Sediment
- Direct release to sediment — check sediment
- [ ] Resuspension, runoff, or erosion — check surface water
- [ ] Uptake by plants or animals — check biota
- [ ] Other (list): ______

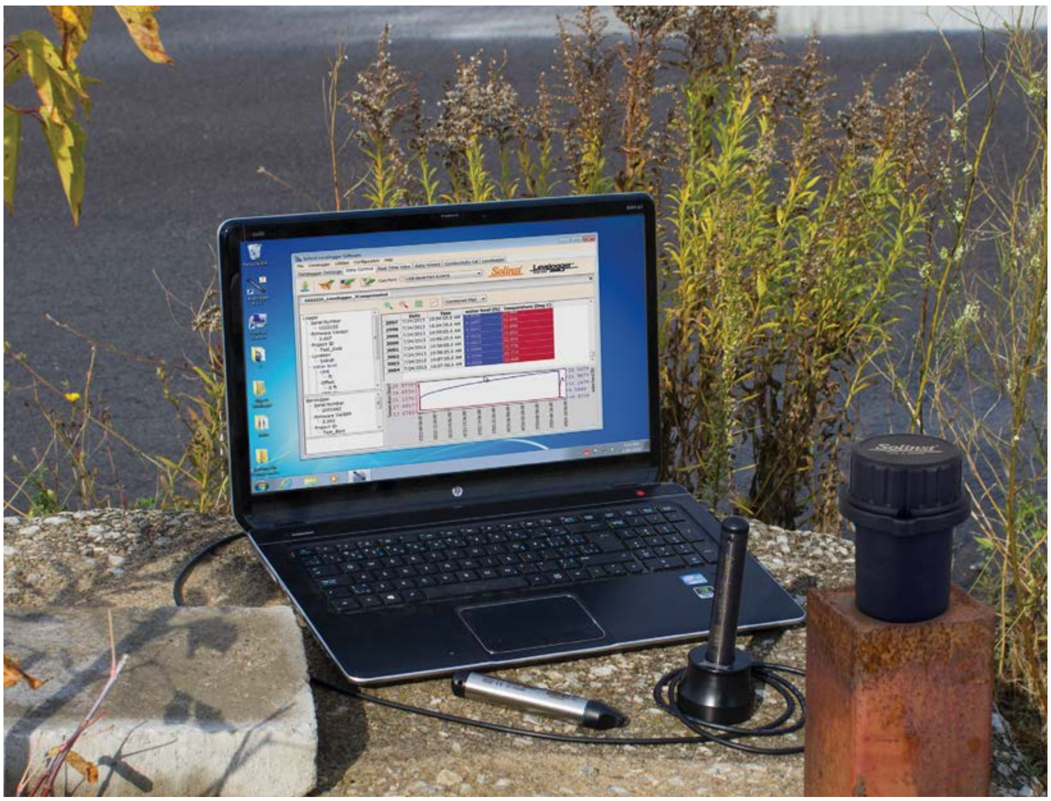
Exposure Media / Exposure Pathway/Route / Current & Future Receptors

Exposure Media	Exposure Pathway/Route	Residents (adults or children)	Commercial or industrial workers	Site visitors, trespassers, or recreational users	Construction workers	Farmers or subsistence harvesters	Subsistence consumers	Other
[x] soil	[x] Incidental Soil Ingestion	C/F	C/F	C/F	C/F	F		
	[x] Dermal Absorption of Contaminants from Soil	C/F	C/F	C/F	C/F	F		
	[ ] Inhalation of Fugitive Dust							
[x] groundwater	[x] Ingestion of Groundwater	C/F	C/F	C/F	C/F	F		
	[x] Dermal Absorption of Contaminants in Groundwater	C/F	C/F	C/F	C/F	F		
	[x] Inhalation of Volatile Compounds in Tap Water	C/F	C/F	C/F	C/F	F		
[x] air	[x] Inhalation of Outdoor Air	C/F	C/F	C/F	C/F	F		
	[x] Inhalation of Indoor Air	C/F	C/F	C/F	C/F	F		
	[ ] Inhalation of Fugitive Dust							
[ ] surface water	[ ] Ingestion of Surface Water							
	[ ] Dermal Absorption of Contaminants in Surface Water							
	[ ] Inhalation of Volatile Compounds in Tap Water							
[ ] sediment	[ ] Direct Contact with Sediment							
[x] biota	[x] Ingestion of Wild or Farmed Foods	C/F		C/F		F		

APPENDIX C: LEVELOGGER$^{©}$ MANUAL

Solinst®

A Guide to Levelogger Deployment & Communication



Deployment Options

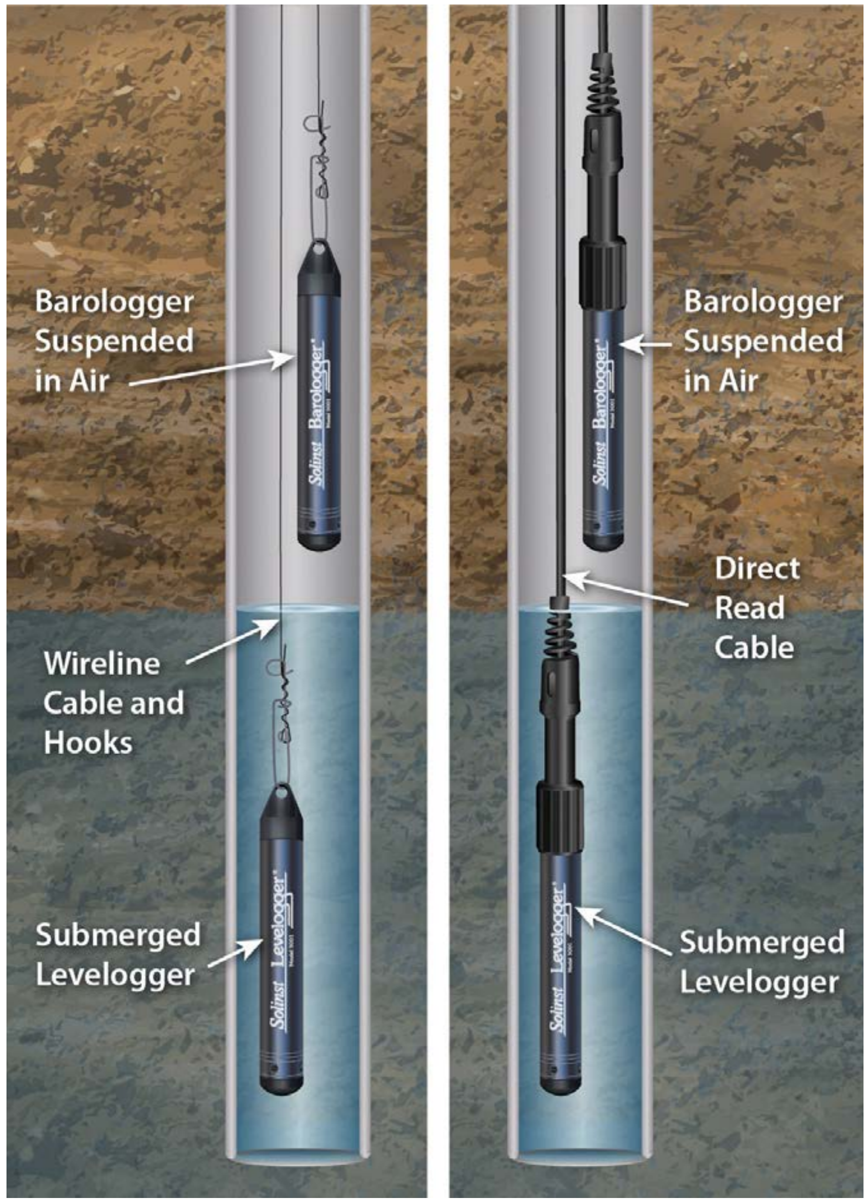
Wireline/Kevlar Cord Deployment

Use this method when you wish to minimize up front costs, and pre-program Leveloggers in the office. Lower into the well, suspended on wireline or Kevlar cord from a Solinst 2" (4" with reducer) Lockable Well Cap.

The Solinst Lockable 2" Well Cap when used with a stainless steel wireline and hook, or a Kevlar Cord.

Stainless Steel Wireline Cable Spool and Hook.

Spool of Kevlar Cord.



Direct Read Cable Deployment

Use this method when you want direct communication with your Levelogger while it is deployed, and to view real-time readings. Deploy with Direct Read Cables using a Solinst 2" (4" with reducer) Lockable Well Cap.

The Solinst 2" Lockable Well Cap has openings for two Direct Read Cables and an opening for other monitoring equipment, such as a Water Level Meter.

Direct Read Cables are available in lengths up to 1500 ft (450 m).

Monitoring Artesian Conditions

Solinst offers an assembly for monitoring artesian wells. It provides options for in-well, and top of well installation, and can accommodate the use of Direct Read Cables.

Levelogger Artesian Well Fitting

® Kevlar is a registered trademark of DuPont Corp.

Communication Options

Communicating with Solinst Levelogger PC Software

Standard (Wireline/Kevlar Cord) **Communication**

To retrieve data or re-program, remove the Levelogger from the well and use an **Optical Reader** attached to a portable or office computer.

Direct Read Communication

Pre-program Leveloggers in the office using an Optical Reader. In the field use a laptop and PC Interface Cable, to program, view or download data. **The Direct Read Communication Package** from Solinst includes an Optical Reader and PC Interface Cable.

In-field Communication

Levelogger App Interface connected to a Direct Read Cable provides a wireless *Bluetooth*® connection between the Levelogger and the Solinst Levelogger App on your iOS or Android™ smart device, for programming or downloading data.

A DataGrabber connected to a Direct Read Cable allows Levelogger data to be copied to a USB memory key.

A Direct Read to Optical Adaptor allows direct connection of a Levelogger to a Levelogger App Interface or DataGrabber for programming or downloading data in the field. This is useful for Leveloggers not deployed using a Direct Read Cable.

Remote Monitoring Options

Solinst Telemetry Systems

Solinst has options for wireless remote communication using cellular or radio telemetry. Real-time data is sent from field-located Leveloggers to your office PC.

RRL Remote Radio Link *uses short-distance radio to send remote water level data from Leveloggers to a Home Station radio connected to a PC.*

STS Telemetry Systems *use GSM/CDMA cellular communication to send remote water level data from Leveloggers to a Home Station PC.*

SDI-12 Interface Cable

Solinst Leveloggers are able to communicate with third-party dataloggers using SDI-12 protocol, by connecting a Levelogger's Direct Read Cable to a Solinst SDI-12 Interface Cable. The SDI-12 Interface Cable is wired to the third-party datalogger.

NOTES:

For Information on deploying the Rainlogger Edge, see our *Rainlogger Edge Setup* document.

For information on deploying your Leveloggers in surface water applications, see our *Long-term Open Channel and Surface Water Monitoring with Leveloggers* technical bulletin.

Always ensure proper maintenance and care of your Levelogger, see our *Ensuring Proper Use and Maintenance of Leveloggers* technical bulletin.

Printed in Canada
March 15, 2016

For further information contact: Solinst Canada Ltd.
Fax: +1 (905) 873-1992; (800) 516-9081 Tel: +1 (905) 873-2255; (800) 661-2023
35 Todd Road, Georgetown, Ontario Canada L7G 4R8
Web Site: www.solinst.com E-mail: instruments@solinst.com

Solinst®

APPENDIX D: GROUNDWATER SAMPLING FORM

CES-AGVIQ OF ALASKA

GROUNDWATER SAMPLING FORM

CLIENT: Defense Logistics Agency – Energy

SITE: Moose Creek Pipeline Release - Moose Creek

SAMPLER(S) NAME:

DATE:

WEATHER:

MONITORING WELL ID:

SAMPLE ID ON COC:

SHEET **OF**

PURGE METHOD:

1 in = 0.083 ft; 2 in = 0.167 ft; 3 in = 0.25 ft; 4 in = 0.333 ft

SAMPLE METHOD:

PRODUCT PRESENT:

WATER LEVEL MEASURING DEVICE:

TYPE OF PUMP:

WELL INTEGRITY:

REQUIRED REPAIRS:

PUMP INTAKE DEPTH:

DIAMETER OF WELL: (FT)

RADIUS OF WELL (R): (FT)

TOTAL DEPTH OF WELL BELOW MEASURING POINT (D): (FT)

DEPTH TO GW BELOW MEASURING POINT (d): (FT)

LENGTH OF WATER COLUM (L): (D-d)= (FT)

VOLUME OF WATER COLUMN (V): (3.14xRxRxL) (CUBIC FT)

WELL VOLUME: (7.48xV)= (GAL) **X3=** (GAL)

Min Purge Volume **Max Purge Volume**

Note: Groundwater volumes above were calculated in the field and used for approximate purge volumes; rounded values are shown for informational purposes only.

TIME	VOLUME (GAL)	WATER LEVEL (ft BTOC)	TEMP (deg C)	Conductivity(mS/cm)	DO (mg/L)	pH	ORP (mV)	TURBIDITY (NTU)	VISUAL APPEARANCE OF WATER	STABILIZED (YES/NO) (1)

(1) STABILIZATION is achieved when three (3) consecutive readings of pH, conductivity, and either turbidity or DO collected in 3-5 minute intervals meet the following criteria:

- ±0.1 standard units for pH
- ±10% for temperature
- ±3% for specific conductance (conductivity)
- ±10 mV for ORP or ±10% if between -100 mV and +100 mV
- ±10% for DO > 0.50 mg/L. Three DO readings < 0.50 mg/L can be considered stabile.
- ±10% for turbidity > 10 ntu. Three turbidity readings < 10 NTU can be considered stabile.

PURGE UNTIL PARAMETER STABILIZATION or UNTIL 3 WELL VOLUMES ARE REMOVED

TOTAL VOLUME PURGED: **(GAL)** **FLOW RATE (desired range is 100 to 500 mL/min):**

SAMPLE TIME:

QC SAMPLES COLLECTED:

FIELD TESTS: Mn2+ = **Sulfide =** **Fe2+ =**

ANALYSIS (fill in number of bottles collected)

BTEX (SW8260B)_______ PAHs (SW8270D SIMSV)___________ others:___________________

GRO (AK 101)_______ Total Lead (SW6020A)______________ ___________________

DRO/RRO (AK 102/103 SV)____

COMMENTS:

APPENDIX E: RESPONSE TO COMMENTS MATRIX

DEC Comments on
Moose Creek Pipeline Release Moose Creek, Alaska 2018 Low Groundwater Monitoring Work Plan (Draft)
November 16, 2018

Reviewer: Alaska Department of Environmental Conservation

Comment No.	Page	Section	Comment / Recommendation	Response
1.	10	3.0	How will the spent GAC be disposed of? GAC used to remove PFOS/PFOA cannot be sent to the FNSB landfill.	This section has been revised to document sampling and characterization that will be performed on the purge water and spent GAC.
2.	3	App B	The CSM graphic lists wild and farmed foods as a current and/or future exposure pathway. Please revise the "Receptors" section of the CSM to include subsistence harvesters and subsistence consumers as receptors that could be affected by the contamination.	The Receptors section of the CSM has been revised.