FINAL REPORT

Port of Alaska Modernization Program Petroleum and Cement Terminal Environmental Characterization Report: Waterline Realignment Addendum

Prepared for

Port of Alaska

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Contents

Section Page

Section Page

Appendices

Tables

Figures

Acronyms and Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
AAC	Alaska Administrative Code
ABI	Alaska Basic Industries
ADEC	Alaska Department of Environmental Conservation
bgs	below ground surface
COPC	contaminant of potential concern
COWI	COWI North America, Inc.
DRO	diesel-range organics
EDB	ethylene dibromide (1,2-dibromoethane)
ELAP	Environmental Laboratory Accreditation Program
EPA	Environmental Protection Agency
GCL	groundwater cleanup level
GFo	glaciofluvial outwash
GPS	global positioning system
GRO	gasoline-range organics
HHSCL	human health soil cleanup level
IDW	investigation derived waste
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LOD	limit of detection
LOQ	limit of quantitation
LST	landing ship-tank
MB	method blank
mg/kg	milligrams per kilogram
MOA	Municipality of Anchorage
MS	matrix spike
MSCL	migration to groundwater soil cleanup level
MSD	matrix spike duplicate
PAH	polycyclic aromatic hydrocarbon
PAMP	Port of Alaska Modernization Program
PCE	tetrachloroethene
PCT	Petroleum and Cement Terminal

PID	photoionization detector
POAVY	Port of Alaska valve yard
Port	Port of Alaska
ppm	parts per million
QEP	qualified environmental professional
R&M	R&M Consultants, Inc.
RPD	relative percent difference
RRO	residual-range organics
SAP	sampling and analysis plan
SGS	SGS North America, Inc.
TB	trip blank
TCE	trichloroethene
TH	test hole
TW	test well
TMW	temporary monitoring well
µg/L	micrograms per liter
USGS	U.S. Geological Survey
VOC	volatile organic compounds

Executive Summary

This investigation was conducted on 6 July 2018 by R&M Consultants, Inc. (R&M) to investigate environmental conditions and the location of a buried World War II Landing Ship-Tank (LST) to support route selection for waterline installation as part of the proposed Petroleum and Cement Terminal (PCT) Project at the Port of Alaska (Port) as part of the Municipality of Anchorage's (MOA) Port of Alaska Modernization Program (PAMP). This investigation and report were performed as an addendum to the 2017 Route Clearance Study. Investigation included collection of soil samples at periodic intervals along the alignment. Chemical samples were analyzed for gasoline-range organics (GRO), diesel-range organics (DRO), residual-range organics (RRO), volatile organic compounds (VOC), and polycyclic aromatic hydrocarbons (PAH). Site work was guided by the Alaska Department of Environmental Conservation (ADEC) approved 2017 Environmental Sampling and Analysis Plan (SAP) for the Petroleum and Cement Terminal.

Background

The Port in general has known hydrocarbon contamination that is fairly widespread, resulting from historical releases from pipelines and tank farms dating back to the 1964 Earthquake. Information regarding historical releases are available at ADEC. The Port is listed as a contaminated site on the ADEC Contaminated Sites Database as File No. 2100.38.535 and is adjacent to multiple other listed contaminated sites. The Port, in general, has fuel related contaminants of potential concern (COPC).

Chemical Results Summary

1,2-dibromoethene (Ethylene dibromide [EDB]) exceeded ADEC migration to groundwater cleanup levels for one soil sample analyzed for this investigation. There were low level detections of other fuel related contaminants, but they were present at concentrations well below cleanup levels.

Conclusions Summary

Soil was found contaminated with EDB (a common fuel additive) above regulatory cleanup levels by the 2018 investigation. Groundwater may be affected by EDB soil contamination as detection in soil exceeded the migration to groundwater cleanup level. Field screening may not be an effective method to screen for soil contamination during proposed construction as field screening will not resolve the presence or absence of EDB given the extremely low cleanup level.

Detected contaminants were below human health cleanup level for DRO, RRO, chrysene, fluoranthene, phenanthrene, and pyrene. This investigation was limited in extent and was not designed to fully characterize the area. The potential for higher levels of contamination is possible beyond what this investigation detected.

The EDB detection exceeds the migration to groundwater cleanup level, but is more than 10 times below the human health cleanup level and is considered insignificant from a human health perspective based on ADEC conceptual site model guidance.

The 2017 investigation found that soil and groundwater were found contaminated with petroleum hydrocarbons, VOC, and PAH above regulatory cleanup levels. Only one VOC analyte related to petroleum hydrocarbons (1,2,4-trimethylbenzene) was detected in soil above the human health soil cleanup level. DRO, RRO, dichlorofluoromethane, methylene chloride, and 1-methylnaphthalene were detected in groundwater samples above groundwater cleanup levels. Groundwater cleanup levels are considered to be protective of human health impacts.

The approximate locations of contaminated media (soil and groundwater) encountered by the 2017 and 2018 environmental investigations along the proposed utility alignment occur south of the ABI Cement Dome and northwest of the Delta Western tank farm along the water front**.** There is a potential for contaminated media to be encountered between the test boring locations. These investigations were designed to test for the presence or absence of contamination along the utility alignment, not to fully characterize the extent of contamination horizontally or vertically.

Recommendations Summary

R&M provides the following recommendations for disposal of IDW generated during the 2017 and 2018 investigations:

- Dispose of waste soil cuttings and waste water at an approved treatment, storage, and disposal facility after obtaining approval to transport from ADEC due to exceedance of cleanup levels in soil. R&M will coordinate with ADEC and an approved treatment, storage, and disposal facility to properly dispose of IDW generated during this investigation in accordance with local, State, and Federal regulations.

R&M provides the following recommendations for proposed construction at the site based on results from the 2017 and 2018 investigations:

- Provide a copy of this report to ADEC in accordance with the approved SAP for the Port ADEC file. Proposed construction contractor(s) should be provided a copy of this report.
- Coordinate with ADEC for disposal or reuse of contaminated soil encountered during construction.
- Determine a method for managing excavation dewatering activities as it is not covered by the construction general permit as the project is within 1,500 feet of a known contaminated site and the project area contains known contamination of soil and groundwater.

Construction contractor specific recommendations are as follows to mitigate cost or schedule impacts to the project associated with handing and disposing of contaminated material during construction based on results from the 2017 and 2018 investigations:

- Retain an environmental consultant to develop the work plan, site specific safety plan, and dewatering plan described in the above recommendations prior to beginning construction.
- Environmental planning documents should provide ADEC pre-approved disposal or reuse criteria for soil or water removed from the excavation during construction. This should include sampling and field screening criteria, as applicable.
- ADEC approved disposal locations should be determined as part of planning document development.
- Groundwater is shallow and cannot be removed from an excavation without prior ADEC approval as the Construction General Permit is not applicable due to known contamination within the project area.
- The construction contractor should plan to be able to temporarily containerize dewatering effluent and stockpile soil in an area 200 feet from water (including Cook Inlet). Stockpiled soil with suspected contamination must be placed on a liner meeting 18 AAC 75 specifications that may need to be surrounded with berms (ADEC, 2017a).

Introduction

COWI North America, Inc. (COWI) retained R&M Consultants, Inc. (R&M) to investigate environmental conditions and the location of a buried World War II Landing Ship-Tank (LST) to support route selection for waterline installation as part of the proposed Petroleum and Cement Terminal (PCT) Project at the Port of Alaska (Port) as part of the Municipality of Anchorage's (MOA) Port of Alaska Modernization Program (PAMP). The aging and seismically vulnerable existing POL Trestle will be replaced with a new terminal facility, to include underground utility lines (i.e. water, petroleum products, and cement), for which an environmental study is necessary to characterize site conditions prior to construction.

Following initial investigation of environmental conditions along the proposed utility route in 2017, the design team made alterations to the proposed path of the waterline alignment. This new proposed route had not been adequately screened for potential contamination in soil by the 2017 investigation. Additionally, a buried LST was located within the proposed utility realignment and presented a potential source of contamination. This investigation and report were performed as an addendum to the 2017 Route Clearance Study (R&M, 2018).

This report was prepared in accordance with 18 Alaska Administrative Code (AAC) 75 (ADEC, 2017a), Alaska Department of Environmental Conservation (ADEC) Field Sampling Guidance (ADEC, 2017e), and the 2017 Environmental Sampling and Analysis Plan (SAP) for the Petroleum and Cement Terminal (R&M, 2017). Site location and features are shown on **Drawings A-01 and A-02** in Appendix A.

1.1 Site History

The Port in general has known hydrocarbon contamination that is fairly widespread, resulting from historical releases from pipelines and tank farms dating back to the 1964 Earthquake. Information regarding historical releases are available at ADEC. The Port is listed as a contaminated site on the ADEC Contaminated Sites Database as File No. 2100.38.535 and is adjacent to multiple other listed contaminated sites. The Port, in general, has fuel related contaminants of potential concern (COPC) that are identified in **Section 1.2.**

1.2 Investigation Objectives

The environmental investigation was designed to provide subsurface information on potential environmental contamination that could affect the design and construction of underground utilities associated with the PCT Project. Field objectives for the investigation were as follows:

- Provide environmental data to support project design associated with the proposed waterline re-alignment and provide compliance with ADEC regulatory requirements.
- Field screen soil samples for signs of contamination.
- Collect and analyze soil and groundwater samples for the following COPC.
  - Gasoline-range organics (GRO).
  - Diesel-range organics (DRO).
  - Residual-range organics (RRO).
  - Volatile organic compounds (VOC).
  - Polycyclic aromatic hydrocarbons (PAH).
- Containerize and characterize investigation derived waste (IDW).

- Provide recommendations for handling soil and groundwater excavated or dewatered during construction.
- Provide data regarding potential site and construction worker health and safety considerations during construction and eventual operation of the proposed facility.

1.3 Sampling and Analysis Plan Modifications

Prior to the environmental investigation or utility locates, a SAP was developed and approved by ADEC (R&M, 2017). Following approval, the following modifications occurred in relation to the proposed waterline re-alignment:

- After the initial Route Clearance Study performed in 2017 changes were made to the proposed water line alignment. Due to the presence of a buried LST and contamination detected in the area during the 2017 investigation additional investigation was proposed.
- Samples were additionally tested for low level VOCs to account for lower cleanup levels for some VOC compounds.
- Eight additional test holes were advanced to investigate the location of a buried LST (ship) and to collect chemical data to support meeting ADEC regulatory requirements during construction. Three of the eight test holes were sampled and logged. The remaining five were advanced solely to determine the location of the buried LST and no soil core or samples were collected.

Site Description

The project area is located within the South Backlands area of the Port in the vicinity of the cement storage dome within the MOA, Alaska (Section 7, Township 13 North, Range 3 West, U.S. Geological Survey (USGS) Quadrangle Anchorage A-8 NW of the Seward Meridian). The site is within an area identified as an ADEC contaminated site located at 61.238741 degrees north and 149.885993 degrees west in World Geodetic System 1984 decimal degree coordinates based on the ADEC Contaminated Sites Program database listing for file number 2102.38.535. General site location and Project features are shown on **Drawing A-02**. General site information is provided in the following subsections.

2.1 Topography and Surface Drainage

The site is generally flat in the developed area, which then slopes steeply into Cook Inlet. The South Backlands area were constructed by infilling on former tidal flats. Precipitation eventually runs off into Cook Inlet either directly or after passing through a storm water collection system.

2.2 General Geology

The South Backlands area consists of recent fill placed over tidal silt deposits at different times over the last century. The tidal silt deposit is underlain by a variable glaciofluvial outwash (GFo) sand and gravel deposit. This deposit typically extended from the bottom of the tidal silts to the top of the Bootlegger Cove Formation, with a thickness ranging from five to 30 feet. The Bootlegger Cove Formation consists of glaciolacustrine silt and clay and underlies the GFo. The material is generally characterized as silty, lean clay with interbeds of fine sand and silt. An older unit of GFo material is variably present within the Bootlegger Cove Formation. This unit mainly consists of sand and gravel with interbedded clay layers. The thickness ranges from 10 to 40 feet, and my not be continuous over the PCT Project area.

Figure 1. Typical soil conditions showing granular fill soil over fine-grained tidal silt deposits.

2.3 Groundwater Conditions

Groundwater within the project area is anticipated to be heavily influenced by tidal variation and likely varies by tens of feet along with the tidal cycle. Due to tidal influence, groundwater is likely saline to brackish as groundwater flowing in from the east mixes with seawater or is overwhelmed by seawater at high tide.

The 2017 investigation (R&M, 2018) encountered groundwater at between 2 and 15 feet bgs. Groundwater was shallowest near the Alaska Basic Industries (ABI) cement dome and deepest in the vicinity of the Port of Alaska valve yard (POAVY). Tidal effects are likely to have controlled groundwater depth as the tide was going out as test borings advanced from the ABI cement dome to the POAVY during the 2017 investigation. This investigation encountered groundwater between 4.5 to 10 feet bgs.

2.4 Climate

Based on climate data (1931 to 2012) recorded at the Anchorage Merrill Field, Alaska weather station (500285) near the Port, the mean annual air temperature is approximately 36 degrees Fahrenheit (°F), with maximum and minimum monthly averages of approximately 58 °F (July) and 13 °F (January), respectively. The area receives an average of 14.6 inches of precipitation per year, with a maximum monthly mean of approximately 2.6 inches in August (WRCC, 2018).

2.5 Geotechnical Conditions

Fill material typically consisted of poorly graded gravel with silt and sand containing cobbles and possibly boulders. In the South Backlands Area, the fill contained layers consisting of poorly graded sand and poorly graded sand with silt and gravel. The thickness of the fill material ranged from 6.5 feet to greater than 15 feet, and was greater than 10 feet thick in most borings. In some areas the tidal silt deposits are interlayered with fill material, as observed in Test Boring RM17-TH06. The underlying tidal silt deposit consisted for non-plastic to slightly plastic silt to sandy silt. Groundwater was encountered in every borehole at depth ranging from about 2 feet to about 14 feet, and was between 6 and 12 feet in most borings.

2.6 Excavation Considerations

Groundwater should be expected in trenches and excavation extended deeper than about 6 feet (potentially shallower). Excavations which encounter groundwater will be unstable and the need for dewatering and shoring should be expected. The permeability of the soil is expected to be high, so flow into excavations below the groundwater table will be rapid. Dewatering systems will need to be designed to handle a high flow. The groundwater level in excavations may vary with the tide cycle.

Most of the existing fill materials will be suitable for re-use as trench backfill, provided that it is free of debris, not mixed with the underlying silty soils, and is not too wet to compact. The tidal silt materials is not expected to be useable as backfill material.

2.7 Buried LST

Locating the buried LST was an additional data objective for this investigation. Five test holes were advanced to locate the LST with no soil core recovered. Macrocore 2.25-inch outside diameter MC5 tooling was used to collect soil core and to probe the location of the buried LST with a closed point. Drill tooling refused in three test holes at 6.25 and 7 feet bgs in locations consistent with the buried LST. In locations outside the suspected location of the buried LST, drill tooling was advanced between 20 and 30

feet where the test holes were terminated. A geophysical study was conducted before the investigation to attempt to approximately locate the LST. The geophysical study report is included as **Appendix F.**

Investigation Methods and Results

Samples were collected according to procedures specified by the SAP (R&M, 2017) and ADEC Field Sampling Guidance (ADEC, 2017e). Test boring logs are provided as **Appendix B.** Field notes are provided in **Appendix C**. Christopher Fell of R&M was the ADEC qualified environmental professional (QEP) on site as required by 18 Alaska Administrative Code (AAC) 75 (ADEC, 2017a). The field investigation occurred on 6 July 2018.

The investigation consisted of test borings and temporary monitoring wells (TMW) located using swing tie methods to known surveyed points. Eight test borings (only three were sampled) were advanced at the locations shown on **Drawing A-02**.

Samples were submitted to SGS North America, Inc. in Anchorage, Alaska (SGS). SGS (17-021, expires 31 December 2019) is an ADEC approved laboratory and is Environmental Laboratory Accreditation Program (ELAP) certified for the analytical methods used. Level 2 laboratory data reports are included in **Appendix E**. An ADEC checklist is included in **Appendix F** (ADEC, 2017d). The following sections provide additional details about the investigation and present chemical results.

3.1 Soil Field Screening

Field screening included visual, olfactory, and photoionization detector (PID) screening of soil samples collected during this investigation. Visual and olfactory screening included observation for signs of contamination including soil discoloration, sheen on groundwater or pore water, and/or unusual odors (i.e. petroleum or solvent). PID screening used the heated headspace method (ADEC, 2017e).

The PID calibration was checked per the manufacturer specifications using 100 parts per million (ppm) isobutylene calibration gas and bump checks performed periodically with calibration gas to assess instrument drift. If checks varied more than 5 percent from the calibrated values the instrument was recalibrated in accordance with the SAP (R&M, 2017).

Soil samples were field screened from continuous soil cores collected via direct push methods in test holes RM18-TH01, RM18-TH02, and RM18-TH08. Visual, olfactory, and/or PID field screening methods did not indicate the presence of contamination in the test holes. PID field screening results were compared to the levels detailed in **Table 1** and are summarized in **Table 2**.

Table 1. PID Field Screening Action Levels

Field Screening Criteria	Classification
PID reading less than 15 ppm	Contamination not suspected
PID reading greater than or equal to 15 ppm	Suspected contamination

Table Notes:

For definitions, see the Acronyms and Abbreviations table.

Table 2. Field Screening Results: Test Holes RM18-TH01, RM18-TH02, and RM18-TH08

Test Boring	Field Screen ID	Depth (feet bgs)	PID Reading (ppm)	Visual and/or Olfactory Observations	Coincident Chemical Sample(s)
RM18-TH01	FS-01	0.0 to 2.5	0.0	None	Not Applicable
	FS-02	2.5 to 5.0	0.0	None	COWI18-TH01-01
	FS-03	5.0 to 10	0.0	None	Not Applicable
	FS-04	10 to 15	0.0	None	Not Applicable
	FS-05	15 to 17.5	0.0	None	Not Applicable
	FS-06	17.5 to 20	0.0	None	Not Applicable
	FS-07	20 to 22.5	0.0	None	Not Applicable
	FS-08	22.5 to 25	0.0	None	Not Applicable
	FS-09	25 to 27.5	0.0	None	Not Applicable
	FS-10	27.5 to 30	0.0	None	Not Applicable
RM18-TH02	FS-01	0.0 to 2.5	0.0	None	Not Applicable
	FS-02	2.5 to 5.0	0.0	None	Not Applicable
	FS-03	5.0 to 7.5	0.0	None	COWI18-TH02-01
	FS-04	7.5 to 10	0.0	None	Not Applicable
	FS-05	10 to 12.5	0.0	None	Not Applicable
	FS-06	12.5 to 15	0.0	None	Not Applicable
	FS-07	15 to 17.5	0.0	None	Not Applicable
	FS-08	17.5 to 20	0.0	None	Not Applicable
	FS-09	20 to 22.5	0.0	None	Not Applicable
	FS-10	22.5 to 25	0.0	None	Not Applicable
No field screening or sampling in RM18-TH03 through RM18-TH07					
RM18-TH08	FS-01	0.0 to 2.5	0.0	None	Not Applicable
	FS-02	2.5 to 5.0	0.0	None	Not Applicable
	FS-03	5.0 to 7.5	0.0	None	Not Applicable
	FS-04	7.5 to 10	0.0	None	Not Applicable
	FS-05	10 to 12.5	0.0	None	COWI18-TH08-01 COWI18-TH04-01
	FS-06	12.5 to 15	0.0	None	Not Applicable

Table Notes:

For definitions, see the Acronyms and Abbreviations table

PID results exceeding the screening level (15 ppm) or visual or olfactory signs of contamination are highlighted red and are BOLD.

Observed groundwater interface interval is highlighted blue.

3.2 Soil Chemical Sampling and Results

Soil samples were collected based on field screening results and soil horizons most likely to be contaminated based on ADEC Field Sampling Guidance (ADEC, 2017e). Chemical samples were collected using Macrocore drill tooling and from new, disposable macrocore polyvinyl chloride liners. Chemical samples were immediately placed in a pre-chilled cooler following collection and were maintained as described in **Section 4**. Three primary and one duplicate chemical samples were collected. **Table 3** provides a summary of samples collected including test boring association, sample identification, type (i.e. primary, duplicate, etc.), and sample intervals.

Table 3. Chemical Soil Sample Summary Information

Test Boring Identification	Sample Identification	Sample Interval (feet bgs)	Sample Type
RM18-TH01	**COWI18-TH01-01**	**2.0 to 5.0**	**Primary**
RM18-TH02	COWI18-TH02-01	5.0 to 7.5	Primary
RM18-TH08	COWI18-TH08-01	10 to 12.5	Primary
	COWI18-TH04-01		Duplicate

Table Notes:

For definitions, see the Acronyms and Abbreviations table.

Samples with at least one result exceeding a cleanup level are highlighted red and are **BOLD**.

Analytes from the analyte classes DRO, RRO, VOC, and PAH were detected in at least one of the samples analyzed and results are summarized below. Primary and associated duplicate samples are treated as a single analysis for the following discussion with the highest detection being utilized. Additionally, naphthalene is present in analyses for VOC and PAH but was not detected in project samples. The duplicate sample is displayed in **Table 4** with the same depth as the primary sample and is shaded gray. Quality control samples included one primary – duplicate pair.

Soil chemical results are compared against ADEC Method Two human health and petroleum hydrocarbon (most stringent of ingestion or inhalation) cleanup levels (HHSCL) for the under 40-inch zone and the associated migration to groundwater cleanup levels (MSCL) (ADEC, 2017a).

DRO was detected in one sample below the cleanup level and RRO was detected in all samples at concentrations below the cleanup level. PAH analytes (chrysene, fluoranthene, phenanthrene, and pyrene) were detected in one sample at concentrations below the respective cleanup levels. 1,2-dibromoethene [ethylene dibromide] (EDB) was detected above the 0.00024 milligrams per kilogram (mg/kg) cleanup level in Test Boring RM18-TH01.

Table 4. Summarized Soil Volatile Organic Compound Results

Test Boring Location	Sample Number[2,3]	Depth (feet)	DRO	RRO	EDB	Chrysene	Fluor-anthene	Phen-anthrene	Pyrene
			Cleanup Level[1] (mg/kg)						
			250	***11,000***	***0.00024***	***82***	***590***	***39***	***87***
			10,250	***10,000***	***0.42***	***200***	***3,100***	***1,900***	***2,300***
RM18-TH01	COWI18-TH01-01	2.0 to 5.0	9.93 J	24.9	**0.000378 J**	0.00714 J	0.0173 J	0.0145 J	0.0138 J
RM18-TH02	COWI18-TH02-01	5.0 to 7.5	ND(10.8)	13.0 J	ND(0.000259)	ND(0.0134)	ND(0.0134)	ND(0.0134)	ND(0.0134)
RM18-TH08	COWI18-TH08-01	10 to 12.5	ND(13.1)	28.3	ND(0.000416)	ND(0.0164)	ND(0.0164	ND(0.0164	ND(0.0164
	COWI18-TH04-01		ND(13.1)	33.5	ND(0.000433)	ND(0.0164)	ND(0.0164)	ND(0.0164)	ND(0.0164)

Table Notes:

For definitions, see the Acronyms and Abbreviations table.

Non-detect results are displayed as the LOD followed by a "U" flag. Data flags (i.e. J, etc) are defined in the level 2 laboratory reports provided in **Appendix D.**

1 HHSCL and MSCL for the under 40-inch zone are highlighted red and yellow, respectively (ADEC, 2017a). Results exceeding a cleanup level are highlighted red and are **BOLD**.

2 Chemical samples collected at the same depth are a primary-duplicate pair.

3 Duplicate samples are shaded grey.

3.3 Decontamination

Reusable sampling equipment that contacted potentially contaminated soil or water, including direct push tooling, were decontaminated before each use to prevent cross contamination. Alconox® solution and a nylon brush was used to scrub the tooling. Next, the equipment was rinsed twice with potable water. The resulting waste decontamination water was collected in a metal trough and later transferred to a drum (See **Section 3.4**).

3.4 Investigation Derived Waste

Miscellaneous solid wastes, such as personnel protective equipment and disposable sampling equipment, were temporarily stored in the appropriate waste receptacles at the site. Final disposal of the materials was at the local permitted sanitary landfill.

Soil cuttings were used as test boring backfill or were containerized in an open-top drum in accordance with the SAP (R&M, 2017). Decontamination water was placed in the same drum. Chemical data indicate that soil cuttings from test hole RM18-TH01 had a detected concentration of EDB exceeding MSCL cleanup levels.

Based on soil chemical testing results, the containerized soil cuttings and waste water is potentially contaminated with EDB at concentrations exceeding MSCL. Refer to **Section 5.2.1** for disposal recommendations.

Quality Assurance/Quality Control

Samples were collected by a QEP, as defined in 18 AAC 75 Oil and Other Hazardous Substances Pollution Control regulations (ADEC, 2017a). Data quality review was conducted to evaluate whether field measurements and analytical methods were performed according to method and project specifications and to qualify data affected by sample-handling or analytical anomalies.

Data quality review involved the evaluation of documentation and analytical reports associated with selected samples or groups of samples. Data review followed the ADEC Technical Memorandum on Data Quality Objectives, Checklists, Quality Assurance Requirements for Laboratory Data, and Sample Handling (ADEC, 2017b). Chemical data limit of detection (LOD) sensitivities were compared to the most stringent cleanup levels published in 18 AAC 75 (ADEC, 2017a). An ADEC data review checklist is included in **Appendix E** (ADEC, 2017d). Additional data qualifiers (flags) were added based on quality review of the data deliverables.

Table 5. Qualifier Definitions

Qualifier	Definition
J	Result refers to a concentration greater than the method detection limit but below the LOQ.
B	Indicates the reported value is similar in concentration to the result of a related blank sample.
QH, QL, QN	Indicates the reported result is an estimated value (high, low, unknown) due to a deficiency in related quality criteria.
MH, ML, MN	Indicates the reported result is an estimated value (bias: high, low, unknown) due to matrix interference.
R	Indicates the reported result is rejected as inherently unreliable due to quality control deficiencies and is not recommended for project use.

Table Notes:

For definitions, see the Acronyms and Abbreviations table.

Samples were maintained at 0 to 6 degrees Celsius (°C) under standard chain-of-custody procedures until delivery or shipment to the analytical laboratory. R&M delivered the samples to SGS under strict chain-of-custody procedures. Laboratory check-in and holding time information are summarized in **Table 8**.

Table 6. Cooler Check-In and Holding Time Information

Analytical Laboratory	Samples Analyzed Within Holding Time	ADEC Temperature Range (°C)	Check-in Temperature (°C)	Notes
SGS	Yes	0 to 6	4.4	Soil

Table Notes:

For definitions, see the Acronyms and Abbreviations table.

The following sections discuss quality assurance and quality control parameters for the above referenced laboratory report. This report is applicable to all samples collected for GRO, DRO, RRO, VOC, and PAH analyses. Detailed discussion of data quality and usability are provided in the ADEC data review checklist included in **Appendix E.**

4.1 Precision

Field duplicates must be collected at a rate of at least one per ten primary field samples (10 percent) for each matrix sampled, for each target analyte. For this project, one soil field duplicates were collected for 3 primary samples, a rate of 33 percent. Data quality and usability are not considered to be affected.

Laboratory control spike (LCS) and laboratory control spike duplicates (LCSD) recoveries were within acceptable ranges accept for 1,3-dichloropropene, which was non-detect in project samples. Data quality and usability are not considered affected.

Surrogate recovery for 4-bromofluorobenzene was not within acceptable ranges and the samples was re-run by the lab to confirm the results. Data quality and usability are not considered affected.

Recovery of trichlorofluoromethane was recovered above acceptable ranges in the matrix spike/matrix spike duplicate pair. The analyte was non-detect in project samples and data quality and usability are not considered affected.

Soil field duplicate relative percent difference (RPD) was assessed for RRO (only detections in the primary/duplicate pair were calculated). RRO met quality control limits with an RPD of 17 percent. Data quality and usability are not considered affected.

4.2 Accuracy

LCS and LCSD recoveries and RPDs were within acceptable ranges except for 1,3-dichloropropene which was recovered above the acceptable range. 1,3-dichloropropene was not detected in project samples.

Surrogate recoveries were within acceptable ranges.

4.3 Representativeness

Samples were collected from appropriate matrices and locations to adequately characterize the media targeted for investigation as defined in the approved SAP (R&M, 2017).

4.4 Comparability

Field screening results and observations relate to results obtained by laboratory analysis of the target analytes.

4.5 Completeness

All chemical data results included with this report are considered usable.

4.6 Sensitivity

Soil LODs were less than the regulatory cleanup levels for the target analytes with the exception of 1,2-dibromoethane (EDB).

Analyses of trip blanks (TB) were non-detect or less than the limit of quantitation (LOQ) for the target analytes.

Analysis of laboratory method blank (MB) were non-detect or less than the LOQs for the target analytes.

Conclusions and Recommendations

Data and field observations generated during this investigation were analyzed to produce conclusions and recommendations related to environmental conditions along the proposed utility routes. Data were assessed for potential environmental impacts to PCT construction including soil and groundwater management and human health concerns for construction workers.

5.1 Investigation Conclusions

Soil was found contaminated with EDB (a common fuel additive) above regulatory cleanup levels by the 2018 investigation. Groundwater may be affected by EDB soil contamination as detection in soil exceeded the migration to groundwater cleanup level. Field screening may not be an effective method to screen for soil contamination during proposed construction as field screening will not resolve the presence or absence of EDB given the extremely low cleanup level.

Detected contaminants were below human health cleanup level for EDB, DRO, RRO, chrysene, fluoranthene, phenanthrene, and pyrene. This investigation was limited in extent and was not designed to fully characterize the area. The potential for higher levels of contamination is possible beyond what this investigation detected.

The EDB detection exceeds the migration to groundwater cleanup level from RM18-TH01, but is more than 10 times below the human health cleanup level and is considered insignificant from a human health perspective based on ADEC conceptual site model guidance.

The 2017 investigation found that soil and groundwater were found contaminated with petroleum hydrocarbons, VOC, and PAH above regulatory cleanup levels. Only one VOC analyte related to petroleum hydrocarbons (1,2,4-trimethylbenzene) was detected in soil above the human health soil cleanup level. DRO, RRO, dichlorofluoromethane, methylene chloride, and 1-methylnaphthalene were detected in groundwater samples above groundwater cleanup levels. Groundwater cleanup levels are considered to be protective of human health impacts (R&M, 2018).

The approximate locations of contaminated media (soil and groundwater) encountered by the 2017 and 2018 environmental investigations along the proposed utility alignments are shown on **Drawing A-03** and are located south of the ABI Cement Dome and northwest of the Delta Western tank farm along the water front. There is a potential for contaminated media to be encountered between the test boring locations. These investigations were designed to test for the presence or absence of contamination along the utility alignment, not to fully characterize the extent of contamination horizontally or vertically.

5.2 Recommendations

The following sections detail recommendations based on the findings of this investigation, the 2017 investigation and the regulatory framework for managing contaminated media within the proposed waterline re-alignment corridor.

5.2.1 IDW Recommendations

R&M provides the following recommendations for disposal of IDW generated during the investigation:

- Dispose of waste soil cuttings and waste water at an approved treatment, storage, and disposal facility after obtaining approval to transport from ADEC due to exceedance of cleanup levels in soil. R&M will

coordinate with ADEC and an approved treatment, storage, and disposal facility to properly dispose of IDW generated during this investigation in accordance with local, State, and Federal regulations.

5.2.2 Construction Recommendations

R&M provides the following recommendations for proposed construction in the proposed waterline re-alignment corridor based on results from the 2017 and 2018 investigations:

- Provide a copy of this report to ADEC in accordance with the approved SAP for the Port ADEC file. Proposed construction contractor(s) should be provided a copy of this report as part of project documents.
- Coordinate with ADEC for disposal or reuse of contaminated soil encountered during construction.
  - R&M recommends developing an ADEC approved work plan to monitor soil along the proposed utility corridor during construction and to provide pre-approved decision points for handling contaminated material encountered during construction to minimize impacts to project schedule. We recommend beginning development of the work plan approximately 60 days prior to beginning excavation.
  - Contaminated soil may be replaced in a trench at the approximate location generated if it is below human health cleanup levels.
    - ADEC may require chemical testing of soil prior to reuse as backfill in addition to sampling conducted by this investigation. This would require an area to temporarily stockpile soil until ADEC approves use as backfill or offsite transport and disposal.
    - An ADEC pre-approved work plan may minimize impacts to project schedule or construction resources by defining when additional testing may be required (i.e. based on field screening of excavated soil).
  - Contaminated soil above migration to groundwater cleanup levels that cannot be replaced in the trench as backfill (in the approximate location from where it was generated) may need to be disposed of offsite with prior approval from ADEC.
    - Soil removed from the Port will require prior approval from ADEC due to the Port's status as a contaminated site.
    - An ADEC pre-approved work plan would be able to define work flow and a reporting chain of command to expedite removal of soil from the Port.
- Determine a method for managing excavation dewatering activities, if necessary.
  - Dewatering is not covered by the construction general permit as the project is within 1,500 feet of a known contaminated site and the project area contains known contamination of soil and groundwater.
  - An ADEC dewatering permit will be necessary to perform any dewatering activities during construction.
  - Water removed from the excavation would need to be treated at an offsite facility, or an onsite treatment system would be needed (i.e. a granular activated carbon filtration system).
  - A dewatering plan in support of the ADEC permit could be included in the recommended ADEC pre-approved work plan.

5.2.3 Construction Contractor Recommendations

Construction contractor specific recommendations are as follows to mitigate cost or schedule impacts to the project associated with handing and disposing of contaminated material during construction based on results from the 2017 and 2018 investigations.

- Retain an environmental consultant to develop the work plan, site specific safety plan, and dewatering plan described in the above recommendations prior to beginning construction.
- Environmental planning documents should provide ADEC pre-approved disposal or reuse criteria for soil or water removed from the excavation during construction. This should include sampling and field screening criteria, as applicable.
- ADEC approved disposal locations should be determined as part of planning document development.
- Groundwater is shallow and cannot be removed from an excavation without prior ADEC approval as the Construction General Permit is not applicable due to known contamination within the project area.
- The construction contractor should plan to temporarily containerize dewatering effluent and stockpile soil in an area 200 feet from water (including Cook Inlet). Stockpiled soil with suspected contamination must be placed on a liner meeting 18 AAC 75 specifications that may need to be surrounded with berms (ADEC, 2017a).

Closure

This report has been prepared for the use of COWI and their representatives in the study of this site. The findings presented within this report are based on limited sampling and laboratory analyses conducted by R&M. Since opinions of conditions prevailing on a particular site must be based on the work authorized by the client, all findings/data must be construed as representative of the site at a particular moment in time and the result of services performed within the scope, limitations, and cost of the work requested. Changes in the conditions of this site may occur with the passage of time and may be due to natural processes or the works of humans. In addition, changes in government codes, either State or Federal regulations or laws, may occur. Due to such changes, which are beyond our control, observations and recommendations applicable to this site may need to be revised wholly or in part from time to time.

R&M Consultants, Inc. performed this work in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No warranty, express or implied, beyond exercise of reasonable care and professional diligence, is made.

References

ADEC (Alaska Department of Environmental Conservation), 2017a. “18 AAC 75: Oil and Other Hazardous Substances Pollution Control.” 7 November 2017.

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

ADEC, 2017c. “Guidance on Developing Conceptual Site Models.” January 2017.

ADEC, 2017d. “Laboratory Data Review Checklist.” July 2017.

ADEC, 2017e. “Field Sampling Guidance.” August 2017.

R&M (R&M Consultants, Inc.), 2017. Environmental Sampling and Analysis Plan: Petroleum and Cement Terminal. Prepared for COWI North America and the Port of Alaska. 17 October 2017.

R&M, 2018. Route Clearance Study: Petroleum and Cement Terminal. Prepared for COWI North America and the Port of Alaska. 5 February 2018.

WRCC (Western Regional Climate Center), 2018. http://www.wrcc.dri.edu/index.html, accessed 22 August 2018.

Appendix A: Drawings

VERIFY SCALES

BAR IS ONE INCH ON ORIGINAL DRAWING

0 1"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

REV	DATE	DESCRIPTION	BY	APVD

REVISIONS

COWI

R&M CONSULTANTS, INC.

DSGN: CDF | DR: CDF | CHK: KMM | APVD: JD

CONSULTANT

SEAL

PORT of ALASKA

PORT of ALASKA MODERNIZATION PROGRAM

LOCATION AND VICINITY MAP

PORT OF ALASKA

PORT OF ALASKA MODERNIZATION PROGRAM

PETROLEUM AND CEMENT TERMINAL

ANCHORAGE, ALASKA

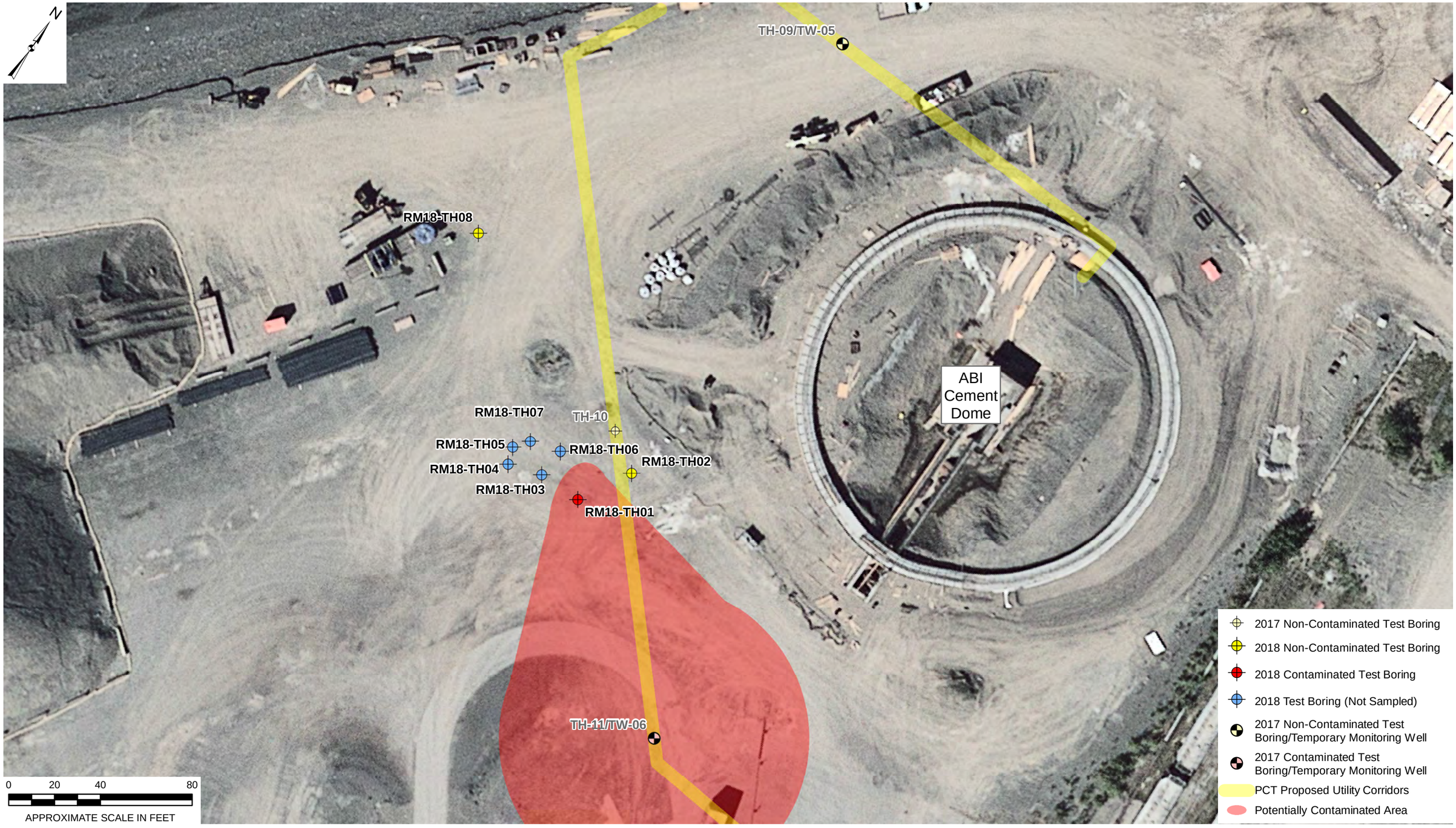
HORIZ SCALE: SHOWN
VERT SCALE: N/A

DATE: 24 JULY 2018
SHEET:

DWG. A-01

FILE NO.-

Drawing: A-01 Location and Vicinity
Date: 7/27/2018 01:37 PM



VERIFY SCALES

BAR IS ONE INCH ON ORIGINAL DRAWING

0 1"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

REV	DATE	DESCRIPTION	BY	APVD

REVISIONS

COWI

R&M CONSULTANTS, INC.

DSGN: CDF | DR: CDF | CHK: KMM | APVD: JD

CONSULTANT

SEAL

PORT of ALASKA

PORT OF ALASKA MODERNIZATION PROGRAM

INVESTIGATION LOCATIONS AND SITE FEATURES MAP

PORT OF ALASKA

PORT OF ALASKA MODERNIZATION PROGRAM

PETROLEUM AND CEMENT TERMINAL

ANCHORAGE, ALASKA

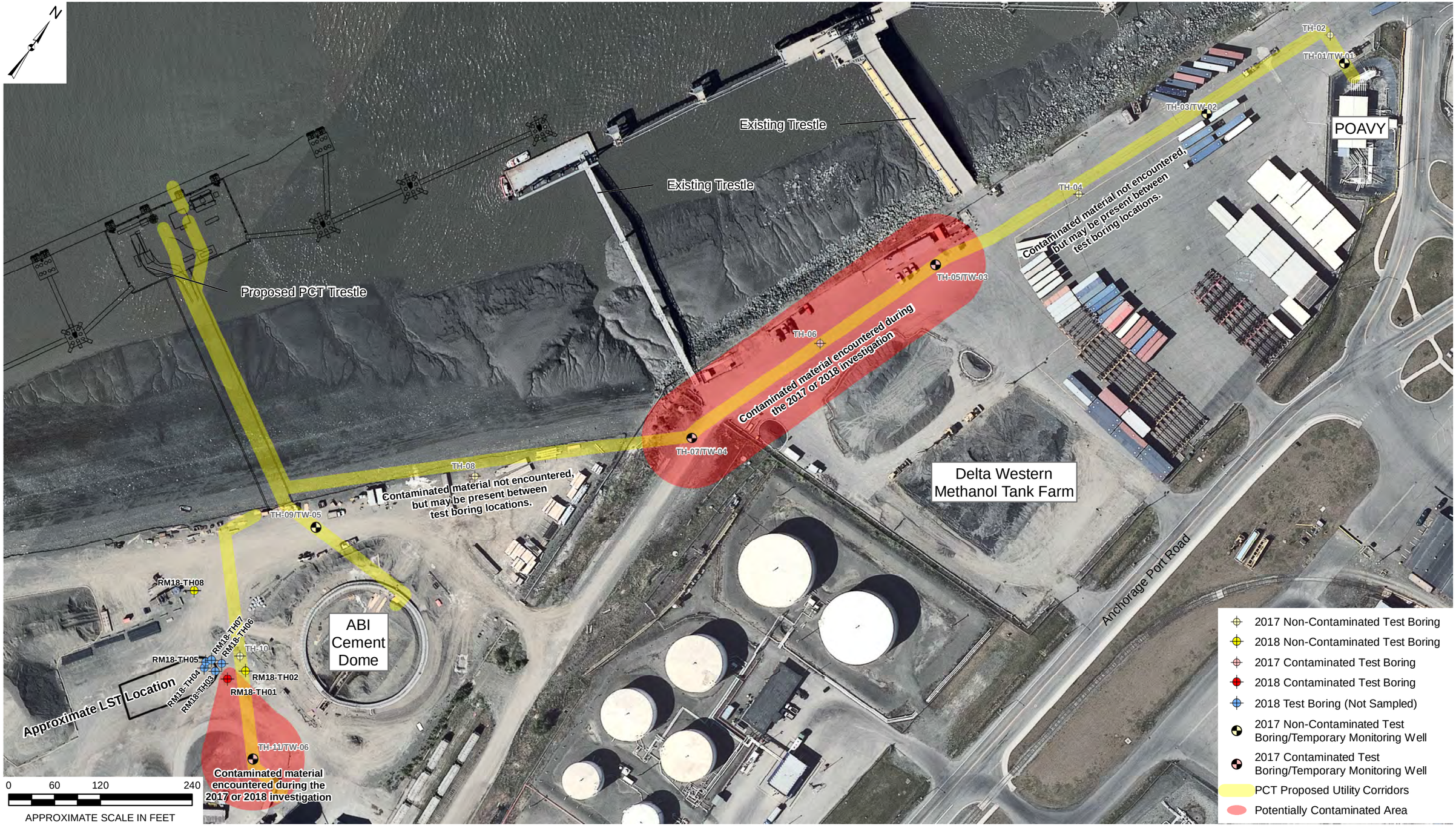
HORIZ SCALE: SHOWN
VERT SCALE: N/A

DATE: 27 JUL 2018
SHEET:

DWG.: A-02

Drawing: A-02 InvestLoc
Date: 9/6/2018 11:46 AM

FILE NO.-



VERIFY SCALES

BAR IS ONE INCH ON ORIGINAL DRAWING.

0 1"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

REV	DATE	DESCRIPTION	BY	APVD

REVISIONS

COWI

R&M CONSULTANTS, INC.

DSGN: CDF | DR: CDF | CHK: KMM | APVD: JD

CONSULTANT

SEAL

PORT of ALASKA

2017 AND 2018 INVESTIGATION AND IDENTIFIED HYDROCARBON CONTAMINATION LOCATIONS

PORT OF ALASKA

PORT OF ALASKA MODERNIZATION PROGRAM

PETROLEUM AND CEMENT TERMINAL

ANCHORAGE, ALASKA

HORIZ SCALE: SHOWN
VERT SCALE: N/A

DATE: 27 JUL 2018
SHEET:

DWG.: A-03

FILE NO.-

Drawing: A-03 InvestLoc
Date: 9/6/2018 11:37 AM

Appendix B: Test Boring Logs

SOILS
CONSISTENCY AND SYMBOLS

CLASSIFICATION: Identification and classification of the soil is accomplished in accordance with the ASTM version of the Unified Soil Classification System. When laboratory testing data on material passing the 75-mm sieve is available Standard D 2487 (Classification of Soils for Engineering Purposes) is used and when laboratory data is not available D 2488 (Visual-Manual Procedure) is used. This classification system identifies three major soil divisions: coarse-grained soils, fine-grained soils, and highly organic soils. These three divisions are further subdivided into a total of 15 basic soils groups. Based on the results of visual observations and prescribed laboratory tests, a soil is catalogued according to the basic soil groups, assigned a group symbol(s) and name, and thereby classified. Flow charts contained in the two standards can be used to assign the appropriate group symbol(s) and name.

SOIL DENSITY/CONSISTENCY - CRITERIA: Soil density/consistency as defined below and determined by normal field and laboratory methods applies only to non-frozen material. For these materials, the influence of such factors as soil structure, i.e. fissure systems shrinkage cracks, slickensides, etc., must be taken into consideration in making any correlation with the consistency values listed below. In permafrost zones, the consistency and strength of frozen soil may vary significantly and inexplicably with ice content, thermal regime and soil type.

COARSE GRAINED
(DOT&PF 2007)

Relative Density	N * (blows/FT.)
Very loose	0 - 4
Loose	5 - 10
Medium dense	11 - 30
Dense	31 - 50
Very dense	>50

FINE GRAINED
(ASTM D2488)

Consistency	Thumbnail Test
Very soft	Thumb > 1 in.
Soft	Thumb = 1 in.
Firm	Thumb = 1/4 in.
Hard	Thumbnail indents
Very hard	Thumbnail will not indent

* Standard Penetration "N": Blows per 12 inches of a 140-pound manual hammer (lifted with rope & cathead) falling 30 inches on a 2-inch O.D. split-spoon sampler except where noted. Blow counts presented on test boring logs are direct field values (i.e.they have not been corrected to account for hammer efficiency, borehole diameter, sampling method, or rod length)

KEY TO TEST RESULTS

DD - Dry Density
LL - Liquid Limit
MC - Moisture Content
Org - Organic Content
PI - Plastic Index
PL - Plastic Limit
PP - Pocket Penetrometer
P200 - % Passing No. 200 Screen
P.02 - % Passing 0.02 mm
P.005 - % Passing 0.005 mm
P.002 - % Passing 0.002 mm

* (DRAWING 1 NEW SOIL CONSISTENCY&CLASS (NON-DOT&PF) 7/16/18 01:23 PM

DWN:	B.M.M.
CKD:	C.H.R.
DATE:	GENERAL
SCALE:	NONE

R&M CONSULTANTS, INC.

GENERAL NOTES

FB:	N/A
GRID:	N/A
PROJ.NO:	GENERAL
DWG.NO:	1

STANDARD SYMBOLS

SYMBOL	NAME	PARTICLE SIZE	SYMBOL	NAME
	CLAY	< 0.002mm, Plastic		ORGANICS
	SILT	0.002mm, - #200		ICE
	SAND	#200, - #4		ICE W/SOIL INCLUSIONS
	GRAVEL	#4, - 3"		ICE LENSE IN SOIL
	COBBLES & BOULDERS	3" - 12" & > 12"		ICE CRYSTALS IN CLAY

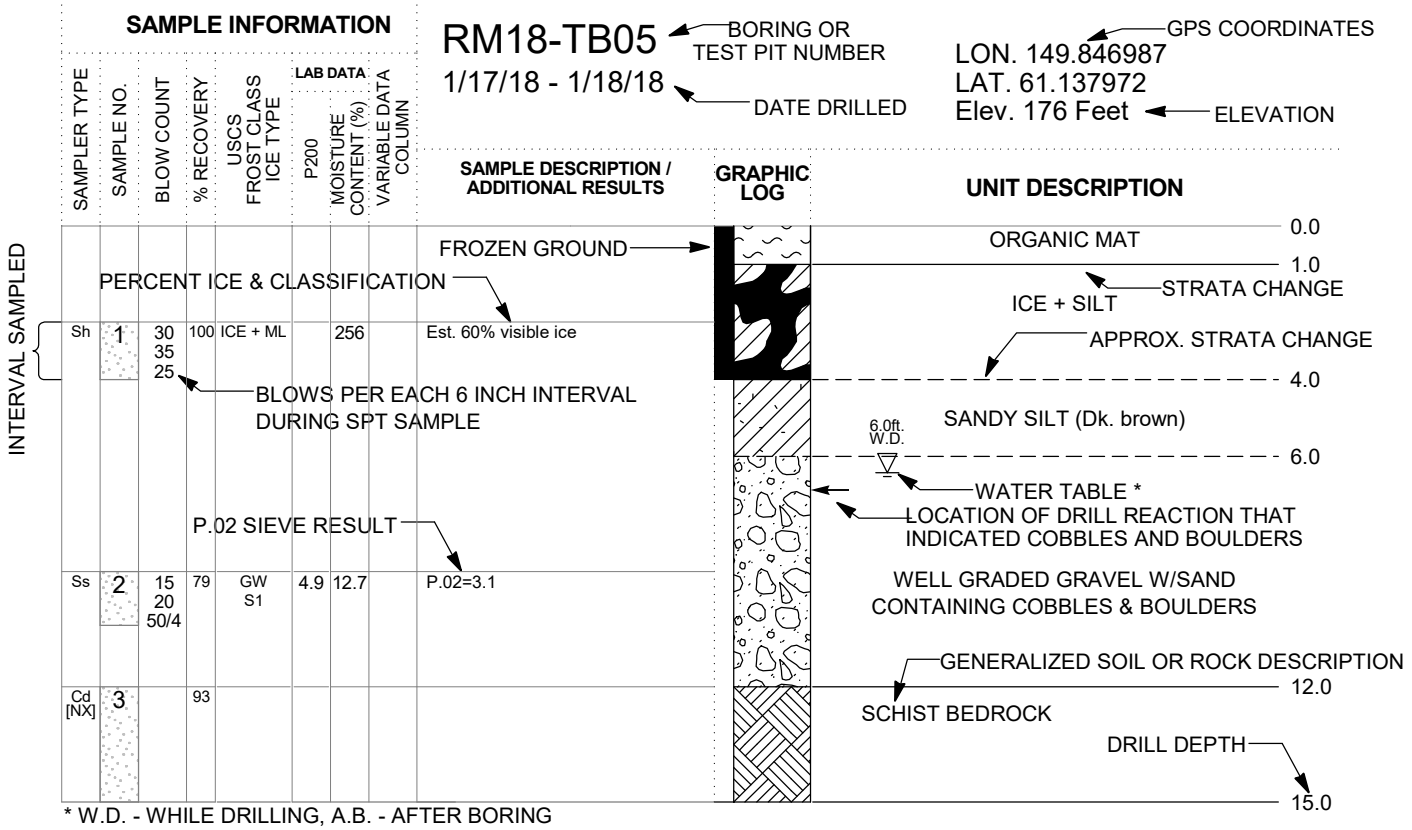
(The symbols shown above are frequently used in combinations, e. g. SILTY GRAVEL W/SAND)

SAMPLER TYPE SYMBOLS

A	Auger Sample	MC	1.5 In. I.D. Macro-core	Ss	1.4 In. Split Spoon w/140 lb. Manual Hammer
C	Cuttings Sample	MC7	3.0 In. I.D. Macro-core	Ssa	1.4 In. Split Spoon w/140 lb. Auto Hammer
Cd	Double Tube Core Barrel	Sh	2.5 In. Split Spoon w/340 lb. Manual Hammer	Tm	Modified Shelby Tube
Cs	Single Tube or Auger Core	Sha	2.5 In. Split Spoon w/340 lb. Auto Hammer	Ts	3.0 In. Shelby Tube
Ct	Triple Tube Core Barrel	Sl	2.5 In. Split Spoon w/140 lb. Hammer	[XX]	Sampler ID (Rock Core - NX, NQ, etc.)
G	Grab Sample				

NOTE: Sampler types are either noted above the boring log or adjacent to it at the respective depth. An individual log may not utilize all of the items listed.

TYPICAL BORING AND TEST PIT LOG



* W.D. - WHILE DRILLING, A.B. - AFTER BORING
** - REFER TO SAMPLER SYMBOL (Ss, Sh, ETC.) FOR SAMPLER I.D. & HAMMER WEIGHT/TYPE
NOTE: Water levels shown on the boring logs are the levels measured in the boring at the times indicated.

* (DRAWING 1 NEW EXPLAN OF SELCTD SYM (NON-DOT&PF)) 7/16/18 01:22 PM

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CKD:	C.H.R.
DATE:	GENERAL
SCALE:	NONE

R&M CONSULTANTS, INC.

EXPLANATION OF SELECTED SYMBOLS

FB:	N/A
GRID:	N/A
PROJ.NO:	GENERAL
DWG.NO:	2

RM18-TH01

7/6/18

DEPTH (FT)	SAMPLER TYPE	SAMPLE NO.	BLOW COUNT	% RECOVERY	USCS FROST CLASS ICE TYPE	LAB DATA P200 (%)	LAB DATA MOISTURE CONTENT (%)	SAMPLE DESCRIPTION / ADDITIONAL RESULTS	GRAPHIC LOG	UNIT DESCRIPTION
0	Mc5	1		68	GW*			Brown, Moist, Chem Sample: COWI18-TH01-01 (2.5 to 5.0 ft), PID=0.0 (0 and 2.5 ft)ppm		0.0 ASPHALT (FILL) 0.3 WELL GRADED GRAVEL W/SAND (FILL) (Brown, Gravel to 2.5" dia., subrounded, hard, Fine to coarse sand, Moist)
4								4.5 WD ▽		
		2			SM*			Brown, Wet		4.5 SILTY SAND W/GRAVEL (FILL) (Brown to gray, Gravel to 1.5" dia., subrounded, hard, Fine to medium sand, Wet)
6	Mc5	3		50	SM*			Brown, Wet, PID=0.0ppm		
10	Mc5	4		42	SM*			Brown, Wet, PID=0.0 (10 and 12.5 ft)ppm		
14		5			ML*			Gray, Wet		14.5 SILT W/ SAND (Gray, Fine sand, Low plasticity to plastic, Wet)
16	Mc5	6		86	ML*			Gray, Wet, PID=0.0 (15 and 17.5 ft)ppm		
20	Mc5	7		64	ML*			Gray, Wet, PID=0.0 (20 and 22.5 ft)ppm		
26	Mc5	8		92	ML*			Gray, Wet, PID=0.0 (25 and 27.5 ft)ppm		
30										30.0

*Estimated classification (Visual Manual Method Only)

G:\GINT_PROJECTS\2508.01 COWI\GEOTECH\WATERLINE\2508.01 WATER LINE.GPJ

NEW RM LOG 2508.01 WATER LINE.GPJ RM_DATATEMPLATE_UPDATE.GDT 9/5/18

DWN:	C.D.F
CKD:	R.M.P.
DATE:	JULY 2018
SCALE:	SHOWN

R&M CONSULTANTS, INC.

ANCHORAGE PORT MODERNIZATION
PETROLEUM AND CEMENT TERMINAL
LOG OF TEST BORING
RM18-TH01

FB:	NA
GRID:	1031
PROJ.NO:	2508.01
DWG.NO:	3

RM18-TH02

7/6/18

DEPTH (FT)	SAMPLER TYPE	SAMPLE NO.	BLOW COUNT	% RECOVERY	USCS FROST CLASS ICE TYPE	LAB DATA: P200 (%)	LAB DATA: MOISTURE CONTENT (%)	SAMPLE DESCRIPTION / ADDITIONAL RESULTS	GRAPHIC LOG	UNIT DESCRIPTION
0		1		96	GW*			Brown, Moist, PID=0.0 (0 and 2.5 ft)ppm		WELL GRADED GRAVEL W/SAND (FILL) (Brown, Gravel to 2.5" dia., subrounded, hard, Fine to coarse sand, Moist) 0.0
2										
4										
6		2		68	GW*			Brown, Moist, Chem Sample: COWI18-TH02-01 (5 to 7.5 ft), Coffman Corrosion Sample (7.5 to 10 ft), PID=0.0 (5 and 7.5 ft)ppm		
8		3			SP*			Brown, Moist		POORLY GRADED SAND (FILL) (Brown, Fine to coarse sand, Moist to wet) 8.3
10		4		80	ML*			Gray, Wet, PID=0.0 (10 and 12.5 ft)ppm 10.0 WD ▽		SILT (Gray, Low plasticity to plastic, Wet) 10.0
12										
14										
16		5		80	ML*			Gray, Wet, PID=0.0 (15 and 17.5 feet)ppm		
18										
20		6		80	ML*			Gray, Wet, PID=0.0 (20 and 22.5 feet)ppm		
22										
24										
26		7		80	ML*			Gray, Wet		
28										
30										30.0

*Estimated classification (Visual Manual Method Only)

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NEW RM LOG 2508.01 WATER LINE.GPJ RM_DATATEMPLATE_UPDATE.GDT 9/5/18

DWN:	C.D.F
CKD:	R.M.P.
DATE:	JULY 2018
SCALE:	SHOWN

R&M CONSULTANTS, INC.

ANCHORAGE PORT MODERNIZATION
PETROLEUM AND CEMENT TERMINAL
LOG OF TEST BORING
RM18-TH02

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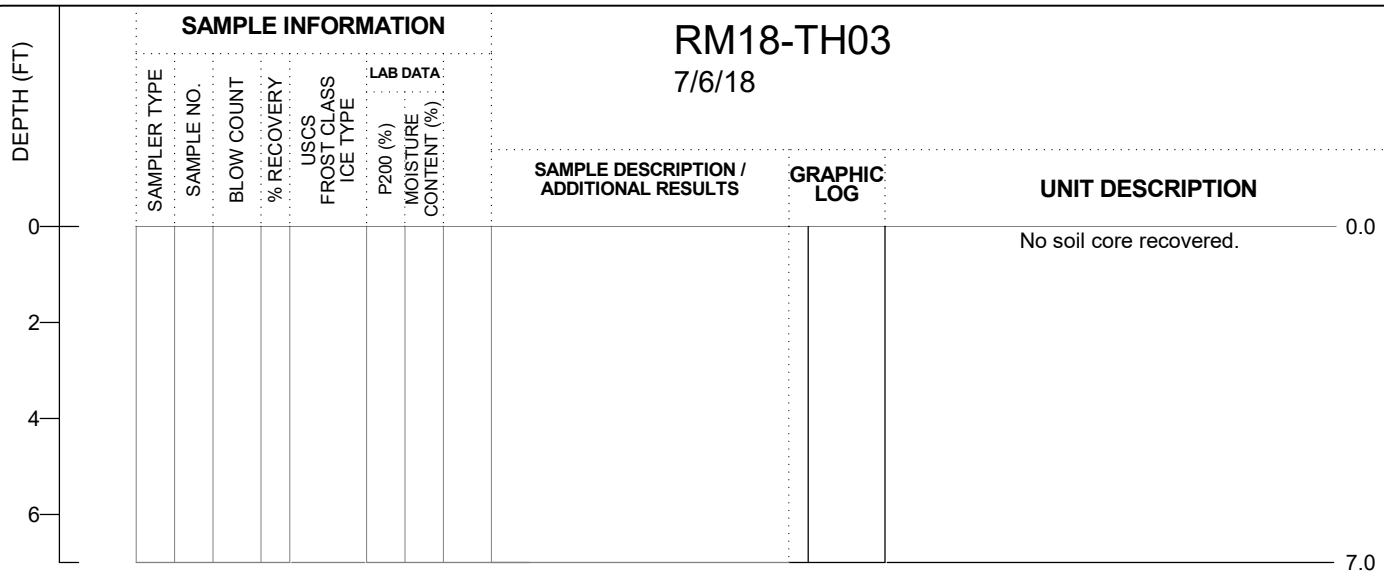
GRID:	1031
PROJ.NO:	2508.01
DWG.NO:	4

RM18-TH03

7/6/18



No soil core collected.
MC5 tooling driven to depth with a solid point to explore for the buried LST.

Refusal at 7 feet bgs. Interpreted to be the buried LST

G:\GINT_PROJECTS\2508.01 COW\GEOTECH\WATERLINE\2508.01 WATER LINE.GPJ

NEW RM LOG 2508.01 WATER LINE.GPJ RM_DATATEMPLATE_UPDATE.GDT 9/5/18

DWN:	C.D.F
CKD:	R.M.P.
DATE:	JULY 2018
SCALE:	SHOWN

R&M CONSULTANTS, INC.

ANCHORAGE PORT MODERNIZATION
PETROLEUM AND CEMENT TERMINAL
LOG OF TEST BORING
RM18-TH03

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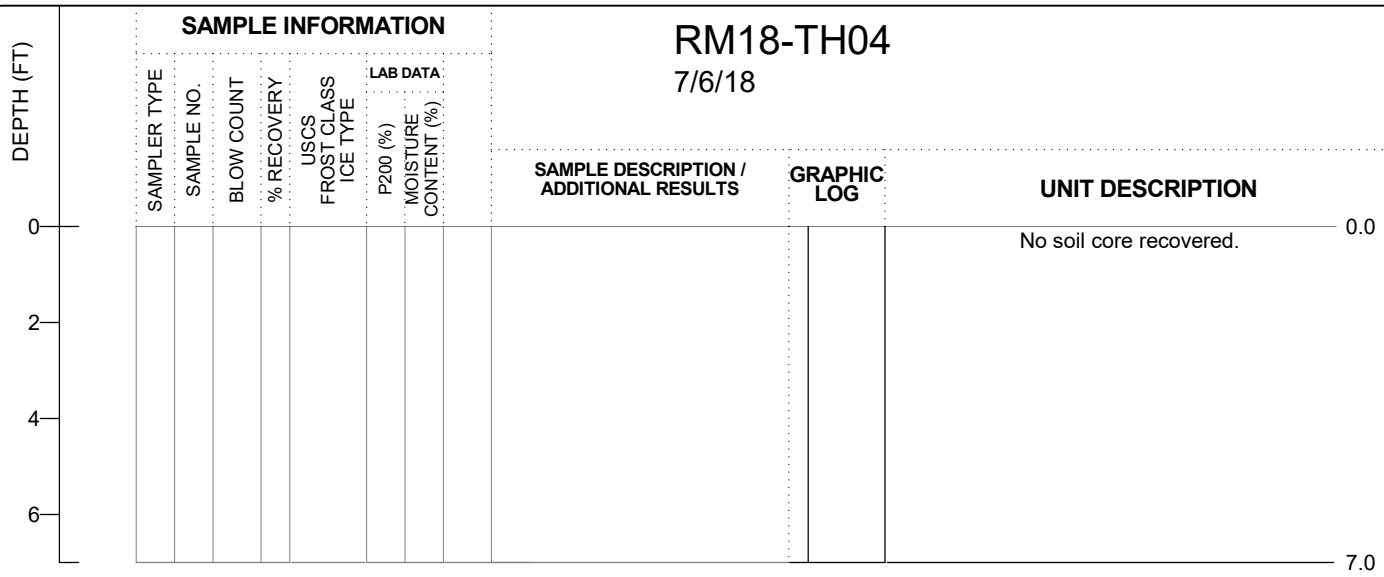
GRID:	1031
PROJ.NO:	2508.01
DWG.NO:	5

RM18-TH04

7/6/18



No soil core collected.
MC5 tooling driven to depth with a solid point to explore for the buried LST.

Refusal at 7 feet bgs. Interpreted to be the buried LST

DWN:	C.D.F
CKD:	R.M.P.
DATE:	JULY 2018
SCALE:	SHOWN

R&M CONSULTANTS, INC.

ANCHORAGE PORT MODERNIZATION
PETROLEUM AND CEMENT TERMINAL
LOG OF TEST BORING
RM18-TH04

FB:	NA
GRID:	1031
PROJ.NO:	2508.01
DWG.NO:	6

RM18-TH05

7/6/18

DEPTH (FT)	SAMPLE INFORMATION: SAMPLER TYPE	SAMPLE NO.	BLOW COUNT	% RECOVERY	USCS FROST CLASS ICE TYPE	LAB DATA: P200 (%)	LAB DATA: MOISTURE CONTENT (%)	SAMPLE DESCRIPTION / ADDITIONAL RESULTS	GRAPHIC LOG	UNIT DESCRIPTION
0										0.0 No soil core recovered.
2										
4										
6										
8										
10										
12										
14										
16										
18										
20										
22										
24										
26										
28										
30										30.0

No soil core collected.
MC5 tooling driven to depth with a solid point to explore for the buried LST.
Test boring terminated at 30 feet with no refusal.

NEW RM LOG 2508.01 WATER LINE.GPJ RM_DATATEMPLATE_UPDATE.GDT 9/5/18
G:\GINT_PROJECTS\2508.01 COWI\GEOTECH\WATERLINE\2508.01 WATER LINE.GPJ

DWN:	C.D.F
CKD:	R.M.P.
DATE:	JULY 2018
SCALE:	SHOWN

R&M CONSULTANTS, INC.

ANCHORAGE PORT MODERNIZATION
PETROLEUM AND CEMENT TERMINAL
LOG OF TEST BORING
RM18-TH05

FB:	NA
GRID:	1031
PROJ.NO:	2508.01
DWG.NO:	7

RM18-TH06

7/6/18

DEPTH (FT)	SAMPLE INFORMATION: SAMPLER TYPE	SAMPLE NO.	BLOW COUNT	% RECOVERY	USCS FROST CLASS ICE TYPE	LAB DATA: P200 (%)	LAB DATA: MOISTURE CONTENT (%)	SAMPLE DESCRIPTION / ADDITIONAL RESULTS	GRAPHIC LOG	UNIT DESCRIPTION
0										No soil core recovered. 0.0
2										
4										
6										6.3

No soil core collected.
MC5 tooling driven to depth with a solid point to explore for the buried LST.

Refusal at 6.25 feet bgs. Interpreted to be the buried LST

NEW RM LOG 2508.01 WATER LINE.GPJ RM_DATATEMPLATE_UPDATE.GDT 9/5/18 G:\GINT_PROJECTS\2508.01 COW\GEOTECH\WATERLINE\2508.01 WATER LINE.GPJ

DWN:	C.D.F
CKD:	R.M.P.
DATE:	JULY 2018
SCALE:	SHOWN

R&M CONSULTANTS, INC.

ANCHORAGE PORT MODERNIZATION
PETROLEUM AND CEMENT TERMINAL
LOG OF TEST BORING
RM18-TH06

FB:	NA
GRID:	1031
PROJ.NO:	2508.01
DWG.NO:	8

RM18-TH07

7/6/18

DEPTH (FT)	SAMPLE INFORMATION: SAMPLER TYPE	SAMPLE NO.	BLOW COUNT	% RECOVERY	USCS FROST CLASS ICE TYPE	LAB DATA: P200 (%)	LAB DATA: MOISTURE CONTENT (%)	SAMPLE DESCRIPTION / ADDITIONAL RESULTS	GRAPHIC LOG	UNIT DESCRIPTION
0										No soil core recovered. 0.0
2										
4										
6										
8										
10										
12										
14										
16										
18										
20										20.0

No soil core collected.
MC5 tooling driven to depth with a solid point to explore for the buried LST.
Test boring terminated at 20 feet with no refusal.

NEW RM LOG 2508.01 WATER LINE.GPJ RM_DATATEMPLATE_UPDATE.GDT 9/5/18
G:\GINT_PROJECTS\2508.01 COWI\GEOTECH\WATERLINE\2508.01 WATER LINE.GPJ

DWN:	C.D.F
CKD:	R.M.P.
DATE:	JULY 2018
SCALE:	SHOWN

R&M CONSULTANTS, INC.

ANCHORAGE PORT MODERNIZATION
PETROLEUM AND CEMENT TERMINAL
LOG OF TEST BORING
RM18-TH07

FB:	NA
GRID:	1031
PROJ.NO:	2508.01
DWG.NO:	9

RM18-TH08

7/6/18

DEPTH (FT)	SAMPLER TYPE	SAMPLE NO.	BLOW COUNT	% RECOVERY	USCS FROST CLASS ICE TYPE	LAB DATA: P200 (%)	LAB DATA: MOISTURE CONTENT (%)	SAMPLE DESCRIPTION / ADDITIONAL RESULTS	GRAPHIC LOG	UNIT DESCRIPTION
0		1		84	GW*			Brown, Moist, PID=0.0 (0 and 2.5 ft)ppm		WELL GRADED GRAVEL W/SAND (FILL) (Brown, Gravel to 3" dia., subrounded, hard, Fine to coarse sand, Moist)
5.5		2		88	SP*			Brown, Moist to wet, PID=0.0 (5 and 7.5 ft)ppm 9.0 WD		POORLY GRADED SAND (FILL) (Brown, Gravel to 0.75" dia., subrounded, hard, Fine to medium sand, Moist to wet)
10.0		3		86	ML*			Gray, Wet, Chem Sample: COWI18-TH08-01 & COWI18-TH04-01, PID=0.0 (10 and 12.5 ft)ppm		SILT W/ SAND (Gray, Fine sand, Low plasticity to plastic, Wet)
15.0										

*Estimated classification (Visual Manual Method Only)

G:\GINT_PROJECTS\2508.01 COWI\GEOTECH\WATERLINE\2508.01 WATER LINE.GPJ

NEW RM LOG 2508.01 WATER LINE.GPJ RM_DATATEMPLATE_UPDATE.GDT 9/5/18

DWN:	C.D.F
CKD:	R.M.P.
DATE:	JULY 2018
SCALE:	SHOWN

R&M CONSULTANTS, INC.

ANCHORAGE PORT MODERNIZATION
PETROLEUM AND CEMENT TERMINAL
LOG OF TEST BORING
RM18-TH08

FB:	NA
GRID:	1031
PROJ.NO:	2508.01
DWG.NO:	10

Appendix C: Field Notes

R&M Environmental Vol #2
Miscellaneous Field Notes

Rite in the Rain
ALL-WEATHER
UNIVERSAL
№ 373-MX

COWI AWWU W/L REALIGN 7/6/20
2508.01 C.FELL

0845 C.FELL & DISCOVERY DRILLING ARRIVED ON SITE

SAFETY TAILGATE

- DANIEL — DRILLER
- MARLIN — HELPER
- CHRIS FELL — QEP / SITE LEAD

WX: 63°F, 0-5mph WIND, SUNNY

0850 PID CAL CHECK (S/N 910757)
- ZERO CHECK = 0.0 PPM (CZ)
- 100 PPM CAL GAS = 101.8 PPM (CL)
- ISOBUTYLENE exp 11/17/2026

PID FIELD SCREENING

TEST HOLE	FS #	START/STOP	AG READING (PPM)	DESC/NOTES	ODOR
TH01	01	0937/0946	0.0	2.5-5 FT (CHEM SMPL TH01-01)	NONE
	02	0938/0946	0.0	0-2.5 FT	NONE
	03	0946/0956	0.0	5 to 10 FT	NONE
	04	0954/1006	0.0	10 to 15 FT	NONE
	05	1030/1054	0.0	15-17.5 FT	NONE
	06	1031/1054	0.0	17.5 to 20 FT	↓
	07	1034/1055	0.0	20 to 22.5 FT	NONE
	08	1035/1055	0.0	22.5 to 25 FT	↓
	09	1055/1100	0.0	25 to 27.5 FT	NONE
	10	1056/1108	0.0	27.5 to 30 FT	↓
TH02	01	1100/1132	0.0	0 to 2.5 FT	NONE
	02	1118/1133	0.0	2.5 to 5.0 FT	↓
	03	1124/1145	0.0	5.0 to 7.5 FT (CHEM SMPL TH02-01 (COFFMAN))	NONE
	04	1125/1145	0.0	7.5 to 10.0 FT	↓
	05	1130/1146	0.0	10.0 to 12.5 FT	NONE
	06	1131/1146	0.0	12.5 to 15.0 FT	↓
	07	1141/1202	0.0	15.0 to 17.5 FT	NONE
	08	1142/1203	0.0	17.5 to 20.0 FT	↓
	09	1159/1215	0.0	20 to 22.5 FT	NONE
	10	1200/1215	0.0	22.5 to 25 FT	↓
	11	1215/	(CP)	~~25.0 to 27.5~~	(CP)
	12	1214/	(CP)	~~27.5 to 30.0~~	(CP)

COWJ AWWU W/L REALIGN 7/6/18
2508.01 CFELL

9914 * SAMPLE *
COWJ18-SO-QC01 @ PLACED IN PRE CHILLED COOLER
TRIP CFELL
BLANK 7/6/18
GRO AK101
VOC SW8260 } 1 4oz AMBER TLS
LLVOC SW8260 SIM TARE = 117.02g

0000 * SAMPLE *
COWJ18-~~TH~~01-01 (PRIMARY)
CFELL
FSP1 7/6/18
GRO AK101
2.5 to 5.0 FT VOC SW8260 } 1 4oz AMBER TLS
LLVOC SW8260 SIM TARE = 124.225g
PAH SW8270 SIM } 2 4oz AMBER TLC
DRO/RRO AK102/103
IMMEDIATELY PLACED IN PRE CHILLED COOLER

1100 STARTED DRILLING TH-02

TOOLING DECONED WITH ALCONOX WASH & POTABLE WATER RINSE BETWEEN HOLES.
SAMPLERS DECANNED SAME WAY BTWN EACH SAMPLE.

1152 * SAMPLE *
COWJ18-TH02-01 (PRIMARY
CFELL
5.0 to 7.5 FT 7/6/18
GRO AK101
VOC SW8260 } 1 4oz AMBER TLS
LLVOC SW8260 SIM TARE = 124.506g
PAH SW8270 SIM } 2 4oz AMBER TLC
DRO/RRO AK102/103
IMMEDIATELY PLACED IN PRECHILLED COOLER

Scale: 1 square = _____

COVER ANNW W/L REALIGN
2508.01

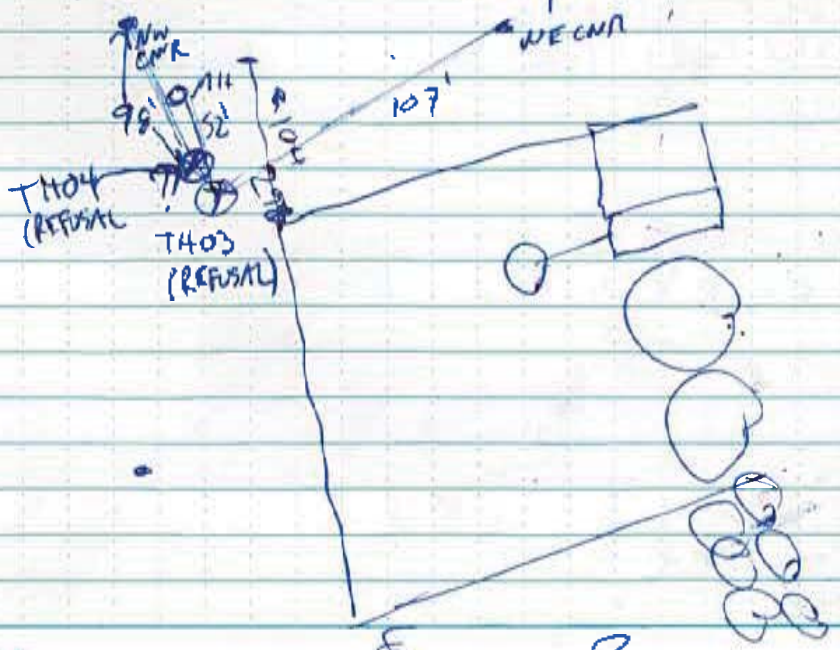
7/6/2018
C. FRUE

TEST HOLE	FS #	START/STOP	BORING PPM	DESC/NOTES	ODOR
TH08	01	1438/1452	0.0	0 to 2.5FT	NONE
	02	1439/1453	0.0	2.5 to 5.0 FT	↓
	03	1441/1453	0.0	5.0 to 7.5	NONE
	04	1442/1454	0.0	7.5 to 10.0	↓
	05	1451/1505	0.0	10.0 TO 12.5	NONE
↓	06	1452/1506	0.0	12.5 TO 15.0	

CHRIS TORRES D. FRUE 7/6/2018

1150 ★ CORROSION SAMPLE COLLECTED IN (1) QUART ZIPLOCK W/ NO HEADSPACE FROM 7.5 to 10.0 FT IN TH02

1317 BOREHOLE LOCATION DISCUSSION W/ DON PORTER / BOB PINTNER / MORGAN WELCH (REM)



Rite in the Rain

Scale: 1 square = _____

COWS AWAY W/L REALIGN 7/6/18
250Ø.Ø1 C.FELL

320 ADVANCED THØ3 TO 7FT → REFUSAL
W/ SOLID POINT

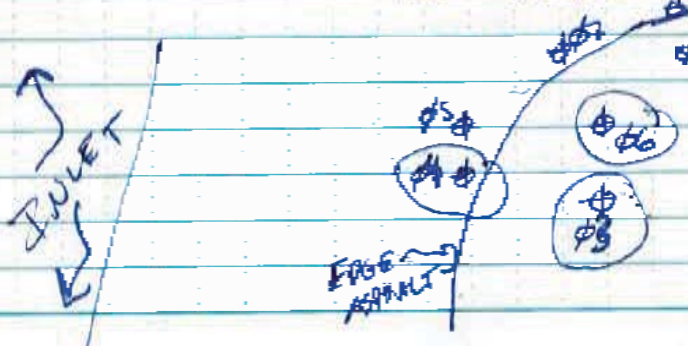
1335 ADVANCED THØ4 TO 7FT → REFUSAL
W/ SOLID POINT

1339 ADVANCING THØ5 (~5FT TOWARDS DOME FROM THØ4)
↳ NO REFUSAL TO 30 FT

1350 ADVANCING THØ6 AT AERIAL INTERP LOCATION (2007 IMAGE) REFUSAL @ 6' 3"

THØ1	NE	68 FT	3Ø FT	
	NW	111 FT		
THØ2	NE	57 FT	3Ø FT	
	NW	99 FT		
THØ3	NE	1Ø2 FT	7 FT	SHIP
	NW	1Ø5 FT		
THØ4	NE	1Ø4 FT	7 FT	SHIP
	NW	91 FT		
THØ5	NE	99 FT	3Ø FT	
	NW	92 FT		
THØ6	NE	87 FT	6.25 FT	SHIP
	NW	1Ø4 FT		
THØ7	NE	86 FT	2Ø FT	
	NW	92 FT		

1404 ADVANCING THØ7 AT EDGE ASPHALT (IN GRAVEL)
↳ NO REFUSAL TO 2Ø FT



Scale: 1 square = _____

COWI AWWU W/L REALIGN 7/6/18
25088.01 CiFELL

1415 PATCHING ASPHALT W/ COLD PATCH
MOVING TO TH08

1455 ★ COFFMAN CORROSION SAMPLE ★
7.5 to 10.0 FT 1 QUART ZIPLOCK
FROM TH08

1509 ★ SAMPLE ★
COWI18-TH08-01 (PRIMARY)
1512 COWI18-TH08-01 (DUPLICATE)
CiFELL
7/6/18

1030 GRO AK101 } 2 4oz AMBER TLS
VOC SW8260 TARE = 124.260 TARE = 124.432
1215 ✓ U VOC SW8260 SIM } 4 4oz AMBER TLC
PAH, SW8270 SIM
DRO/RRO AK102/103

TW08 NE 187 FT
NW 67 FT

1539 DISCOVERY & RAM CLEANING UP AND PREPPING FOR DEMOBE
1600 DROPPED OFF CORROSION SMPLS AT COFFMAN
1643 DROPPED OFF SAMPLES AT SGS

Chris R. Ciffell 7/6/18

Appendix D: Laboratory Data

Laboratory Report of Analysis

To: R & M Consultants Inc
9101 Vanguard Dr
Anchorage, AK 99507
(907)646-9655

Report Number: **1183454**

Client Project: **COWI AWWWU Wtr Ln RIgnmnt**

Dear Christopher Fell,

Enclosed are the results of the analytical services performed under the referenced project for the received samples and associated QC as applicable. The samples are certified to meet the requirements of the National Environmental Laboratory Accreditation Conference Standards. Copies of this report and supporting data will be retained in our files for a period of ten years in the event they are required for future reference. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. Any samples submitted to our laboratory will be retained for a maximum of fourteen (14) days from the date of this report unless other archiving requirements were included in the quote.

If there are any questions about the report or services performed during this project, please call Stephen at (907) 562-2343. We will be happy to answer any questions or concerns which you may have.

Thank you for using SGS North America Inc. for your analytical services. We look forward to working with you again on any additional analytical needs.

Sincerely,
SGS North America Inc.

Stephen C. Ede
Alaska Division Technical Director

Stephen Ede
2018.07.17
09:12:01 -08'00'

Stephen Ede Date
Project Manager
Stephen.Ede@sgs.com

SGS North America Inc. 200 West Potter Drive, Anchorage, AK 99518
t 907.562.2343 f 907.561.5301 www.us.sgs.com

Case Narrative

SGS Client: **R & M Consultants Inc**
SGS Project: **1183454**
Project Name/Site: **COWI AWWWU Wtr Ln RIgnmnt**
Project Contact: **Christopher Fell**

Refer to sample receipt form for information on sample condition.

LCS for HBN 1782136 [VXX/32572 (1457870) LCS

8260C - LCS recovery for cis-1,3-dichloropropene (127%) does not meet QC criteria. This analyte was not detected in associated samples.

1189482001(1457871MS) (1457872) MS

8260C - Surrogate recovery for 4-bromofluorobenzene (52%) does not meet QC criteria. Sample was analyzed twice and results confirmed.

1189487001MS (1459489) MS

8260C - MS recovery for trichlorofluoromethane (199%) does not meet QC criteria. Refer to LCS for accuracy.

1189482001(1457871MSD) (1457873) MSD

8260C - Surrogate recovery for 4-bromofluorobenzene (49%) does not meet QC criteria. Sample was analyzed twice and results confirmed.
8260C - MSD RPD for several analytes do not meet QC criteria. These analytes were not detected in the parent sample.

1189487001MSD (1459490) MSD

8260C - MSD recovery for trichlorofluoromethane (208%) does not meet QC criteria. Refer to LCS for accuracy.

*QC comments may be associated with the field samples found in this report. When applicable, comments will be applied to associated field samples.

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Laboratory Qualifiers

Enclosed are the analytical results associated with the above work order. All results are intended to be used in their entirety and SGS is not responsible for use of less than the complete report. This document is issued by the Company under its General Conditions of Service accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>. Attention is drawn to the limitation of liability, indenmification and jurisdiction issues defined therein.

Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the context or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

SGS maintains a formal Quality Assurance/Quality Control (QA/QC) program. A copy of our Quality Assurance Plan (QAP), which outlines this program, is available at your request. The laboratory certification numbers are AK00971 DW Chemistry (Provisionally Certified as of 06/11/2018 for Mercury by EPA245.1,Beryllium and Copper by EPA200.8) & Microbiology & 17-021 (CS) for ADEC and 2944.01 for DOD ELAP/ISO17025 (RCRA methods: 1020B, 1311, 3010A, 3050B, 3520C, 3550C, 5030B, 5035A, 6020A, 7470A, 7471B, 8015C, 8021B, 8082A, 8260C, 8270D, 8270D-SIM, 9040C, 9045D, 9056A, 9060A, AK101 and AK102/103). Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth by the SGS QAP and, when applicable, other regulatory authorities.

The following descriptors or qualifiers may be found in your report:

*	The analyte has exceeded allowable regulatory or control limits.
!	Surrogate out of control limits.
B	Indicates the analyte is found in a blank associated with the sample.
CCV/CVA/CVB	Continuing Calibration Verification
CCCV/CVC/CVCA/CVCB	Closing Continuing Calibration Verification
CL	Control Limit
DF	Analytical Dilution Factor
DL	Detection Limit (i.e., maximum method detection limit)
E	The analyte result is above the calibrated range.
GT	Greater Than
IB	Instrument Blank
ICV	Initial Calibration Verification
J	The quantitation is an estimation.
LCS(D)	Laboratory Control Spike (Duplicate)
LLQC/LLIQC	Low Level Quantitation Check
LOD	Limit of Detection (i.e., 1/2 of the LOQ)
LOQ	Limit of Quantitation (i.e., reporting or practical quantitation limit)
LT	Less Than
MB	Method Blank
MS(D)	Matrix Spike (Duplicate)
ND	Indicates the analyte is not detected.
RPD	Relative Percent Difference
U	Indicates the analyte was analyzed for but not detected.

Note: Sample summaries which include a result for "Total Solids" have already been adjusted for moisture content. All DRO/RRO analyses are integrated per SOP.

Sample Summary

Client Sample ID	Lab Sample ID	Collected	Received	Matrix
COWI18-TH01-01	1183454001	07/06/2018	07/06/2018	Soil/Solid (dry weight)
COWI18-TH02-01	1183454002	07/06/2018	07/06/2018	Soil/Solid (dry weight)
COWI18-TH04-01	1183454003	07/06/2018	07/06/2018	Soil/Solid (dry weight)
COWI18-TH08-01	1183454004	07/06/2018	07/06/2018	Soil/Solid (dry weight)
COWI18-SO-QC01	1183454005	07/06/2018	07/06/2018	Soil/Solid (dry weight)

Method	Method Description
8270D SIM (PAH)	8270 PAH SIM Semi-Volatiles GC/MS
AK102	Diesel/Residual Range Organics
AK103	Diesel/Residual Range Organics
AK101	Gasoline Range Organics (S)
SM21 2540G	Percent Solids SM2540G
SW8260C	VOC 8260 (S) Field Extracted
SW8260C LL w/MeOH	VOC 8260 LL (S) w/MeOH

Detectable Results Summary

Client Sample ID: **COWI18-TH01-01**
Lab Sample ID: 1183454001

	Parameter	Result	Units
Polynuclear Aromatics GC/MS	Chrysene	7.14J	ug/Kg
	Fluoranthene	17.3J	ug/Kg
	Phenanthrene	14.5J	ug/Kg
	Pyrene	13.8J	ug/Kg
Semivolatile Organic Fuels	Diesel Range Organics	9.93J	mg/Kg
	Residual Range Organics	24.9	mg/Kg
Volatile GC/MS Low Level	1,2-Dibromoethane	0.378J	ug/Kg

Client Sample ID: **COWI18-TH02-01**
Lab Sample ID: 1183454002

	Parameter	Result	Units
Semivolatile Organic Fuels	Residual Range Organics	13.0J	mg/Kg

Client Sample ID: **COWI18-TH04-01**
Lab Sample ID: 1183454003

	Parameter	Result	Units
Semivolatile Organic Fuels	Residual Range Organics	28.3	mg/Kg

Client Sample ID: **COWI18-TH08-01**
Lab Sample ID: 1183454004

	Parameter	Result	Units
Semivolatile Organic Fuels	Residual Range Organics	33.5	mg/Kg

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Results of **COWI18-TH01-01**

Client Sample ID: **COWI18-TH01-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454001
Lab Project ID: 1183454

Collection Date: 07/06/18 10:00
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):91.1
Location: TH01

Results by **Polynuclear Aromatics GC/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
1-Methylnaphthalene	13.6	U	27.1	6.77	ug/Kg	1		07/10/18 21:49
2-Methylnaphthalene	13.6	U	27.1	6.77	ug/Kg	1		07/10/18 21:49
Acenaphthene	13.6	U	27.1	6.77	ug/Kg	1		07/10/18 21:49
Acenaphthylene	13.6	U	27.1	6.77	ug/Kg	1		07/10/18 21:49
Anthracene	13.6	U	27.1	6.77	ug/Kg	1		07/10/18 21:49
Benzo(a)Anthracene	13.6	U	27.1	6.77	ug/Kg	1		07/10/18 21:49
Benzo[a]pyrene	13.6	U	27.1	6.77	ug/Kg	1		07/10/18 21:49
Benzo[b]Fluoranthene	13.6	U	27.1	6.77	ug/Kg	1		07/10/18 21:49
Benzo[g,h,i]perylene	13.6	U	27.1	6.77	ug/Kg	1		07/10/18 21:49
Benzo[k]fluoranthene	13.6	U	27.1	6.77	ug/Kg	1		07/10/18 21:49
Chrysene	7.14	J	27.1	6.77	ug/Kg	1		07/10/18 21:49
Dibenzo[a,h]anthracene	13.6	U	27.1	6.77	ug/Kg	1		07/10/18 21:49
Fluoranthene	17.3	J	27.1	6.77	ug/Kg	1		07/10/18 21:49
Fluorene	13.6	U	27.1	6.77	ug/Kg	1		07/10/18 21:49
Indeno[1,2,3-c,d] pyrene	13.6	U	27.1	6.77	ug/Kg	1		07/10/18 21:49
Naphthalene	10.9	U	21.7	5.42	ug/Kg	1		07/10/18 21:49
Phenanthrene	14.5	J	27.1	6.77	ug/Kg	1		07/10/18 21:49
Pyrene	13.8	J	27.1	6.77	ug/Kg	1		07/10/18 21:49
Surrogates								
2-Methylnaphthalene-d10 (surr)	81.4		58-103		%	1		07/10/18 21:49
Fluoranthene-d10 (surr)	85.5		54-113		%	1		07/10/18 21:49

Batch Information

Analytical Batch: XMS10879
Analytical Method: 8270D SIM (PAH)
Analyst: BMZ
Analytical Date/Time: 07/10/18 21:49
Container ID: 1183454001-A

Prep Batch: XXX39850
Prep Method: SW3550C
Prep Date/Time: 07/08/18 07:42
Prep Initial Wt./Vol.: 22.778 g
Prep Extract Vol: 5 mL

Results of **COWI18-TH01-01**

Client Sample ID: **COWI18-TH01-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454001
Lab Project ID: 1183454

Collection Date: 07/06/18 10:00
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):91.1
Location: TH01

Results by **Semivolatile Organic Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Diesel Range Organics	9.93	J	21.9	6.77	mg/Kg	1		07/09/18 16:23
Surrogates								
5a Androstane (surr)	88.6		50-150		%	1		07/09/18 16:23

Batch Information

Analytical Batch: XFC14369
Analytical Method: AK102
Analyst: CMS
Analytical Date/Time: 07/09/18 16:23
Container ID: 1183454001-A

Prep Batch: XXX39849
Prep Method: SW3550C
Prep Date/Time: 07/07/18 13:14
Prep Initial Wt./Vol.: 30.127 g
Prep Extract Vol: 5 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Residual Range Organics	24.9		21.9	6.77	mg/Kg	1		07/09/18 16:23
Surrogates								
n-Triacontane-d62 (surr)	84.4		50-150		%	1		07/09/18 16:23

Batch Information

Analytical Batch: XFC14369
Analytical Method: AK103
Analyst: CMS
Analytical Date/Time: 07/09/18 16:23
Container ID: 1183454001-A

Prep Batch: XXX39849
Prep Method: SW3550C
Prep Date/Time: 07/07/18 13:14
Prep Initial Wt./Vol.: 30.127 g
Prep Extract Vol: 5 mL

Print Date: 07/17/2018 9:00:08AM

J flagging is activated

Results of **COWI18-TH01-01**

Client Sample ID: **COWI18-TH01-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454001
Lab Project ID: 1183454

Collection Date: 07/06/18 10:00
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):91.1
Location: TH01

Results by **Volatile Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Gasoline Range Organics	1.36	U	2.71	0.812	mg/Kg	1		07/07/18 17:49
Surrogates								
4-Bromofluorobenzene (surr)	92.5		50-150		%	1		07/07/18 17:49

Batch Information

Analytical Batch: VFC14256
Analytical Method: AK101
Analyst: ST
Analytical Date/Time: 07/07/18 17:49
Container ID: 1183454001-C

Prep Batch: VXX32570
Prep Method: SW5035A
Prep Date/Time: 07/06/18 10:00
Prep Initial Wt./Vol.: 61.769 g
Prep Extract Vol: 30.4776 mL

SGS North America Inc.
200 West Potter Drive Anchorage, AK 95518
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Results of **COWI18-TH01-01**

Client Sample ID: **COWI18-TH01-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454001
Lab Project ID: 1183454

Collection Date: 07/06/18 10:00
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):91.1
Location: TH01

Results by **Volatile GC/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
1,1,1,2-Tetrachloroethane	10.9	U	21.7	6.71	ug/Kg	1		07/08/18 21:10
1,1,1-Trichloroethane	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
1,1,2,2-Tetrachloroethane	6.75	U	13.5	4.22	ug/Kg	1		07/08/18 21:10
1,1,2-Trichloroethane	5.40	U	10.8	3.36	ug/Kg	1		07/08/18 21:10
1,1-Dichloroethane	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
1,1-Dichloroethene	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
1,1-Dichloropropene	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
1,2,3-Trichlorobenzene	27.1	U	54.1	16.2	ug/Kg	1		07/08/18 21:10
1,2,3-Trichloropropane	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
1,2,4-Trichlorobenzene	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
1,2,4-Trimethylbenzene	27.1	U	54.1	16.2	ug/Kg	1		07/11/18 15:33
1,2-Dibromo-3-chloropropane	54.0	U	108	33.6	ug/Kg	1		07/08/18 21:10
1,2-Dibromoethane	5.40	U	10.8	3.36	ug/Kg	1		07/08/18 21:10
1,2-Dichlorobenzene	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
1,2-Dichloroethane	5.40	U	10.8	3.36	ug/Kg	1		07/08/18 21:10
1,2-Dichloropropane	5.40	U	10.8	3.36	ug/Kg	1		07/08/18 21:10
1,3,5-Trimethylbenzene	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
1,3-Dichlorobenzene	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
1,3-Dichloropropane	5.40	U	10.8	3.36	ug/Kg	1		07/08/18 21:10
1,4-Dichlorobenzene	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
2,2-Dichloropropane	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
2-Butanone (MEK)	136	U	271	84.5	ug/Kg	1		07/08/18 21:10
2-Chlorotoluene	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
2-Hexanone	54.0	U	108	33.6	ug/Kg	1		07/08/18 21:10
4-Chlorotoluene	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
4-Isopropyltoluene	54.0	U	108	27.1	ug/Kg	1		07/08/18 21:10
4-Methyl-2-pentanone (MIBK)	136	U	271	84.5	ug/Kg	1		07/08/18 21:10
Benzene	6.75	U	13.5	4.22	ug/Kg	1		07/11/18 15:33
Bromobenzene	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
Bromochloromethane	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
Bromodichloromethane	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
Bromoform	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
Bromomethane	109	U	217	67.1	ug/Kg	1		07/08/18 21:10
Carbon disulfide	54.0	U	108	33.6	ug/Kg	1		07/08/18 21:10
Carbon tetrachloride	6.75	U	13.5	4.22	ug/Kg	1		07/08/18 21:10
Chlorobenzene	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
Chloroethane	109	U	217	67.1	ug/Kg	1		07/08/18 21:10

Results of **COWI18-TH01-01**

Client Sample ID: **COWI18-TH01-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454001
Lab Project ID: 1183454

Collection Date: 07/06/18 10:00
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):91.1
Location: TH01

Results by **Volatile GC/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Chloroform	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
Chloromethane	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
cis-1,2-Dichloroethene	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
cis-1,3-Dichloropropene	6.75	U	13.5	4.22	ug/Kg	1		07/08/18 21:10
Dibromochloromethane	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
Dibromomethane	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
Dichlorodifluoromethane	27.1	U	54.1	16.2	ug/Kg	1		07/08/18 21:10
Ethylbenzene	13.6	U	27.1	8.45	ug/Kg	1		07/11/18 15:33
Freon-113	54.0	U	108	33.6	ug/Kg	1		07/08/18 21:10
Hexachlorobutadiene	10.9	U	21.7	6.71	ug/Kg	1		07/08/18 21:10
Isopropylbenzene (Cumene)	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
Methylene chloride	54.0	U	108	33.6	ug/Kg	1		07/08/18 21:10
Methyl-t-butyl ether	54.0	U	108	33.6	ug/Kg	1		07/08/18 21:10
Naphthalene	13.6	U	27.1	8.45	ug/Kg	1		07/11/18 15:33
n-Butylbenzene	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
n-Propylbenzene	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
o-Xylene	13.6	U	27.1	8.45	ug/Kg	1		07/11/18 15:33
P & M -Xylene	27.1	U	54.1	16.2	ug/Kg	1		07/11/18 15:33
sec-Butylbenzene	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
Styrene	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
tert-Butylbenzene	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
Tetrachloroethene	6.75	U	13.5	4.22	ug/Kg	1		07/08/18 21:10
Toluene	13.6	U	27.1	8.45	ug/Kg	1		07/11/18 15:33
trans-1,2-Dichloroethene	13.6	U	27.1	8.45	ug/Kg	1		07/08/18 21:10
trans-1,3-Dichloropropene	6.75	U	13.5	4.22	ug/Kg	1		07/08/18 21:10
Trichloroethene	5.40	U	10.8	3.36	ug/Kg	1		07/08/18 21:10
Trichlorofluoromethane	27.1	U	54.1	16.2	ug/Kg	1		07/08/18 21:10
Vinyl acetate	54.0	U	108	33.6	ug/Kg	1		07/08/18 21:10
Vinyl chloride	5.40	U	10.8	3.36	ug/Kg	1		07/08/18 21:10
Xylenes (total)	40.6	U	81.2	24.7	ug/Kg	1		07/11/18 15:33
Surrogates								
1,2-Dichloroethane-D4 (surr)	102		71-136		%	1		07/08/18 21:10
4-Bromofluorobenzene (surr)	101		55-151		%	1		07/08/18 21:10
Toluene-d8 (surr)	98.8		85-116		%	1		07/08/18 21:10

Print Date: 07/17/2018 9:00:08AM

J flagging is activated

Results of **COWI18-TH01-01**

Client Sample ID: **COWI18-TH01-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454001
Lab Project ID: 1183454

Collection Date: 07/06/18 10:00
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):91.1
Location: TH01

Results by **Volatile GC/MS**

Batch Information

Analytical Batch: VMS18001
Analytical Method: SW8260C
Analyst: NRO
Analytical Date/Time: 07/11/18 15:33
Container ID: 1183454001-C

Prep Batch: VXX32614
Prep Method: SW5035A
Prep Date/Time: 07/06/18 10:00
Prep Initial Wt./Vol.: 61.769 g
Prep Extract Vol: 30.4776 mL

Analytical Batch: VMS17980
Analytical Method: SW8260C
Analyst: FDR
Analytical Date/Time: 07/08/18 21:10
Container ID: 1183454001-C

Prep Batch: VXX32572
Prep Method: SW5035A
Prep Date/Time: 07/06/18 10:00
Prep Initial Wt./Vol.: 61.769 g
Prep Extract Vol: 30.4776 mL

Results of **COWI18-TH01-01**

Client Sample ID: **COWI18-TH01-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454001
Lab Project ID: 1183454

Collection Date: 07/06/18 10:00
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):91.1
Location: TH01

Results by **Volatile GC/MS Low Level**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
1,1,2,2-Tetrachloroethane	1.09 U		2.17	0.671	ug/Kg	1		07/11/18 15:33
1,1,2-Trichloroethane	0.433 U		0.866	0.271	ug/Kg	1		07/11/18 15:33
1,2,3-Trichloropropane	0.540 U		1.08	0.336	ug/Kg	1		07/11/18 15:33
1,2-Dibromoethane	0.378 J		0.541	0.162	ug/Kg	1		07/11/18 15:33
1,2-Dichloroethane	1.09 U		2.17	0.671	ug/Kg	1		07/11/18 15:33
Bromodichloromethane	1.09 U		2.17	0.671	ug/Kg	1		07/11/18 15:33
Bromomethane	10.9 U		21.7	6.71	ug/Kg	1		07/11/18 15:33
Chloroform	1.09 U		2.17	0.671	ug/Kg	1		07/11/18 15:33
Dibromochloromethane	1.09 U		2.17	0.671	ug/Kg	1		07/11/18 15:33
Trichloroethene	2.71 U		5.41	1.62	ug/Kg	1		07/11/18 15:33
Vinyl chloride	0.433 U		0.866	0.271	ug/Kg	1		07/11/18 15:33
Surrogates								
1,2-Dichloroethane-D4 (surr)	98.4		71-136		%	1		07/11/18 15:33
4-Bromofluorobenzene (surr)	110		55-151		%	1		07/11/18 15:33
Toluene-d8 (surr)	100		85-116		%	1		07/11/18 15:33

Batch Information

Analytical Batch: VMS18002
Analytical Method: SW8260C LL w/MeOH
Analyst: NRO
Analytical Date/Time: 07/11/18 15:33
Container ID: 1183454001-C

Prep Batch: VXX32615
Prep Method: SW5035A
Prep Date/Time: 07/06/18 10:00
Prep Initial Wt./Vol.: 61.769 g
Prep Extract Vol: 30.4776 mL

Results of **COWI18-TH02-01**

Client Sample ID: **COWI18-TH02-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454002
Lab Project ID: 1183454

Collection Date: 07/06/18 11:52
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):92.5
Location: TH02

Results by **Polynuclear Aromatics GC/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
1-Methylnaphthalene	13.4	U	26.9	6.74	ug/Kg	1		07/10/18 22:10
2-Methylnaphthalene	13.4	U	26.9	6.74	ug/Kg	1		07/10/18 22:10
Acenaphthene	13.4	U	26.9	6.74	ug/Kg	1		07/10/18 22:10
Acenaphthylene	13.4	U	26.9	6.74	ug/Kg	1		07/10/18 22:10
Anthracene	13.4	U	26.9	6.74	ug/Kg	1		07/10/18 22:10
Benzo(a)Anthracene	13.4	U	26.9	6.74	ug/Kg	1		07/10/18 22:10
Benzo[a]pyrene	13.4	U	26.9	6.74	ug/Kg	1		07/10/18 22:10
Benzo[b]Fluoranthene	13.4	U	26.9	6.74	ug/Kg	1		07/10/18 22:10
Benzo[g,h,i]perylene	13.4	U	26.9	6.74	ug/Kg	1		07/10/18 22:10
Benzo[k]fluoranthene	13.4	U	26.9	6.74	ug/Kg	1		07/10/18 22:10
Chrysene	13.4	U	26.9	6.74	ug/Kg	1		07/10/18 22:10
Dibenzo[a,h]anthracene	13.4	U	26.9	6.74	ug/Kg	1		07/10/18 22:10
Fluoranthene	13.4	U	26.9	6.74	ug/Kg	1		07/10/18 22:10
Fluorene	13.4	U	26.9	6.74	ug/Kg	1		07/10/18 22:10
Indeno[1,2,3-c,d] pyrene	13.4	U	26.9	6.74	ug/Kg	1		07/10/18 22:10
Naphthalene	10.8	U	21.6	5.39	ug/Kg	1		07/10/18 22:10
Phenanthrene	13.4	U	26.9	6.74	ug/Kg	1		07/10/18 22:10
Pyrene	13.4	U	26.9	6.74	ug/Kg	1		07/10/18 22:10
Surrogates								
2-Methylnaphthalene-d10 (surr)	81		58-103		%	1		07/10/18 22:10
Fluoranthene-d10 (surr)	87.8		54-113		%	1		07/10/18 22:10

Batch Information

Analytical Batch: XMS10879
Analytical Method: 8270D SIM (PAH)
Analyst: BMZ
Analytical Date/Time: 07/10/18 22:10
Container ID: 1183454002-A

Prep Batch: XXX39850
Prep Method: SW3550C
Prep Date/Time: 07/08/18 07:42
Prep Initial Wt./Vol.: 22.565 g
Prep Extract Vol: 5 mL

Print Date: 07/17/2018 9:00:08AM

J flagging is activated

Results of **COWI18-TH02-01**

Client Sample ID: **COWI18-TH02-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454002
Lab Project ID: 1183454

Collection Date: 07/06/18 11:52
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):92.5
Location: TH02

Results by **Semivolatile Organic Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Diesel Range Organics	10.8	U	21.5	6.66	mg/Kg	1		07/09/18 16:33
Surrogates								
5a Androstane (surr)	90.4		50-150		%	1		07/09/18 16:33

Batch Information

Analytical Batch: XFC14369
Analytical Method: AK102
Analyst: CMS
Analytical Date/Time: 07/09/18 16:33
Container ID: 1183454002-A

Prep Batch: XXX39849
Prep Method: SW3550C
Prep Date/Time: 07/07/18 13:14
Prep Initial Wt./Vol.: 30.212 g
Prep Extract Vol: 5 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Residual Range Organics	13.0	J	21.5	6.66	mg/Kg	1		07/09/18 16:33
Surrogates								
n-Triacontane-d62 (surr)	84.2		50-150		%	1		07/09/18 16:33

Batch Information

Analytical Batch: XFC14369
Analytical Method: AK103
Analyst: CMS
Analytical Date/Time: 07/09/18 16:33
Container ID: 1183454002-A

Prep Batch: XXX39849
Prep Method: SW3550C
Prep Date/Time: 07/07/18 13:14
Prep Initial Wt./Vol.: 30.212 g
Prep Extract Vol: 5 mL

Print Date: 07/17/2018 9:00:08AM

J flagging is activated

Results of **COWI18-TH02-01**

Client Sample ID: **COWI18-TH02-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454002
Lab Project ID: 1183454

Collection Date: 07/06/18 11:52
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):92.5
Location: TH02

Results by **Volatile Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Gasoline Range Organics	1.29	U	2.59	0.776	mg/Kg	1		07/07/18 17:31
Surrogates								
4-Bromofluorobenzene (surr)	89.5		50-150		%	1		07/07/18 17:31

Batch Information

Analytical Batch: VFC14256
Analytical Method: AK101
Analyst: ST
Analytical Date/Time: 07/07/18 17:31
Container ID: 1183454002-C

Prep Batch: VXX32570
Prep Method: SW5035A
Prep Date/Time: 07/06/18 11:52
Prep Initial Wt./Vol.: 61.923 g
Prep Extract Vol: 29.6437 mL

SGS North America Inc.
200 West Potter Drive Anchorage, AK 95518
t 907.562.2343 **f** 907.561.5301 www.us.sgs.com

Results of **COWI18-TH02-01**

Client Sample ID: **COWI18-TH02-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454002
Lab Project ID: 1183454

Collection Date: 07/06/18 11:52
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):92.5
Location: TH02

Results by **Volatile GC/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
1,1,1,2-Tetrachloroethane	10.4	U	20.7	6.42	ug/Kg	1		07/08/18 21:28
1,1,1-Trichloroethane	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
1,1,2,2-Tetrachloroethane	6.45	U	12.9	4.04	ug/Kg	1		07/08/18 21:28
1,1,2-Trichloroethane	5.20	U	10.4	3.21	ug/Kg	1		07/08/18 21:28
1,1-Dichloroethane	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
1,1-Dichloroethene	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
1,1-Dichloropropene	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
1,2,3-Trichlorobenzene	25.9	U	51.8	15.5	ug/Kg	1		07/08/18 21:28
1,2,3-Trichloropropane	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
1,2,4-Trichlorobenzene	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
1,2,4-Trimethylbenzene	25.9	U	51.8	15.5	ug/Kg	1		07/08/18 21:28
1,2-Dibromo-3-chloropropane	52.0	U	104	32.1	ug/Kg	1		07/08/18 21:28
1,2-Dibromoethane	5.20	U	10.4	3.21	ug/Kg	1		07/08/18 21:28
1,2-Dichlorobenzene	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
1,2-Dichloroethane	5.20	U	10.4	3.21	ug/Kg	1		07/08/18 21:28
1,2-Dichloropropane	5.20	U	10.4	3.21	ug/Kg	1		07/08/18 21:28
1,3,5-Trimethylbenzene	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
1,3-Dichlorobenzene	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
1,3-Dichloropropane	5.20	U	10.4	3.21	ug/Kg	1		07/08/18 21:28
1,4-Dichlorobenzene	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
2,2-Dichloropropane	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
2-Butanone (MEK)	130	U	259	80.7	ug/Kg	1		07/08/18 21:28
2-Chlorotoluene	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
2-Hexanone	52.0	U	104	32.1	ug/Kg	1		07/08/18 21:28
4-Chlorotoluene	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
4-Isopropyltoluene	52.0	U	104	25.9	ug/Kg	1		07/08/18 21:28
4-Methyl-2-pentanone (MIBK)	130	U	259	80.7	ug/Kg	1		07/08/18 21:28
Benzene	6.45	U	12.9	4.04	ug/Kg	1		07/08/18 21:28
Bromobenzene	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
Bromochloromethane	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
Bromodichloromethane	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
Bromoform	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
Bromomethane	104	U	207	64.2	ug/Kg	1		07/08/18 21:28
Carbon disulfide	52.0	U	104	32.1	ug/Kg	1		07/08/18 21:28
Carbon tetrachloride	6.45	U	12.9	4.04	ug/Kg	1		07/08/18 21:28
Chlorobenzene	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
Chloroethane	104	U	207	64.2	ug/Kg	1		07/08/18 21:28

Results of **COWI18-TH02-01**

Client Sample ID: **COWI18-TH02-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454002
Lab Project ID: 1183454

Collection Date: 07/06/18 11:52
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):92.5
Location: TH02

Results by **Volatile GC/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Chloroform	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
Chloromethane	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
cis-1,2-Dichloroethene	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
cis-1,3-Dichloropropene	6.45	U	12.9	4.04	ug/Kg	1		07/08/18 21:28
Dibromochloromethane	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
Dibromomethane	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
Dichlorodifluoromethane	25.9	U	51.8	15.5	ug/Kg	1		07/08/18 21:28
Ethylbenzene	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
Freon-113	52.0	U	104	32.1	ug/Kg	1		07/08/18 21:28
Hexachlorobutadiene	10.4	U	20.7	6.42	ug/Kg	1		07/08/18 21:28
Isopropylbenzene (Cumene)	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
Methylene chloride	52.0	U	104	32.1	ug/Kg	1		07/08/18 21:28
Methyl-t-butyl ether	52.0	U	104	32.1	ug/Kg	1		07/08/18 21:28
Naphthalene	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
n-Butylbenzene	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
n-Propylbenzene	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
o-Xylene	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
P & M -Xylene	25.9	U	51.8	15.5	ug/Kg	1		07/08/18 21:28
sec-Butylbenzene	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
Styrene	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
tert-Butylbenzene	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
Tetrachloroethene	6.45	U	12.9	4.04	ug/Kg	1		07/08/18 21:28
Toluene	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
trans-1,2-Dichloroethene	12.9	U	25.9	8.07	ug/Kg	1		07/08/18 21:28
trans-1,3-Dichloropropene	6.45	U	12.9	4.04	ug/Kg	1		07/08/18 21:28
Trichloroethene	5.20	U	10.4	3.21	ug/Kg	1		07/08/18 21:28
Trichlorofluoromethane	25.9	U	51.8	15.5	ug/Kg	1		07/08/18 21:28
Vinyl acetate	52.0	U	104	32.1	ug/Kg	1		07/08/18 21:28
Vinyl chloride	5.20	U	10.4	3.21	ug/Kg	1		07/08/18 21:28
Xylenes (total)	38.8	U	77.6	23.6	ug/Kg	1		07/08/18 21:28
Surrogates								
1,2-Dichloroethane-D4 (surr)	108		71-136		%	1		07/08/18 21:28
4-Bromofluorobenzene (surr)	104		55-151		%	1		07/08/18 21:28
Toluene-d8 (surr)	85.1		85-116		%	1		07/08/18 21:28

Print Date: 07/17/2018 9:00:08AM

J flagging is activated

Results of **COWI18-TH02-01**

Client Sample ID: **COWI18-TH02-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454002
Lab Project ID: 1183454

Collection Date: 07/06/18 11:52
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):92.5
Location: TH02

Results by **Volatile GC/MS**

Batch Information

Analytical Batch: VMS17980
Analytical Method: SW8260C
Analyst: FDR
Analytical Date/Time: 07/08/18 21:28
Container ID: 1183454002-C

Prep Batch: VXX32572
Prep Method: SW5035A
Prep Date/Time: 07/06/18 11:52
Prep Initial Wt./Vol.: 61.923 g
Prep Extract Vol: 29.6437 mL

Results of **COWI18-TH02-01**

Client Sample ID: **COWI18-TH02-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454002
Lab Project ID: 1183454

Collection Date: 07/06/18 11:52
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):92.5
Location: TH02

Results by **Volatile GC/MS Low Level**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
1,1,2,2-Tetrachloroethane	1.03 U		2.07	0.642	ug/Kg	1		07/11/18 15:48
1,1,2-Trichloroethane	0.414 U		0.828	0.259	ug/Kg	1		07/11/18 15:48
1,2,3-Trichloropropane	0.520 U		1.04	0.321	ug/Kg	1		07/11/18 15:48
1,2-Dibromoethane	0.259 U		0.518	0.155	ug/Kg	1		07/11/18 15:48
1,2-Dichloroethane	1.03 U		2.07	0.642	ug/Kg	1		07/11/18 15:48
Bromodichloromethane	1.03 U		2.07	0.642	ug/Kg	1		07/11/18 15:48
Bromomethane	10.4 U		20.7	6.42	ug/Kg	1		07/11/18 15:48
Chloroform	1.03 U		2.07	0.642	ug/Kg	1		07/11/18 15:48
Dibromochloromethane	1.03 U		2.07	0.642	ug/Kg	1		07/11/18 15:48
Trichloroethene	2.59 U		5.18	1.55	ug/Kg	1		07/11/18 15:48
Vinyl chloride	0.414 U		0.828	0.259	ug/Kg	1		07/11/18 15:48
Surrogates								
1,2-Dichloroethane-D4 (surr)	102		71-136		%	1		07/11/18 15:48
4-Bromofluorobenzene (surr)	105		55-151		%	1		07/11/18 15:48
Toluene-d8 (surr)	98.8		85-116		%	1		07/11/18 15:48

Batch Information

Analytical Batch: VMS18002
Analytical Method: SW8260C LL w/MeOH
Analyst: NRO
Analytical Date/Time: 07/11/18 15:48
Container ID: 1183454002-C

Prep Batch: VXX32615
Prep Method: SW5035A
Prep Date/Time: 07/06/18 11:52
Prep Initial Wt./Vol.: 61.923 g
Prep Extract Vol: 29.6437 mL

Print Date: 07/17/2018 9:00:08AM

J flagging is activated

Results of **COWI18-TH04-01**

Client Sample ID: **COWI18-TH04-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454003
Lab Project ID: 1183454

Collection Date: 07/06/18 15:12
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):76.0
Location: TH04

Results by **Polynuclear Aromatics GC/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
1-Methylnaphthalene	16.4	U	32.8	8.21	ug/Kg	1		07/10/18 22:30
2-Methylnaphthalene	16.4	U	32.8	8.21	ug/Kg	1		07/10/18 22:30
Acenaphthene	16.4	U	32.8	8.21	ug/Kg	1		07/10/18 22:30
Acenaphthylene	16.4	U	32.8	8.21	ug/Kg	1		07/10/18 22:30
Anthracene	16.4	U	32.8	8.21	ug/Kg	1		07/10/18 22:30
Benzo(a)Anthracene	16.4	U	32.8	8.21	ug/Kg	1		07/10/18 22:30
Benzo[a]pyrene	16.4	U	32.8	8.21	ug/Kg	1		07/10/18 22:30
Benzo[b]Fluoranthene	16.4	U	32.8	8.21	ug/Kg	1		07/10/18 22:30
Benzo[g,h,i]perylene	16.4	U	32.8	8.21	ug/Kg	1		07/10/18 22:30
Benzo[k]fluoranthene	16.4	U	32.8	8.21	ug/Kg	1		07/10/18 22:30
Chrysene	16.4	U	32.8	8.21	ug/Kg	1		07/10/18 22:30
Dibenzo[a,h]anthracene	16.4	U	32.8	8.21	ug/Kg	1		07/10/18 22:30
Fluoranthene	16.4	U	32.8	8.21	ug/Kg	1		07/10/18 22:30
Fluorene	16.4	U	32.8	8.21	ug/Kg	1		07/10/18 22:30
Indeno[1,2,3-c,d] pyrene	16.4	U	32.8	8.21	ug/Kg	1		07/10/18 22:30
Naphthalene	13.2	U	26.3	6.57	ug/Kg	1		07/10/18 22:30
Phenanthrene	16.4	U	32.8	8.21	ug/Kg	1		07/10/18 22:30
Pyrene	16.4	U	32.8	8.21	ug/Kg	1		07/10/18 22:30
Surrogates								
2-Methylnaphthalene-d10 (surr)	75.3		58-103		%	1		07/10/18 22:30
Fluoranthene-d10 (surr)	80.6		54-113		%	1		07/10/18 22:30

Batch Information

Analytical Batch: XMS10879
Analytical Method: 8270D SIM (PAH)
Analyst: BMZ
Analytical Date/Time: 07/10/18 22:30
Container ID: 1183454003-A

Prep Batch: XXX39850
Prep Method: SW3550C
Prep Date/Time: 07/08/18 07:42
Prep Initial Wt./Vol.: 22.523 g
Prep Extract Vol: 5 mL

Print Date: 07/17/2018 9:00:08AM

J flagging is activated

Results of **COWI18-TH04-01**

Client Sample ID: **COWI18-TH04-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454003
Lab Project ID: 1183454

Collection Date: 07/06/18 15:12
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):76.0
Location: TH04

Results by **Semivolatile Organic Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Diesel Range Organics	13.1	U	26.2	8.11	mg/Kg	1		07/09/18 16:43
Surrogates								
5a Androstane (surr)	83		50-150		%	1		07/09/18 16:43

Batch Information

Analytical Batch: XFC14369
Analytical Method: AK102
Analyst: CMS
Analytical Date/Time: 07/09/18 16:43
Container ID: 1183454003-A

Prep Batch: XXX39849
Prep Method: SW3550C
Prep Date/Time: 07/07/18 13:14
Prep Initial Wt./Vol.: 30.158 g
Prep Extract Vol: 5 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Residual Range Organics	28.3		26.2	8.11	mg/Kg	1		07/09/18 16:43
Surrogates								
n-Triacontane-d62 (surr)	76		50-150		%	1		07/09/18 16:43

Batch Information

Analytical Batch: XFC14369
Analytical Method: AK103
Analyst: CMS
Analytical Date/Time: 07/09/18 16:43
Container ID: 1183454003-A

Prep Batch: XXX39849
Prep Method: SW3550C
Prep Date/Time: 07/07/18 13:14
Prep Initial Wt./Vol.: 30.158 g
Prep Extract Vol: 5 mL

Print Date: 07/17/2018 9:00:08AM

J flagging is activated

Results of **COWI18-TH04-01**

Client Sample ID: **COWI18-TH04-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454003
Lab Project ID: 1183454

Collection Date: 07/06/18 15:12
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):76.0
Location: TH04

Results by **Volatile Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Gasoline Range Organics	2.16	U	4.32	1.30	mg/Kg	1		07/07/18 17:13
Surrogates								
4-Bromofluorobenzene (surr)	97.8		50-150		%	1		07/07/18 17:13

Batch Information

Analytical Batch: VFC14256
Analytical Method: AK101
Analyst: ST
Analytical Date/Time: 07/07/18 17:13
Container ID: 1183454003-C

Prep Batch: VXX32570
Prep Method: SW5035A
Prep Date/Time: 07/06/18 15:12
Prep Initial Wt./Vol.: 59.823 g
Prep Extract Vol: 39.3393 mL

SGS North America Inc.
200 West Potter Drive Anchorage, AK 95518
t 907.562.2343 **f** 907.561.5301 www.us.sgs.com

Results of **COWI18-TH04-01**

Client Sample ID: **COWI18-TH04-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454003
Lab Project ID: 1183454

Collection Date: 07/06/18 15:12
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):76.0
Location: TH04

Results by **Volatile GC/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
1,1,1,2-Tetrachloroethane	17.3	U	34.6	10.7	ug/Kg	1		07/08/18 21:46
1,1,1-Trichloroethane	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
1,1,2,2-Tetrachloroethane	10.8	U	21.6	6.75	ug/Kg	1		07/08/18 21:46
1,1,2-Trichloroethane	8.65	U	17.3	5.36	ug/Kg	1		07/08/18 21:46
1,1-Dichloroethane	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
1,1-Dichloroethene	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
1,1-Dichloropropene	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
1,2,3-Trichlorobenzene	43.3	U	86.5	25.9	ug/Kg	1		07/08/18 21:46
1,2,3-Trichloropropane	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
1,2,4-Trichlorobenzene	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
1,2,4-Trimethylbenzene	43.3	U	86.5	25.9	ug/Kg	1		07/08/18 21:46
1,2-Dibromo-3-chloropropane	86.5	U	173	53.6	ug/Kg	1		07/08/18 21:46
1,2-Dibromoethane	8.65	U	17.3	5.36	ug/Kg	1		07/08/18 21:46
1,2-Dichlorobenzene	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
1,2-Dichloroethane	8.65	U	17.3	5.36	ug/Kg	1		07/08/18 21:46
1,2-Dichloropropane	8.65	U	17.3	5.36	ug/Kg	1		07/08/18 21:46
1,3,5-Trimethylbenzene	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
1,3-Dichlorobenzene	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
1,3-Dichloropropane	8.65	U	17.3	5.36	ug/Kg	1		07/08/18 21:46
1,4-Dichlorobenzene	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
2,2-Dichloropropane	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
2-Butanone (MEK)	216	U	432	135	ug/Kg	1		07/08/18 21:46
2-Chlorotoluene	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
2-Hexanone	86.5	U	173	53.6	ug/Kg	1		07/08/18 21:46
4-Chlorotoluene	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
4-Isopropyltoluene	86.5	U	173	43.2	ug/Kg	1		07/08/18 21:46
4-Methyl-2-pentanone (MIBK)	216	U	432	135	ug/Kg	1		07/08/18 21:46
Benzene	10.8	U	21.6	6.75	ug/Kg	1		07/08/18 21:46
Bromobenzene	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
Bromochloromethane	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
Bromodichloromethane	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
Bromoform	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
Bromomethane	173	U	346	107	ug/Kg	1		07/08/18 21:46
Carbon disulfide	86.5	U	173	53.6	ug/Kg	1		07/08/18 21:46
Carbon tetrachloride	10.8	U	21.6	6.75	ug/Kg	1		07/08/18 21:46
Chlorobenzene	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
Chloroethane	173	U	346	107	ug/Kg	1		07/08/18 21:46

Print Date: 07/17/2018 9:00:08AM

J flagging is activated

Results of **COWI18-TH04-01**

Client Sample ID: **COWI18-TH04-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454003
Lab Project ID: 1183454

Collection Date: 07/06/18 15:12
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):76.0
Location: TH04

Results by **Volatile GC/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Chloroform	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
Chloromethane	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
cis-1,2-Dichloroethene	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
cis-1,3-Dichloropropene	10.8	U	21.6	6.75	ug/Kg	1		07/08/18 21:46
Dibromochloromethane	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
Dibromomethane	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
Dichlorodifluoromethane	43.3	U	86.5	25.9	ug/Kg	1		07/08/18 21:46
Ethylbenzene	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
Freon-113	86.5	U	173	53.6	ug/Kg	1		07/08/18 21:46
Hexachlorobutadiene	17.3	U	34.6	10.7	ug/Kg	1		07/08/18 21:46
Isopropylbenzene (Cumene)	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
Methylene chloride	86.5	U	173	53.6	ug/Kg	1		07/08/18 21:46
Methyl-t-butyl ether	86.5	U	173	53.6	ug/Kg	1		07/08/18 21:46
Naphthalene	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
n-Butylbenzene	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
n-Propylbenzene	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
o-Xylene	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
P & M -Xylene	43.3	U	86.5	25.9	ug/Kg	1		07/08/18 21:46
sec-Butylbenzene	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
Styrene	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
tert-Butylbenzene	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
Tetrachloroethene	10.8	U	21.6	6.75	ug/Kg	1		07/08/18 21:46
Toluene	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
trans-1,2-Dichloroethene	21.6	U	43.2	13.5	ug/Kg	1		07/08/18 21:46
trans-1,3-Dichloropropene	10.8	U	21.6	6.75	ug/Kg	1		07/08/18 21:46
Trichloroethene	8.65	U	17.3	5.36	ug/Kg	1		07/08/18 21:46
Trichlorofluoromethane	43.3	U	86.5	25.9	ug/Kg	1		07/08/18 21:46
Vinyl acetate	86.5	U	173	53.6	ug/Kg	1		07/08/18 21:46
Vinyl chloride	8.65	U	17.3	5.36	ug/Kg	1		07/08/18 21:46
Xylenes (total)	65.0	U	130	39.4	ug/Kg	1		07/08/18 21:46
Surrogates								
1,2-Dichloroethane-D4 (surr)	111		71-136		%	1		07/08/18 21:46
4-Bromofluorobenzene (surr)	116		55-151		%	1		07/08/18 21:46
Toluene-d8 (surr)	108		85-116		%	1		07/08/18 21:46

Print Date: 07/17/2018 9:00:08AM

J flagging is activated

Results of **COWI18-TH04-01**

Client Sample ID: **COWI18-TH04-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454003
Lab Project ID: 1183454

Collection Date: 07/06/18 15:12
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):76.0
Location: TH04

Results by **Volatile GC/MS**

Batch Information

Analytical Batch: VMS17980
Analytical Method: SW8260C
Analyst: FDR
Analytical Date/Time: 07/08/18 21:46
Container ID: 1183454003-C

Prep Batch: VXX32572
Prep Method: SW5035A
Prep Date/Time: 07/06/18 15:12
Prep Initial Wt./Vol.: 59.823 g
Prep Extract Vol: 39.3393 mL

Results of **COWI18-TH04-01**

Client Sample ID: **COWI18-TH04-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454003
Lab Project ID: 1183454

Collection Date: 07/06/18 15:12
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):76.0
Location: TH04

Results by **Volatile GC/MS Low Level**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
1,1,2,2-Tetrachloroethane	1.73 U		3.46	1.07	ug/Kg	1		07/11/18 16:04
1,1,2-Trichloroethane	0.690 U		1.38	0.432	ug/Kg	1		07/11/18 16:04
1,2,3-Trichloropropane	0.865 U		1.73	0.536	ug/Kg	1		07/11/18 16:04
1,2-Dibromoethane	0.433 U		0.865	0.259	ug/Kg	1		07/11/18 16:04
1,2-Dichloroethane	1.73 U		3.46	1.07	ug/Kg	1		07/11/18 16:04
Bromodichloromethane	1.73 U		3.46	1.07	ug/Kg	1		07/11/18 16:04
Bromomethane	17.3 U		34.6	10.7	ug/Kg	1		07/11/18 16:04
Chloroform	1.73 U		3.46	1.07	ug/Kg	1		07/11/18 16:04
Dibromochloromethane	1.73 U		3.46	1.07	ug/Kg	1		07/11/18 16:04
Trichloroethene	4.33 U		8.65	2.59	ug/Kg	1		07/11/18 16:04
Vinyl chloride	0.690 U		1.38	0.432	ug/Kg	1		07/11/18 16:04
Surrogates								
1,2-Dichloroethane-D4 (surr)	97.1		71-136		%	1		07/11/18 16:04
4-Bromofluorobenzene (surr)	96.4		55-151		%	1		07/11/18 16:04
Toluene-d8 (surr)	98.8		85-116		%	1		07/11/18 16:04

Batch Information

Analytical Batch: VMS18002
Analytical Method: SW8260C LL w/MeOH
Analyst: NRO
Analytical Date/Time: 07/11/18 16:04
Container ID: 1183454003-C

Prep Batch: VXX32615
Prep Method: SW5035A
Prep Date/Time: 07/06/18 15:12
Prep Initial Wt./Vol.: 59.823 g
Prep Extract Vol: 39.3393 mL

Print Date: 07/17/2018 9:00:08AM

J flagging is activated

Results of **COWI18-TH08-01**

Client Sample ID: **COWI18-TH08-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454004
Lab Project ID: 1183454

Collection Date: 07/06/18 15:09
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):75.9
Location: TH08

Results by **Polynuclear Aromatics GC/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
1-Methylnaphthalene	16.4	U	32.8	8.20	ug/Kg	1		07/10/18 22:50
2-Methylnaphthalene	16.4	U	32.8	8.20	ug/Kg	1		07/10/18 22:50
Acenaphthene	16.4	U	32.8	8.20	ug/Kg	1		07/10/18 22:50
Acenaphthylene	16.4	U	32.8	8.20	ug/Kg	1		07/10/18 22:50
Anthracene	16.4	U	32.8	8.20	ug/Kg	1		07/10/18 22:50
Benzo(a)Anthracene	16.4	U	32.8	8.20	ug/Kg	1		07/10/18 22:50
Benzo[a]pyrene	16.4	U	32.8	8.20	ug/Kg	1		07/10/18 22:50
Benzo[b]Fluoranthene	16.4	U	32.8	8.20	ug/Kg	1		07/10/18 22:50
Benzo[g,h,i]perylene	16.4	U	32.8	8.20	ug/Kg	1		07/10/18 22:50
Benzo[k]fluoranthene	16.4	U	32.8	8.20	ug/Kg	1		07/10/18 22:50
Chrysene	16.4	U	32.8	8.20	ug/Kg	1		07/10/18 22:50
Dibenzo[a,h]anthracene	16.4	U	32.8	8.20	ug/Kg	1		07/10/18 22:50
Fluoranthene	16.4	U	32.8	8.20	ug/Kg	1		07/10/18 22:50
Fluorene	16.4	U	32.8	8.20	ug/Kg	1		07/10/18 22:50
Indeno[1,2,3-c,d] pyrene	16.4	U	32.8	8.20	ug/Kg	1		07/10/18 22:50
Naphthalene	13.1	U	26.2	6.56	ug/Kg	1		07/10/18 22:50
Phenanthrene	16.4	U	32.8	8.20	ug/Kg	1		07/10/18 22:50
Pyrene	16.4	U	32.8	8.20	ug/Kg	1		07/10/18 22:50
Surrogates								
2-Methylnaphthalene-d10 (surr)	75.7		58-103		%	1		07/10/18 22:50
Fluoranthene-d10 (surr)	81		54-113		%	1		07/10/18 22:50

Batch Information

Analytical Batch: XMS10879
Analytical Method: 8270D SIM (PAH)
Analyst: BMZ
Analytical Date/Time: 07/10/18 22:50
Container ID: 1183454004-A

Prep Batch: XXX39850
Prep Method: SW3550C
Prep Date/Time: 07/08/18 07:42
Prep Initial Wt./Vol.: 22.596 g
Prep Extract Vol: 5 mL

Print Date: 07/17/2018 9:00:08AM

J flagging is activated

Results of **COWI18-TH08-01**

Client Sample ID: **COWI18-TH08-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454004
Lab Project ID: 1183454

Collection Date: 07/06/18 15:09
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):75.9
Location: TH08

Results by **Semivolatile Organic Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Diesel Range Organics	13.1	U	26.2	8.12	mg/Kg	1		07/09/18 16:52
Surrogates								
5a Androstane (surr)	81.1		50-150		%	1		07/09/18 16:52

Batch Information

Analytical Batch: XFC14369
Analytical Method: AK102
Analyst: CMS
Analytical Date/Time: 07/09/18 16:52
Container ID: 1183454004-A

Prep Batch: XXX39849
Prep Method: SW3550C
Prep Date/Time: 07/07/18 13:14
Prep Initial Wt./Vol.: 30.183 g
Prep Extract Vol: 5 mL

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Residual Range Organics	33.5		26.2	8.12	mg/Kg	1		07/09/18 16:52
Surrogates								
n-Triacontane-d62 (surr)	73.2		50-150		%	1		07/09/18 16:52

Batch Information

Analytical Batch: XFC14369
Analytical Method: AK103
Analyst: CMS
Analytical Date/Time: 07/09/18 16:52
Container ID: 1183454004-A

Prep Batch: XXX39849
Prep Method: SW3550C
Prep Date/Time: 07/07/18 13:14
Prep Initial Wt./Vol.: 30.183 g
Prep Extract Vol: 5 mL

Print Date: 07/17/2018 9:00:08AM

J flagging is activated

Results of **COWI18-TH08-01**

Client Sample ID: **COWI18-TH08-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454004
Lab Project ID: 1183454

Collection Date: 07/06/18 15:09
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):75.9
Location: TH08

Results by **Volatile Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Gasoline Range Organics	2.08 U		4.16	1.25	mg/Kg	1		07/07/18 16:55
Surrogates								
4-Bromofluorobenzene (surr)	103		50-150		%	1		07/07/18 16:55

Batch Information

Analytical Batch: VFC14256
Analytical Method: AK101
Analyst: ST
Analytical Date/Time: 07/07/18 16:55
Container ID: 1183454004-C

Prep Batch: VXX32570
Prep Method: SW5035A
Prep Date/Time: 07/06/18 15:09
Prep Initial Wt./Vol.: 63.975 g
Prep Extract Vol: 40.405 mL

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Results of **COWI18-TH08-01**

Client Sample ID: **COWI18-TH08-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454004
Lab Project ID: 1183454

Collection Date: 07/06/18 15:09
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):75.9
Location: TH08

Results by **Volatile GC/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
1,1,1,2-Tetrachloroethane	16.6	U	33.3	10.3	ug/Kg	1		07/08/18 22:05
1,1,1-Trichloroethane	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
1,1,2,2-Tetrachloroethane	10.4	U	20.8	6.49	ug/Kg	1		07/08/18 22:05
1,1,2-Trichloroethane	8.30	U	16.6	5.16	ug/Kg	1		07/08/18 22:05
1,1-Dichloroethane	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
1,1-Dichloroethene	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
1,1-Dichloropropene	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
1,2,3-Trichlorobenzene	41.6	U	83.2	25.0	ug/Kg	1		07/08/18 22:05
1,2,3-Trichloropropane	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
1,2,4-Trichlorobenzene	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
1,2,4-Trimethylbenzene	41.6	U	83.2	25.0	ug/Kg	1		07/08/18 22:05
1,2-Dibromo-3-chloropropane	83.0	U	166	51.6	ug/Kg	1		07/08/18 22:05
1,2-Dibromoethane	8.30	U	16.6	5.16	ug/Kg	1		07/08/18 22:05
1,2-Dichlorobenzene	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
1,2-Dichloroethane	8.30	U	16.6	5.16	ug/Kg	1		07/08/18 22:05
1,2-Dichloropropane	8.30	U	16.6	5.16	ug/Kg	1		07/08/18 22:05
1,3,5-Trimethylbenzene	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
1,3-Dichlorobenzene	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
1,3-Dichloropropane	8.30	U	16.6	5.16	ug/Kg	1		07/08/18 22:05
1,4-Dichlorobenzene	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
2,2-Dichloropropane	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
2-Butanone (MEK)	208	U	416	130	ug/Kg	1		07/08/18 22:05
2-Chlorotoluene	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
2-Hexanone	83.0	U	166	51.6	ug/Kg	1		07/08/18 22:05
4-Chlorotoluene	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
4-Isopropyltoluene	83.0	U	166	41.6	ug/Kg	1		07/08/18 22:05
4-Methyl-2-pentanone (MIBK)	208	U	416	130	ug/Kg	1		07/08/18 22:05
Benzene	10.4	U	20.8	6.49	ug/Kg	1		07/08/18 22:05
Bromobenzene	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
Bromochloromethane	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
Bromodichloromethane	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
Bromoform	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
Bromomethane	167	U	333	103	ug/Kg	1		07/08/18 22:05
Carbon disulfide	83.0	U	166	51.6	ug/Kg	1		07/08/18 22:05
Carbon tetrachloride	10.4	U	20.8	6.49	ug/Kg	1		07/08/18 22:05
Chlorobenzene	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
Chloroethane	167	U	333	103	ug/Kg	1		07/08/18 22:05

Results of **COWI18-TH08-01**

Client Sample ID: **COWI18-TH08-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454004
Lab Project ID: 1183454

Collection Date: 07/06/18 15:09
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):75.9
Location: TH08

Results by **Volatile GC/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Chloroform	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
Chloromethane	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
cis-1,2-Dichloroethene	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
cis-1,3-Dichloropropene	10.4	U	20.8	6.49	ug/Kg	1		07/08/18 22:05
Dibromochloromethane	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
Dibromomethane	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
Dichlorodifluoromethane	41.6	U	83.2	25.0	ug/Kg	1		07/08/18 22:05
Ethylbenzene	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
Freon-113	83.0	U	166	51.6	ug/Kg	1		07/08/18 22:05
Hexachlorobutadiene	16.6	U	33.3	10.3	ug/Kg	1		07/08/18 22:05
Isopropylbenzene (Cumene)	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
Methylene chloride	83.0	U	166	51.6	ug/Kg	1		07/08/18 22:05
Methyl-t-butyl ether	83.0	U	166	51.6	ug/Kg	1		07/08/18 22:05
Naphthalene	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
n-Butylbenzene	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
n-Propylbenzene	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
o-Xylene	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
P & M -Xylene	41.6	U	83.2	25.0	ug/Kg	1		07/08/18 22:05
sec-Butylbenzene	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
Styrene	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
tert-Butylbenzene	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
Tetrachloroethene	10.4	U	20.8	6.49	ug/Kg	1		07/08/18 22:05
Toluene	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
trans-1,2-Dichloroethene	20.8	U	41.6	13.0	ug/Kg	1		07/08/18 22:05
trans-1,3-Dichloropropene	10.4	U	20.8	6.49	ug/Kg	1		07/08/18 22:05
Trichloroethene	8.30	U	16.6	5.16	ug/Kg	1		07/08/18 22:05
Trichlorofluoromethane	41.6	U	83.2	25.0	ug/Kg	1		07/08/18 22:05
Vinyl acetate	83.0	U	166	51.6	ug/Kg	1		07/08/18 22:05
Vinyl chloride	8.30	U	16.6	5.16	ug/Kg	1		07/08/18 22:05
Xylenes (total)	62.5	U	125	37.9	ug/Kg	1		07/08/18 22:05
Surrogates								
1,2-Dichloroethane-D4 (surr)	112		71-136		%	1		07/08/18 22:05
4-Bromofluorobenzene (surr)	123		55-151		%	1		07/08/18 22:05
Toluene-d8 (surr)	99.7		85-116		%	1		07/08/18 22:05

Print Date: 07/17/2018 9:00:08AM

J flagging is activated

Results of **COWI18-TH08-01**

Client Sample ID: **COWI18-TH08-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454004
Lab Project ID: 1183454

Collection Date: 07/06/18 15:09
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):75.9
Location: TH08

Results by **Volatile GC/MS**

Batch Information

Analytical Batch: VMS17980
Analytical Method: SW8260C
Analyst: FDR
Analytical Date/Time: 07/08/18 22:05
Container ID: 1183454004-C

Prep Batch: VXX32572
Prep Method: SW5035A
Prep Date/Time: 07/06/18 15:09
Prep Initial Wt./Vol.: 63.975 g
Prep Extract Vol: 40.405 mL

Results of **COWI18-TH08-01**

Client Sample ID: **COWI18-TH08-01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454004
Lab Project ID: 1183454

Collection Date: 07/06/18 15:09
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):75.9
Location: TH08

Results by **Volatile GC/MS Low Level**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
1,1,2,2-Tetrachloroethane	1.67	U	3.33	1.03	ug/Kg	1		07/11/18 16:19
1,1,2-Trichloroethane	0.665	U	1.33	0.416	ug/Kg	1		07/11/18 16:19
1,2,3-Trichloropropane	0.830	U	1.66	0.516	ug/Kg	1		07/11/18 16:19
1,2-Dibromoethane	0.416	U	0.832	0.250	ug/Kg	1		07/11/18 16:19
1,2-Dichloroethane	1.67	U	3.33	1.03	ug/Kg	1		07/11/18 16:19
Bromodichloromethane	1.67	U	3.33	1.03	ug/Kg	1		07/11/18 16:19
Bromomethane	16.6	U	33.3	10.3	ug/Kg	1		07/11/18 16:19
Chloroform	1.67	U	3.33	1.03	ug/Kg	1		07/11/18 16:19
Dibromochloromethane	1.67	U	3.33	1.03	ug/Kg	1		07/11/18 16:19
Trichloroethene	4.16	U	8.32	2.50	ug/Kg	1		07/11/18 16:19
Vinyl chloride	0.665	U	1.33	0.416	ug/Kg	1		07/11/18 16:19
Surrogates								
1,2-Dichloroethane-D4 (surr)	103		71-136		%	1		07/11/18 16:19
4-Bromofluorobenzene (surr)	96.3		55-151		%	1		07/11/18 16:19
Toluene-d8 (surr)	99.3		85-116		%	1		07/11/18 16:19

Batch Information

Analytical Batch: VMS18002
Analytical Method: SW8260C LL w/MeOH
Analyst: NRO
Analytical Date/Time: 07/11/18 16:19
Container ID: 1183454004-C

Prep Batch: VXX32615
Prep Method: SW5035A
Prep Date/Time: 07/06/18 15:09
Prep Initial Wt./Vol.: 63.975 g
Prep Extract Vol: 40.405 mL

Print Date: 07/17/2018 9:00:08AM

J flagging is activated

Results of **COWI18-SO-QC01**

Client Sample ID: **COWI18-SO-QC01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454005
Lab Project ID: 1183454

Collection Date: 07/06/18 09:14
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):
Location: COWI18

Results by **Volatile Fuels**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Gasoline Range Organics	1.28	U	2.57	0.770	mg/Kg	1		07/07/18 15:43
Surrogates								
4-Bromofluorobenzene (surr)	79.5		50-150		%	1		07/07/18 15:43

Batch Information

Analytical Batch: VFC14256
Analytical Method: AK101
Analyst: ST
Analytical Date/Time: 07/07/18 15:43
Container ID: 1183454005-A

Prep Batch: VXX32570
Prep Method: SW5035A
Prep Date/Time: 07/06/18 09:14
Prep Initial Wt./Vol.: 48.692 g
Prep Extract Vol: 25 mL

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Results of **COWI18-SO-QC01**

Client Sample ID: **COWI18-SO-QC01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454005
Lab Project ID: 1183454

Collection Date: 07/06/18 09:14
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):
Location: COWI18

Results by **Volatile GC/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
1,1,1,2-Tetrachloroethane	10.3	U	20.5	6.37	ug/Kg	1		07/08/18 18:42
1,1,1-Trichloroethane	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
1,1,2,2-Tetrachloroethane	6.40	U	12.8	4.00	ug/Kg	1		07/08/18 18:42
1,1,2-Trichloroethane	5.15	U	10.3	3.18	ug/Kg	1		07/08/18 18:42
1,1-Dichloroethane	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
1,1-Dichloroethene	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
1,1-Dichloropropene	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
1,2,3-Trichlorobenzene	25.6	U	51.3	15.4	ug/Kg	1		07/08/18 18:42
1,2,3-Trichloropropane	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
1,2,4-Trichlorobenzene	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
1,2,4-Trimethylbenzene	25.6	U	51.3	15.4	ug/Kg	1		07/08/18 18:42
1,2-Dibromo-3-chloropropane	51.5	U	103	31.8	ug/Kg	1		07/08/18 18:42
1,2-Dibromoethane	5.15	U	10.3	3.18	ug/Kg	1		07/08/18 18:42
1,2-Dichlorobenzene	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
1,2-Dichloroethane	5.15	U	10.3	3.18	ug/Kg	1		07/08/18 18:42
1,2-Dichloropropane	5.15	U	10.3	3.18	ug/Kg	1		07/08/18 18:42
1,3,5-Trimethylbenzene	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
1,3-Dichlorobenzene	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
1,3-Dichloropropane	5.15	U	10.3	3.18	ug/Kg	1		07/08/18 18:42
1,4-Dichlorobenzene	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
2,2-Dichloropropane	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
2-Butanone (MEK)	129	U	257	80.1	ug/Kg	1		07/08/18 18:42
2-Chlorotoluene	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
2-Hexanone	51.5	U	103	31.8	ug/Kg	1		07/08/18 18:42
4-Chlorotoluene	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
4-Isopropyltoluene	51.5	U	103	25.7	ug/Kg	1		07/08/18 18:42
4-Methyl-2-pentanone (MIBK)	129	U	257	80.1	ug/Kg	1		07/08/18 18:42
Benzene	6.40	U	12.8	4.00	ug/Kg	1		07/08/18 18:42
Bromobenzene	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
Bromochloromethane	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
Bromodichloromethane	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
Bromoform	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
Bromomethane	103	U	205	63.7	ug/Kg	1		07/08/18 18:42
Carbon disulfide	51.5	U	103	31.8	ug/Kg	1		07/08/18 18:42
Carbon tetrachloride	6.40	U	12.8	4.00	ug/Kg	1		07/08/18 18:42
Chlorobenzene	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
Chloroethane	103	U	205	63.7	ug/Kg	1		07/08/18 18:42

Results of **COWI18-SO-QC01**

Client Sample ID: **COWI18-SO-QC01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454005
Lab Project ID: 1183454

Collection Date: 07/06/18 09:14
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):
Location: COWI18

Results by **Volatile GC/MS**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
Chloroform	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
Chloromethane	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
cis-1,2-Dichloroethene	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
cis-1,3-Dichloropropene	6.40	U	12.8	4.00	ug/Kg	1		07/08/18 18:42
Dibromochloromethane	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
Dibromomethane	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
Dichlorodifluoromethane	25.6	U	51.3	15.4	ug/Kg	1		07/08/18 18:42
Ethylbenzene	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
Freon-113	51.5	U	103	31.8	ug/Kg	1		07/08/18 18:42
Hexachlorobutadiene	10.3	U	20.5	6.37	ug/Kg	1		07/08/18 18:42
Isopropylbenzene (Cumene)	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
Methylene chloride	51.5	U	103	31.8	ug/Kg	1		07/08/18 18:42
Methyl-t-butyl ether	51.5	U	103	31.8	ug/Kg	1		07/08/18 18:42
Naphthalene	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
n-Butylbenzene	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
n-Propylbenzene	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
o-Xylene	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
P & M -Xylene	25.6	U	51.3	15.4	ug/Kg	1		07/08/18 18:42
sec-Butylbenzene	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
Styrene	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
tert-Butylbenzene	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
Tetrachloroethene	6.40	U	12.8	4.00	ug/Kg	1		07/08/18 18:42
Toluene	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
trans-1,2-Dichloroethene	12.9	U	25.7	8.01	ug/Kg	1		07/08/18 18:42
trans-1,3-Dichloropropene	6.40	U	12.8	4.00	ug/Kg	1		07/08/18 18:42
Trichloroethene	5.15	U	10.3	3.18	ug/Kg	1		07/08/18 18:42
Trichlorofluoromethane	25.6	U	51.3	15.4	ug/Kg	1		07/08/18 18:42
Vinyl acetate	51.5	U	103	31.8	ug/Kg	1		07/08/18 18:42
Vinyl chloride	5.15	U	10.3	3.18	ug/Kg	1		07/08/18 18:42
Xylenes (total)	38.5	U	77.0	23.4	ug/Kg	1		07/08/18 18:42
Surrogates								
1,2-Dichloroethane-D4 (surr)	116		71-136		%	1		07/08/18 18:42
4-Bromofluorobenzene (surr)	92.4		55-151		%	1		07/08/18 18:42
Toluene-d8 (surr)	95.7		85-116		%	1		07/08/18 18:42

Print Date: 07/17/2018 9:00:08AM

J flagging is activated

Results of **COWI18-SO-QC01**

Client Sample ID: **COWI18-SO-QC01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454005
Lab Project ID: 1183454

Collection Date: 07/06/18 09:14
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):
Location: COWI18

Results by **Volatile GC/MS**

Batch Information

Analytical Batch: VMS17980
Analytical Method: SW8260C
Analyst: FDR
Analytical Date/Time: 07/08/18 18:42
Container ID: 1183454005-A

Prep Batch: VXX32572
Prep Method: SW5035A
Prep Date/Time: 07/06/18 09:14
Prep Initial Wt./Vol.: 48.692 g
Prep Extract Vol: 25 mL

Results of **COWI18-SO-QC01**

Client Sample ID: **COWI18-SO-QC01**
Client Project ID: **COWI AWWWU Wtr Ln RIgnmnt**
Lab Sample ID: 1183454005
Lab Project ID: 1183454

Collection Date: 07/06/18 09:14
Received Date: 07/06/18 16:43
Matrix: Soil/Solid (dry weight)
Solids (%):
Location: COWI18

Results by **Volatile GC/MS Low Level**

Parameter	Result	Qual	LOQ/CL	DL	Units	DF	Allowable Limits	Date Analyzed
1,1,2,2-Tetrachloroethane	1.02 U		2.05	0.637	ug/Kg	1		07/11/18 14:47
1,1,2-Trichloroethane	0.410 U		0.821	0.257	ug/Kg	1		07/15/18 16:40
1,2,3-Trichloropropane	0.515 U		1.03	0.318	ug/Kg	1		07/11/18 14:47
1,2-Dibromoethane	0.257 U		0.513	0.154	ug/Kg	1		07/15/18 16:40
1,2-Dichloroethane	1.02 U		2.05	0.637	ug/Kg	1		07/11/18 14:47
Bromodichloromethane	1.02 U		2.05	0.637	ug/Kg	1		07/11/18 14:47
Bromomethane	10.3 U		20.5	6.37	ug/Kg	1		07/11/18 14:47
Chloroform	1.02 U		2.05	0.637	ug/Kg	1		07/11/18 14:47
Dibromochloromethane	1.02 U		2.05	0.637	ug/Kg	1		07/15/18 16:40
Trichloroethene	2.56 U		5.13	1.54	ug/Kg	1		07/11/18 14:47
Vinyl chloride	0.410 U		0.821	0.257	ug/Kg	1		07/11/18 14:47
Surrogates								
1,2-Dichloroethane-D4 (surr)	103		71-136		%	1		07/11/18 14:47
4-Bromofluorobenzene (surr)	99		55-151		%	1		07/11/18 14:47
Toluene-d8 (surr)	99.9		85-116		%	1		07/11/18 14:47

Batch Information

Analytical Batch: VMS18002
Analytical Method: SW8260C LL w/MeOH
Analyst: NRO
Analytical Date/Time: 07/11/18 14:47
Container ID: 1183454005-A

Prep Batch: VXX32615
Prep Method: SW5035A
Prep Date/Time: 07/06/18 09:14
Prep Initial Wt./Vol.: 48.692 g
Prep Extract Vol: 25 mL

Analytical Batch: VMS18007
Analytical Method: SW8260C LL w/MeOH
Analyst: NRO
Analytical Date/Time: 07/15/18 16:40
Container ID: 1183454005-A

Prep Batch: VXX32627
Prep Method: SW5035A
Prep Date/Time: 07/06/18 09:14
Prep Initial Wt./Vol.: 48.692 g
Prep Extract Vol: 25 mL

Method Blank

Blank ID: MB for HBN 1782125 [SPT/10534]
Blank Lab ID: 1457820

Matrix: Soil/Solid (dry weight)

QC for Samples:
1183454001, 1183454002, 1183454003, 1183454004

Results by **SM21 2540G**

Parameter	Results	LOQ/CL	DL	Units
Total Solids	100			%

Batch Information

Analytical Batch: SPT10534
Analytical Method: SM21 2540G
Instrument:
Analyst: EJA
Analytical Date/Time: 7/6/2018 11:00:00PM

SGS North America Inc.
200 West Potter Drive Anchorage, AK 95518
t 907.562.2343 **f** 907.561.5301 www.us.sgs.com

Duplicate Sample Summary

Original Sample ID: 1183455009
Duplicate Sample ID: 1457821
QC for Samples:
1183454001, 1183454002, 1183454003, 1183454004

Analysis Date: 07/06/2018 23:00
Matrix: Soil/Solid (dry weight)

Results by **SM21 2540G**

NAME	Original	Duplicate	Units	RPD (%)	RPD CL
Total Solids	62.4	62.8	%	0.58	(< 15)

Batch Information

Analytical Batch: SPT10534
Analytical Method: SM21 2540G
Instrument:
Analyst: EJA

Print Date: 07/17/2018 9:00:12AM

Duplicate Sample Summary

Original Sample ID: 1183418001
Duplicate Sample ID: 1457823
QC for Samples:
1183454001, 1183454002, 1183454003, 1183454004

Analysis Date: 07/06/2018 23:00
Matrix: Soil/Solid (dry weight)

Results by **SM21 2540G**

NAME	Original	Duplicate	Units	RPD (%)	RPD CL
Total Solids	91.5	91.4	%	0.08	(< 15)

Batch Information

Analytical Batch: SPT10534
Analytical Method: SM21 2540G
Instrument:
Analyst: JZC

Print Date: 07/17/2018 9:00:12AM

Method Blank

Blank ID: MB for HBN 1782131 [VXX/32570]
Blank Lab ID: 1457842

Matrix: Soil/Solid (dry weight)

QC for Samples:
1183454001, 1183454002, 1183454003, 1183454004, 1183454005

Results by **AK101**

Parameter	Results	LOQ/CL	DL	Units
Gasoline Range Organics	1.25U	2.50	0.750	mg/Kg
Surrogates				
4-Bromofluorobenzene (surr)	98.8	50-150		%

Batch Information

Analytical Batch: VFC14256
Analytical Method: AK101
Instrument: Agilent 7890A PID/FID
Analyst: ST
Analytical Date/Time: 7/7/2018 3:25:00PM

Prep Batch: VXX32570
Prep Method: SW5035A
Prep Date/Time: 7/7/2018 8:00:00AM
Prep Initial Wt./Vol.: 50 g
Prep Extract Vol: 25 mL

Blank Spike Summary

Blank Spike ID: LCS for HBN 1183454 [VXX32570]
Blank Spike Lab ID: 1457843
Date Analyzed: 07/07/2018 13:55

Spike Duplicate ID: LCSD for HBN 1183454 [VXX32570]
Spike Duplicate Lab ID: 1457844
Matrix: Soil/Solid (dry weight)

QC for Samples: 1183454001, 1183454002, 1183454003, 1183454004, 1183454005

Results by **AK101**

	Blank Spike (mg/Kg)			Spike Duplicate (mg/Kg)					
Parameter	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Gasoline Range Organics	12.5	11.5	92	12.5	11.4	91	(60-120)	0.87	(< 20)
Surrogates									
4-Bromofluorobenzene (surr)	1.25	104	104	1.25	101	101	(50-150)	3.40	

Batch Information

Analytical Batch: **VFC14256**
Analytical Method: **AK101**
Instrument: **Agilent 7890A PID/FID**
Analyst: **ST**

Prep Batch: **VXX32570**
Prep Method: **SW5035A**
Prep Date/Time: **07/07/2018 08:00**
Spike Init Wt./Vol.: 12.5 mg/Kg Extract Vol: 25 mL
Dupe Init Wt./Vol.: 12.5 mg/Kg Extract Vol: 25 mL

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200 West Potter Drive Anchorage, AK 95518
t 907.562.2343 f 907.561.5301 www.us.sgs.com

Method Blank

Blank ID: MB for HBN 1782136 [VXX/32572]
Blank Lab ID: 1457869

Matrix: Soil/Solid (dry weight)

QC for Samples:
1183454001, 1183454002, 1183454003, 1183454004, 1183454005

Results by **SW8260C**

Parameter	Results	LOQ/CL	DL	Units
1,1,1,2-Tetrachloroethane	10.0U	20.0	6.20	ug/Kg
1,1,1-Trichloroethane	12.5U	25.0	7.80	ug/Kg
1,1,2,2-Tetrachloroethane	6.25U	12.5	3.90	ug/Kg
1,1,2-Trichloroethane	5.00U	10.0	3.10	ug/Kg
1,1-Dichloroethane	12.5U	25.0	7.80	ug/Kg
1,1-Dichloroethene	12.5U	25.0	7.80	ug/Kg
1,1-Dichloropropene	12.5U	25.0	7.80	ug/Kg
1,2,3-Trichlorobenzene	25.0U	50.0	15.0	ug/Kg
1,2,3-Trichloropropane	12.5U	25.0	7.80	ug/Kg
1,2,4-Trichlorobenzene	12.5U	25.0	7.80	ug/Kg
1,2,4-Trimethylbenzene	25.0U	50.0	15.0	ug/Kg
1,2-Dibromo-3-chloropropane	50.0U	100	31.0	ug/Kg
1,2-Dibromoethane	5.00U	10.0	3.10	ug/Kg
1,2-Dichlorobenzene	12.5U	25.0	7.80	ug/Kg
1,2-Dichloroethane	5.00U	10.0	3.10	ug/Kg
1,2-Dichloropropane	5.00U	10.0	3.10	ug/Kg
1,3,5-Trimethylbenzene	12.5U	25.0	7.80	ug/Kg
1,3-Dichlorobenzene	12.5U	25.0	7.80	ug/Kg
1,3-Dichloropropane	5.00U	10.0	3.10	ug/Kg
1,4-Dichlorobenzene	12.5U	25.0	7.80	ug/Kg
2,2-Dichloropropane	12.5U	25.0	7.80	ug/Kg
2-Butanone (MEK)	125U	250	78.0	ug/Kg
2-Chlorotoluene	12.5U	25.0	7.80	ug/Kg
2-Hexanone	50.0U	100	31.0	ug/Kg
4-Chlorotoluene	12.5U	25.0	7.80	ug/Kg
4-Isopropyltoluene	50.0U	100	25.0	ug/Kg
4-Methyl-2-pentanone (MIBK)	125U	250	78.0	ug/Kg
Benzene	6.25U	12.5	3.90	ug/Kg
Bromobenzene	12.5U	25.0	7.80	ug/Kg
Bromochloromethane	12.5U	25.0	7.80	ug/Kg
Bromodichloromethane	12.5U	25.0	7.80	ug/Kg
Bromoform	12.5U	25.0	7.80	ug/Kg
Bromomethane	100U	200	62.0	ug/Kg
Carbon disulfide	50.0U	100	31.0	ug/Kg
Carbon tetrachloride	6.25U	12.5	3.90	ug/Kg
Chlorobenzene	12.5U	25.0	7.80	ug/Kg
Chloroethane	100U	200	62.0	ug/Kg
Chloroform	12.5U	25.0	7.80	ug/Kg

Method Blank

Blank ID: MB for HBN 1782136 [VXX/32572]
Blank Lab ID: 1457869

Matrix: Soil/Solid (dry weight)

QC for Samples:
1183454001, 1183454002, 1183454003, 1183454004, 1183454005

Results by **SW8260C**

Parameter	Results	LOQ/CL	DL	Units
Chloromethane	12.5U	25.0	7.80	ug/Kg
cis-1,2-Dichloroethene	12.5U	25.0	7.80	ug/Kg
cis-1,3-Dichloropropene	6.25U	12.5	3.90	ug/Kg
Dibromochloromethane	12.5U	25.0	7.80	ug/Kg
Dibromomethane	12.5U	25.0	7.80	ug/Kg
Dichlorodifluoromethane	25.0U	50.0	15.0	ug/Kg
Ethylbenzene	12.5U	25.0	7.80	ug/Kg
Freon-113	50.0U	100	31.0	ug/Kg
Hexachlorobutadiene	10.0U	20.0	6.20	ug/Kg
Isopropylbenzene (Cumene)	12.5U	25.0	7.80	ug/Kg
Methylene chloride	50.0U	100	31.0	ug/Kg
Methyl-t-butyl ether	50.0U	100	31.0	ug/Kg
Naphthalene	12.5U	25.0	7.80	ug/Kg
n-Butylbenzene	12.5U	25.0	7.80	ug/Kg
n-Propylbenzene	12.5U	25.0	7.80	ug/Kg
o-Xylene	12.5U	25.0	7.80	ug/Kg
P & M -Xylene	25.0U	50.0	15.0	ug/Kg
sec-Butylbenzene	12.5U	25.0	7.80	ug/Kg
Styrene	12.5U	25.0	7.80	ug/Kg
tert-Butylbenzene	12.5U	25.0	7.80	ug/Kg
Tetrachloroethene	6.25U	12.5	3.90	ug/Kg
Toluene	12.5U	25.0	7.80	ug/Kg
trans-1,2-Dichloroethene	12.5U	25.0	7.80	ug/Kg
trans-1,3-Dichloropropene	6.25U	12.5	3.90	ug/Kg
Trichloroethene	5.00U	10.0	3.10	ug/Kg
Trichlorofluoromethane	25.0U	50.0	15.0	ug/Kg
Vinyl acetate	50.0U	100	31.0	ug/Kg
Vinyl chloride	5.00U	10.0	3.10	ug/Kg
Xylenes (total)	37.5U	75.0	22.8	ug/Kg
Surrogates				
1,2-Dichloroethane-D4 (surr)	110	71-136		%
4-Bromofluorobenzene (surr)	94.5	55-151		%
Toluene-d8 (surr)	96.7	85-116		%

Method Blank

Blank ID: MB for HBN 1782136 [VXX/32572]
Blank Lab ID: 1457869

Matrix: Soil/Solid (dry weight)

QC for Samples:
1183454001, 1183454002, 1183454003, 1183454004, 1183454005

Results by **SW8260C**

Parameter	Results	LOQ/CL	DL	Units

Batch Information

Analytical Batch: VMS17980
Analytical Method: SW8260C
Instrument: VSA Agilent GC/MS 7890B/5977A
Analyst: FDR
Analytical Date/Time: 7/8/2018 4:22:00PM

Prep Batch: VXX32572
Prep Method: SW5035A
Prep Date/Time: 7/8/2018 6:00:00AM
Prep Initial Wt./Vol.: 50 g
Prep Extract Vol: 25 mL

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1183454 [VXX32572]
Blank Spike Lab ID: 1457870
Date Analyzed: 07/08/2018 16:40

Matrix: Soil/Solid (dry weight)

QC for Samples: 1183454001, 1183454002, 1183454003, 1183454004, 1183454005

Results by **SW8260C**

Blank Spike (ug/Kg)

Parameter	Spike	Result	Rec (%)	CL
1,1,1,2-Tetrachloroethane	750	788	105	(78-125)
1,1,1-Trichloroethane	750	872	116	(73-130)
1,1,2,2-Tetrachloroethane	750	737	98	(70-124)
1,1,2-Trichloroethane	750	759	101	(78-121)
1,1-Dichloroethane	750	802	107	(76-125)
1,1-Dichloroethene	750	842	112	(70-131)
1,1-Dichloropropene	750	872	116	(76-125)
1,2,3-Trichlorobenzene	750	680	91	(66-130)
1,2,3-Trichloropropane	750	745	99	(73-125)
1,2,4-Trichlorobenzene	750	691	92	(67-129)
1,2,4-Trimethylbenzene	750	715	95	(75-123)
1,2-Dibromo-3-chloropropane	750	811	108	(61-132)
1,2-Dibromoethane	750	829	111	(78-122)
1,2-Dichlorobenzene	750	693	92	(78-121)
1,2-Dichloroethane	750	805	107	(73-128)
1,2-Dichloropropane	750	803	107	(76-123)
1,3,5-Trimethylbenzene	750	761	101	(73-124)
1,3-Dichlorobenzene	750	762	102	(77-121)
1,3-Dichloropropane	750	772	103	(77-121)
1,4-Dichlorobenzene	750	691	92	(75-120)
2,2-Dichloropropane	750	908	121	(67-133)
2-Butanone (MEK)	2250	2360	105	(51-148)
2-Chlorotoluene	750	770	103	(75-122)
2-Hexanone	2250	2270	101	(53-145)
4-Chlorotoluene	750	757	101	(72-124)
4-Isopropyltoluene	750	773	103	(73-127)
4-Methyl-2-pentanone (MIBK)	2250	2330	104	(65-135)
Benzene	750	791	105	(77-121)
Bromobenzene	750	775	103	(78-121)
Bromochloromethane	750	786	105	(78-125)
Bromodichloromethane	750	885	118	(75-127)
Bromoform	750	838	112	(67-132)
Bromomethane	750	904	121	(53-143)
Carbon disulfide	1130	1270	113	(63-132)

Print Date: 07/17/2018 9:00:20AM

Blank Spike Summary

Blank Spike ID: LCS for HBN 1183454 [VXX32572]
Blank Spike Lab ID: 1457870
Date Analyzed: 07/08/2018 16:40

Matrix: Soil/Solid (dry weight)

QC for Samples: 1183454001, 1183454002, 1183454003, 1183454004, 1183454005

Results by **SW8260C**

Blank Spike (ug/Kg)

Parameter	Spike	Result	Rec (%)		CL
Carbon tetrachloride	750	868	116		(70-135)
Chlorobenzene	750	754	101		(79-120)
Chloroethane	750	835	111		(59-139)
Chloroform	750	779	104		(78-123)
Chloromethane	750	802	107		(50-136)
cis-1,2-Dichloroethene	750	784	105		(77-123)
cis-1,3-Dichloropropene	750	951	127	*	(74-126)
Dibromochloromethane	750	814	109		(74-126)
Dibromomethane	750	766	102		(78-125)
Dichlorodifluoromethane	750	890	119		(29-149)
Ethylbenzene	750	795	106		(76-122)
Freon-113	1130	1240	110		(66-136)
Hexachlorobutadiene	750	773	103		(61-135)
Isopropylbenzene (Cumene)	750	823	110		(68-134)
Methylene chloride	750	726	97		(70-128)
Methyl-t-butyl ether	1130	1080	96		(73-125)
Naphthalene	750	686	91		(62-129)
n-Butylbenzene	750	693	92		(70-128)
n-Propylbenzene	750	725	97		(73-125)
o-Xylene	750	785	105		(77-123)
P & M -Xylene	1500	1560	104		(77-124)
sec-Butylbenzene	750	785	105		(73-126)
Styrene	750	804	107		(76-124)
tert-Butylbenzene	750	762	102		(73-125)
Tetrachloroethene	750	809	108		(73-128)
Toluene	750	775	103		(77-121)
trans-1,2-Dichloroethene	750	802	107		(74-125)
trans-1,3-Dichloropropene	750	764	102		(71-130)
Trichloroethene	750	781	104		(77-123)
Trichlorofluoromethane	750	761	102		(62-140)
Vinyl acetate	750	870	116		(50-151)
Vinyl chloride	750	841	112		(56-135)
Xylenes (total)	2250	2350	104		(78-124)

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1183454 [VXX32572]
Blank Spike Lab ID: 1457870
Date Analyzed: 07/08/2018 16:40

Matrix: Soil/Solid (dry weight)

QC for Samples: 1183454001, 1183454002, 1183454003, 1183454004, 1183454005

Results by **SW8260C**

	Blank Spike (%)			
Parameter	Spike	Result	Rec (%)	CL
Surrogates				
1,2-Dichloroethane-D4 (surr)	750	101	101	(71-136)
4-Bromofluorobenzene (surr)	750	100	100	(55-151)
Toluene-d8 (surr)	750	109	109	(85-116)

Batch Information

Analytical Batch: **VMS17980**
Analytical Method: **SW8260C**
Instrument: **VSA Agilent GC/MS 7890B/5977A**
Analyst: **FDR**

Prep Batch: **VXX32572**
Prep Method: **SW5035A**
Prep Date/Time: **07/08/2018 06:00**
Spike Init Wt./Vol.: 750 ug/Kg Extract Vol: 25 mL
Dupe Init Wt./Vol.: Extract Vol:

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Matrix Spike Summary

Original Sample ID: 1457871
MS Sample ID: 1457872 MS
MSD Sample ID: 1457873 MSD

Analysis Date: 07/08/2018 19:00
Analysis Date: 07/08/2018 17:09
Analysis Date: 07/08/2018 17:28
Matrix: Solid/Soil (Wet Weight)

QC for Samples: 1183454001, 1183454002, 1183454003, 1183454004, 1183454005

Results by **SW8260C**

		Matrix Spike (ug/Kg)			Spike Duplicate (ug/Kg)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
1,1,1,2-Tetrachloroethane	12.2U	908	922	102	908	915	101	78-125	0.76	(< 20)
1,1,1-Trichloroethane	15.2U	908	833	92	908	984	108	73-130	16.60	(< 20)
1,1,2,2-Tetrachloroethane	7.60U	908	908	100	908	918	101	70-124	1.10	(< 20)
1,1,2-Trichloroethane	6.05U	908	939	103	908	1000	111	78-121	6.70	(< 20)
1,1-Dichloroethane	15.2U	908	745	82	908	875	96	76-125	16.10	(< 20)
1,1-Dichloroethene	15.2U	908	884	97	908	1070	118	70-131	19.00	(< 20)
1,1-Dichloropropene	15.2U	908	912	100	908	953	105	76-125	4.40	(< 20)
1,2,3-Trichlorobenzene	30.4U	908	746	82	908	804	89	66-130	7.40	(< 20)
1,2,3-Trichloropropane	15.2U	908	860	95	908	872	96	73-125	1.40	(< 20)
1,2,4-Trichlorobenzene	15.2U	908	716	79	908	806	89	67-129	11.80	(< 20)
1,2,4-Trimethylbenzene	210	908	1020	89	908	1000	87	75-123	1.30	(< 20)
1,2-Dibromo-3-chloropropane	60.5U	908	1020	112	908	1040	115	61-132	2.70	(< 20)
1,2-Dibromoethane	6.05U	908	1000	111	908	1030	113	78-122	2.20	(< 20)
1,2-Dichlorobenzene	15.2U	908	790	87	908	848	93	78-121	7.00	(< 20)
1,2-Dichloroethane	6.05U	908	919	101	908	924	102	73-128	0.56	(< 20)
1,2-Dichloropropane	6.05U	908	941	104	908	901	99	76-123	4.40	(< 20)
1,3,5-Trimethylbenzene	45.2	908	856	89	908	843	88	73-124	1.50	(< 20)
1,3-Dichlorobenzene	15.2U	908	825	91	908	820	90	77-121	0.59	(< 20)
1,3-Dichloropropane	6.05U	908	891	98	908	927	102	77-121	4.00	(< 20)
1,4-Dichlorobenzene	15.2U	908	799	88	908	815	90	75-120	2.00	(< 20)
2,2-Dichloropropane	15.2U	908	820	90	908	966	106	67-133	16.30	(< 20)
2-Butanone (MEK)	152U	2720	2750	101	2720	2740	101	51-148	0.10	(< 20)
2-Chlorotoluene	15.2U	908	850	94	908	817	90	75-122	4.00	(< 20)
2-Hexanone	60.5U	2720	2690	99	2720	2810	103	53-145	4.20	(< 20)
4-Chlorotoluene	15.2U	908	820	90	908	802	88	72-124	2.20	(< 20)
4-Isopropyltoluene	70.1J	908	866	88	908	867	88	73-127	0.07	(< 20)
4-Methyl-2-pentanone (MIBK)	152U	2720	3040	111	2720	3030	111	65-135	0.15	(< 20)
Benzene	292	908	1200	100	908	1160	96	77-121	3.20	(< 20)
Bromobenzene	15.2U	908	854	94	908	826	91	78-121	3.30	(< 20)
Bromochloromethane	15.2U	908	858	95	908	929	102	78-125	7.90	(< 20)
Bromodichloromethane	15.2U	908	1040	115	908	1040	115	75-127	0.06	(< 20)
Bromoform	15.2U	908	1050	115	908	1030	113	67-132	1.60	(< 20)
Bromomethane	122U	908	1060	117	908	1150	127	53-143	7.90	(< 20)
Carbon disulfide	60.5U	1360	1440	106	1360	1670	123	63-132	15.00	(< 20)
Carbon tetrachloride	7.60U	908	837	92	908	993	109	70-135	17.10	(< 20)
Chlorobenzene	15.2U	908	858	95	908	882	97	79-120	2.70	(< 20)
Chloroethane	122U	908	941	104	908	1080	119	59-139	13.80	(< 20)

Print Date: 07/17/2018 9:00:22AM

Matrix Spike Summary

Original Sample ID: 1457871
MS Sample ID: 1457872 MS
MSD Sample ID: 1457873 MSD

Analysis Date: 07/08/2018 19:00
Analysis Date: 07/08/2018 17:09
Analysis Date: 07/08/2018 17:28
Matrix: Solid/Soil (Wet Weight)

QC for Samples: 1183454001, 1183454002, 1183454003, 1183454004, 1183454005

Results by **SW8260C**

		Matrix Spike (ug/Kg)			Spike Duplicate (ug/Kg)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Chloroform	15.2U	908	760	84	908	879	97	78-123	14.50	(< 20)
Chloromethane	15.2U	908	799	88	908	976	108	50-136	19.90	(< 20)
cis-1,2-Dichloroethene	15.2U	908	764	84	908	874	96	77-123	13.50	(< 20)
cis-1,3-Dichloropropene	7.60U	908	1090	120	908	1050	116	74-126	3.20	(< 20)
Dibromochloromethane	15.2U	908	1010	111	908	1020	112	74-126	0.96	(< 20)
Dibromomethane	15.2U	908	946	104	908	969	107	78-125	2.40	(< 20)
Dichlorodifluoromethane	30.4U	908	724	80	908	901	99	29-149	21.80 *	(< 20)
Ethylbenzene	200	908	1040	93	908	1080	96	76-122	3.20	(< 20)
Freon-113	60.5U	1360	1270	94	1360	1630	120	66-136	24.90 *	(< 20)
Hexachlorobutadiene	12.2U	908	876	97	908	853	94	61-135	2.70	(< 20)
Isopropylbenzene (Cumene)	27.0J	908	977	105	908	915	98	68-134	6.60	(< 20)
Methylene chloride	60.5U	908	797	88	908	935	103	70-128	15.90	(< 20)
Methyl-t-butyl ether	60.5U	1360	1220	89	1360	1470	108	73-125	18.70	(< 20)
Naphthalene	298	908	983	75	908	1130	92	62-129	14.20	(< 20)
n-Butylbenzene	15.2U	908	737	81	908	785	87	70-128	6.30	(< 20)
n-Propylbenzene	27.6J	908	867	93	908	844	90	73-125	2.70	(< 20)
o-Xylene	321	908	1290	106	908	1180	95	77-123	8.40	(< 20)
P & M -Xylene	863	1820	2690	101	1820	2590	95	77-124	3.70	(< 20)
sec-Butylbenzene	15.2U	908	802	88	908	787	87	73-126	1.90	(< 20)
Styrene	15.2U	908	962	106	908	886	98	76-124	8.10	(< 20)
tert-Butylbenzene	15.2U	908	823	91	908	798	88	73-125	3.00	(< 20)
Tetrachloroethene	7.60U	908	961	106	908	951	105	73-128	1.00	(< 20)
Toluene	1560	908	2480	101	908	2340	86	77-121	5.70	(< 20)
trans-1,2-Dichloroethene	15.2U	908	877	97	908	1080	119	74-125	20.30 *	(< 20)
trans-1,3-Dichloropropene	7.60U	908	992	109	908	933	103	71-130	6.10	(< 20)
Trichloroethene	6.05U	908	923	102	908	920	101	77-123	0.33	(< 20)
Trichlorofluoromethane	30.4U	908	1030	114	908	1070	118	62-140	3.80	(< 20)
Vinyl acetate	60.5U	908	796	88	908	945	104	50-151	17.10	(< 20)
Vinyl chloride	6.05U	908	849	94	908	1020	112	56-135	18.10	(< 20)
Xylenes (total)	1180	2720	3970	102	2720	3770	95	78-124	5.20	(< 20)
Surrogates										
1,2-Dichloroethane-D4 (surr)		908	916	101	908	906	100	71-136	1.00	
4-Bromofluorobenzene (surr)		822	424	52 *	822	400	49 *	55-151	5.90	
Toluene-d8 (surr)		908	959	106	908	913	101	85-116	4.90	

Print Date: 07/17/2018 9:00:22AM

Matrix Spike Summary

Original Sample ID: 1457871
MS Sample ID: 1457872 MS
MSD Sample ID: 1457873 MSD

Analysis Date:
Analysis Date: 07/08/2018 17:09
Analysis Date: 07/08/2018 17:28
Matrix: Solid/Soil (Wet Weight)

QC for Samples: 1183454001, 1183454002, 1183454003, 1183454004, 1183454005

Results by **SW8260C**

		Matrix Spike (%)			Spike Duplicate (%)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL

Batch Information

Analytical Batch: VMS17980
Analytical Method: SW8260C
Instrument: VSA Agilent GC/MS 7890B/5977A
Analyst: FDR
Analytical Date/Time: 7/8/2018 5:09:00PM

Prep Batch: VXX32572
Prep Method: Vol. Extraction SW8260 Field Extracted L
Prep Date/Time: 7/8/2018 6:00:00AM
Prep Initial Wt./Vol.: 76.00g
Prep Extract Vol: 46.15mL

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Method Blank

Blank ID: MB for HBN 1782504 [VXX/32614]
Blank Lab ID: 1459487

Matrix: Soil/Solid (dry weight)

QC for Samples:
1183454001

Results by **SW8260C**

Parameter	Results	LOQ/CL	DL	Units
1,2,4-Trimethylbenzene	25.0U	50.0	15.0	ug/Kg
Benzene	6.25U	12.5	3.90	ug/Kg
Ethylbenzene	12.5U	25.0	7.80	ug/Kg
Naphthalene	12.5U	25.0	7.80	ug/Kg
o-Xylene	12.5U	25.0	7.80	ug/Kg
P & M -Xylene	25.0U	50.0	15.0	ug/Kg
Toluene	12.5U	25.0	7.80	ug/Kg
Xylenes (total)	37.5U	75.0	22.8	ug/Kg
Surrogates				
1,2-Dichloroethane-D4 (surr)	101	71-136		%
4-Bromofluorobenzene (surr)	104	55-151		%
Toluene-d8 (surr)	99.6	85-116		%

Batch Information

Analytical Batch: VMS18001
Analytical Method: SW8260C
Instrument: VRA Agilent GC/MS 7890B/5977A
Analyst: NRO
Analytical Date/Time: 7/11/2018 11:18:00AM

Prep Batch: VXX32614
Prep Method: SW5035A
Prep Date/Time: 7/11/2018 6:00:00AM
Prep Initial Wt./Vol.: 50 g
Prep Extract Vol: 25 mL

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1183454 [VXX32614]
Blank Spike Lab ID: 1459488
Date Analyzed: 07/11/2018 11:33

Matrix: Soil/Solid (dry weight)

QC for Samples: 1183454001

Results by **SW8260C**

Blank Spike (ug/Kg)

Parameter	Spike	Result	Rec (%)	CL
1,2,4-Trimethylbenzene	750	711	95	(75-123)
Benzene	750	729	97	(77-121)
Ethylbenzene	750	790	105	(76-122)
Naphthalene	750	799	107	(62-129)
o-Xylene	750	757	101	(77-123)
P & M -Xylene	1500	1570	105	(77-124)
Toluene	750	770	103	(77-121)
Xylenes (total)	2250	2330	103	(78-124)
Surrogates				
1,2-Dichloroethane-D4 (surr)	750	100	100	(71-136)
4-Bromofluorobenzene (surr)	750	97.2	97	(55-151)
Toluene-d8 (surr)	750	101	101	(85-116)

Batch Information

Analytical Batch: **VMS18001**
Analytical Method: **SW8260C**
Instrument: **VRA Agilent GC/MS 7890B/5977A**
Analyst: **NRO**

Prep Batch: **VXX32614**
Prep Method: **SW5035A**
Prep Date/Time: **07/11/2018 06:00**
Spike Init Wt./Vol.: 750 ug/Kg Extract Vol: 25 mL
Dupe Init Wt./Vol.: Extract Vol:

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Matrix Spike Summary

Original Sample ID: 1189487001
MS Sample ID: 1459489 MS
MSD Sample ID: 1459490 MSD

QC for Samples: 1183454001

Analysis Date: 07/11/2018 15:03
Analysis Date: 07/11/2018 13:45
Analysis Date: 07/11/2018 14:01
Matrix: Soil/Solid (dry weight)

Results by **SW8260C**

		Matrix Spike (ug/Kg)			Spike Duplicate (ug/Kg)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
1,2,4-Trimethylbenzene	31.6U	949	827	87	949	818	86	75-123	1.00	(< 20)
Benzene	7.90U	949	825	87	949	802	85	77-121	2.90	(< 20)
Ethylbenzene	15.8U	949	877	92	949	850	90	76-122	3.00	(< 20)
Naphthalene	15.8U	949	916	97	949	894	94	62-129	2.50	(< 20)
o-Xylene	15.8U	949	818	86	949	819	86	77-123	0.15	(< 20)
P & M -Xylene	31.6U	1895	1733	92	1895	1708	90	77-124	1.70	(< 20)
Toluene	15.8U	949	878	93	949	864	91	77-121	1.60	(< 20)
Xylenes (total)	47.5U	2843	2556	90	2843	2531	89	78-124	1.10	(< 20)
Surrogates										
1,2-Dichloroethane-D4 (surr)		949	950	100	949	930	98	71-136	2.10	
4-Bromofluorobenzene (surr)		964	595	62	964	590	61	55-151	0.75	
Toluene-d8 (surr)		949	961	101	949	953	100	85-116	0.93	

Batch Information

Analytical Batch: VMS18001
Analytical Method: SW8260C
Instrument: VRA Agilent GC/MS 7890B/5977A
Analyst: NRO
Analytical Date/Time: 7/11/2018 1:45:01PM

Prep Batch: VXX32614
Prep Method: Vol. Extraction SW8260 Field Extracted L
Prep Date/Time: 7/11/2018 6:00:00AM
Prep Initial Wt./Vol.: 161.70g
Prep Extract Vol: 82.06mL

Print Date: 07/17/2018 9:00:27AM

Method Blank

Blank ID: MB for HBN 1782506 [VXX/32615]
Blank Lab ID: 1459494

Matrix: Soil/Solid (dry weight)

QC for Samples:
1183454001, 1183454002, 1183454003, 1183454004, 1183454005

Results by **SW8260C LL w/MeOH**

Parameter	Results	LOQ/CL	DL	Units
1,1,2,2-Tetrachloroethane	1.00U	2.00	0.620	ug/Kg
1,1,2-Trichloroethane	0.400U	0.800	0.250	ug/Kg
1,2,3-Trichloropropane	0.500U	1.00	0.310	ug/Kg
1,2-Dibromoethane	0.250U	0.500	0.150	ug/Kg
1,2-Dichloroethane	1.00U	2.00	0.620	ug/Kg
Bromodichloromethane	1.00U	2.00	0.620	ug/Kg
Bromomethane	10.0U	20.0	6.20	ug/Kg
Chloroform	1.00U	2.00	0.620	ug/Kg
Dibromochloromethane	1.00U	2.00	0.620	ug/Kg
Trichloroethene	2.50U	5.00	1.50	ug/Kg
Vinyl chloride	0.400U	0.800	0.250	ug/Kg
Surrogates				
1,2-Dichloroethane-D4 (surr)	101	71-136		%
4-Bromofluorobenzene (surr)	104	55-151		%
Toluene-d8 (surr)	99.6	85-116		%

Batch Information

Analytical Batch: VMS18002
Analytical Method: SW8260C LL w/MeOH
Instrument: VRA Agilent GC/MS 7890B/5977A
Analyst: NRO
Analytical Date/Time: 7/11/2018 11:18:00AM

Prep Batch: VXX32615
Prep Method: SW5035A
Prep Date/Time: 7/11/2018 6:00:00AM
Prep Initial Wt./Vol.: 50 g
Prep Extract Vol: 25 mL

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1183454 [VXX32615]
Blank Spike Lab ID: 1459495
Date Analyzed: 07/11/2018 11:33

Matrix: Soil/Solid (dry weight)

QC for Samples: 1183454001, 1183454002, 1183454003, 1183454004, 1183454005

Results by **SW8260C LL w/MeOH**

Blank Spike (ug/Kg)

Parameter	Spike	Result	Rec (%)	CL
1,1,2,2-Tetrachloroethane	750	748	100	(70-124)
1,1,2-Trichloroethane	750	800	107	(78-121)
1,2,3-Trichloropropane	750	743	99	(73-125)
1,2-Dibromoethane	750	790	105	(78-122)
1,2-Dichloroethane	750	784	105	(73-128)
Bromodichloromethane	750	801	107	(75-127)
Bromomethane	750	778	104	(53-143)
Chloroform	750	719	96	(78-123)
Dibromochloromethane	750	848	113	(74-126)
Trichloroethene	750	738	98	(77-123)
Vinyl chloride	750	736	98	(56-135)
Surrogates				
1,2-Dichloroethane-D4 (surr)	750	100	100	(71-136)
4-Bromofluorobenzene (surr)	750	97.2	97	(55-151)
Toluene-d8 (surr)	750	101	101	(85-116)

Batch Information

Analytical Batch: **VMS18002**
Analytical Method: **SW8260C LL w/MeOH**
Instrument: **VRA Agilent GC/MS 7890B/5977A**
Analyst: **NRO**

Prep Batch: **VXX32615**
Prep Method: **SW5035A**
Prep Date/Time: **07/11/2018 06:00**
Spike Init Wt./Vol.: 750 ug/Kg Extract Vol: 25 mL
Dupe Init Wt./Vol.: Extract Vol:

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Matrix Spike Summary

Original Sample ID: 1189487001
MS Sample ID: 1459496 MS
MSD Sample ID: 1459497 MSD

Analysis Date: 07/11/2018 15:03
Analysis Date: 07/11/2018 13:45
Analysis Date: 07/11/2018 14:01
Matrix: Soil/Solid (dry weight)

QC for Samples: 1183454001, 1183454002, 1183454003, 1183454004, 1183454005

Results by **SW8260C LL w/MeOH**

		Matrix Spike (ug/Kg)			Spike Duplicate (ug/Kg)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
1,1,2,2-Tetrachloroethane	1.26U	949	883	93	949	863	91	70-124	2.40	(< 20)
1,1,2-Trichloroethane	0.505U	949	889	94	949	858	90	78-121	3.60	(< 20)
1,2,3-Trichloropropane	0.635U	949	885	93	949	852	90	73-125	3.90	(< 20)
1,2-Dibromoethane	0.720	949	870	92	949	845	89	78-122	2.90	(< 20)
1,2-Dichloroethane	1.26U	949	872	92	949	845	89	73-128	3.00	(< 20)
Bromodichloromethane	1.26U	949	880	93	949	857	90	75-127	2.60	(< 20)
Bromomethane	12.7U	949	906	96	949	909	96	53-143	0.29	(< 20)
Chloroform	1.26U	949	804	85	949	791	83	78-123	1.70	(< 20)
Dibromochloromethane	1.26U	949	933	98	949	906	96	74-126	2.80	(< 20)
Trichloroethene	3.17U	949	822	87	949	813	86	77-123	1.00	(< 20)
Vinyl chloride	0.505U	949	744	79	949	736	78	56-135	1.10	(< 20)
Surrogates										
1,2-Dichloroethane-D4 (surr)		949	950	100	949	930	98	71-136	2.10	
4-Bromofluorobenzene (surr)		964	595	62	964	590	61	55-151	0.75	
Toluene-d8 (surr)		949	961	101	949	953	100	85-116	0.93	

Batch Information

Analytical Batch: VMS18002
Analytical Method: SW8260C LL w/MeOH
Instrument: VRA Agilent GC/MS 7890B/5977A
Analyst: NRO
Analytical Date/Time: 7/11/2018 1:45:00PM

Prep Batch: VXX32615
Prep Method: Vol. Extraction SW8260 LL w/MeOH
Prep Date/Time: 7/11/2018 6:00:00AM
Prep Initial Wt./Vol.: 161.70g
Prep Extract Vol: 82.06mL

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Method Blank

Blank ID: MB for HBN 1782532 [VXX/32627]
Blank Lab ID: 1459602

Matrix: Soil/Solid (dry weight)

QC for Samples:
1183454005

Results by **SW8260C LL w/MeOH**

Parameter	Results	LOQ/CL	DL	Units
1,1,2-Trichloroethane	0.400U	0.800	0.250	ug/Kg
1,2-Dibromoethane	0.250U	0.500	0.150	ug/Kg
Dibromochloromethane	1.00U	2.00	0.620	ug/Kg
Surrogates				
1,2-Dichloroethane-D4 (surr)	101	71-136		%
4-Bromofluorobenzene (surr)	103	55-151		%
Toluene-d8 (surr)	99.4	85-116		%

Batch Information

Analytical Batch: VMS18007
Analytical Method: SW8260C LL w/MeOH
Instrument: VRA Agilent GC/MS 7890B/5977A
Analyst: NRO
Analytical Date/Time: 7/15/2018 12:04:00PM

Prep Batch: VXX32627
Prep Method: SW5035A
Prep Date/Time: 7/15/2018 6:00:00AM
Prep Initial Wt./Vol.: 50 g
Prep Extract Vol: 25 mL

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1183454 [VXX32627]
Blank Spike Lab ID: 1459603
Date Analyzed: 07/15/2018 12:19

Matrix: Soil/Solid (dry weight)

QC for Samples: 1183454005

Results by **SW8260C LL w/MeOH**

Blank Spike (ug/Kg)

Parameter	Spike	Result	Rec (%)	CL
1,1,2-Trichloroethane	750	747	100	(78-121)
1,2-Dibromoethane	750	736	98	(78-122)
Dibromochloromethane	750	781	104	(74-126)
Surrogates				
1,2-Dichloroethane-D4 (surr)	750	97.2	97	(71-136)
4-Bromofluorobenzene (surr)	750	103	103	(55-151)
Toluene-d8 (surr)	750	100	100	(85-116)

Batch Information

Analytical Batch: **VMS18007**
Analytical Method: **SW8260C LL w/MeOH**
Instrument: **VRA Agilent GC/MS 7890B/5977A**
Analyst: **NRO**

Prep Batch: **VXX32627**
Prep Method: **SW5035A**
Prep Date/Time: **07/15/2018 06:00**
Spike Init Wt./Vol.: 750 ug/Kg Extract Vol: 25 mL
Dupe Init Wt./Vol.: Extract Vol:

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Matrix Spike Summary

Original Sample ID: 1459604
MS Sample ID: 1459605 MS
MSD Sample ID: 1459606 MSD

Analysis Date: 07/15/2018 20:30
Analysis Date: 07/15/2018 15:23
Analysis Date: 07/15/2018 15:38
Matrix: Solid/Soil (Wet Weight)

QC for Samples: 1183454005

Results by **SW8260C LL w/MeOH**

		Matrix Spike (ug/Kg)			Spike Duplicate (ug/Kg)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
1,1,2-Trichloroethane	0.277U	518	480	93	518	527	102	78-121	9.30	(< 20)
1,2-Dibromoethane	0.173U	518	475	92	518	521	100	78-122	9.30	(< 20)
Dibromochloromethane	0.690U	518	515	99	518	556	107	74-126	7.70	(< 20)
Surrogates										
1,2-Dichloroethane-D4 (surr)		518	488	94	518	507	98	71-136	3.90	
4-Bromofluorobenzene (surr)		864	526	61	864	520	60	55-151	1.20	
Toluene-d8 (surr)		518	518	100	518	523	101	85-116	1.00	

Batch Information

Analytical Batch: VMS18007
Analytical Method: SW8260C LL w/MeOH
Instrument: VRA Agilent GC/MS 7890B/5977A
Analyst: NRO
Analytical Date/Time: 7/15/2018 3:23:00PM

Prep Batch: VXX32627
Prep Method: Vol. Extraction SW8260 LL w/MeOH
Prep Date/Time: 7/15/2018 6:00:00AM
Prep Initial Wt./Vol.: 72.35g
Prep Extract Vol: 25.00mL

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Method Blank

Blank ID: MB for HBN 1782129 [XXX/39849]
Blank Lab ID: 1457832

Matrix: Soil/Solid (dry weight)

QC for Samples:
1183454001, 1183454002, 1183454003, 1183454004

Results by **AK102**

Parameter	Results	LOQ/CL	DL	Units
Diesel Range Organics	10.0U	20.0	6.20	mg/Kg
Surrogates				
5a Androstane (surr)	103	60-120		%

Batch Information

Analytical Batch: XFC14369
Analytical Method: AK102
Instrument: Agilent 7890B R
Analyst: CMS
Analytical Date/Time: 7/9/2018 3:54:00PM

Prep Batch: XXX39849
Prep Method: SW3550C
Prep Date/Time: 7/7/2018 1:14:06PM
Prep Initial Wt./Vol.: 30 g
Prep Extract Vol: 5 mL

Blank Spike Summary

Blank Spike ID: LCS for HBN 1183454 [XXX39849]
Blank Spike Lab ID: 1457833
Date Analyzed: 07/09/2018 16:04

Spike Duplicate ID: LCSD for HBN 1183454 [XXX39849]
Spike Duplicate Lab ID: 1457834
Matrix: Soil/Solid (dry weight)

QC for Samples: 1183454001, 1183454002, 1183454003, 1183454004

Results by **AK102**

	Blank Spike (mg/Kg)			Spike Duplicate (mg/Kg)					
Parameter	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Diesel Range Organics	833	882	106	833	875	105	(75-125)	0.74	(< 20)
Surrogates									
5a Androstane (surr)	16.7	100	100	16.7	101	101	(60-120)	0.95	

Batch Information

Analytical Batch: **XFC14369**
Analytical Method: **AK102**
Instrument: **Agilent 7890B R**
Analyst: **CMS**

Prep Batch: **XXX39849**
Prep Method: **SW3550C**
Prep Date/Time: **07/07/2018 13:14**
Spike Init Wt./Vol.: 833 mg/Kg Extract Vol: 5 mL
Dupe Init Wt./Vol.: 833 mg/Kg Extract Vol: 5 mL

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Method Blank

Blank ID: MB for HBN 1782129 [XXX/39849]
Blank Lab ID: 1457832

Matrix: Soil/Solid (dry weight)

QC for Samples:
1183454001, 1183454002, 1183454003, 1183454004

Results by **AK103**

Parameter	Results	LOQ/CL	DL	Units
Residual Range Organics	7.87J	20.0	6.20	mg/Kg
Surrogates				
n-Triacontane-d62 (surr)	97.7	60-120		%

Batch Information

Analytical Batch: XFC14369
Analytical Method: AK103
Instrument: Agilent 7890B R
Analyst: CMS
Analytical Date/Time: 7/9/2018 3:54:00PM

Prep Batch: XXX39849
Prep Method: SW3550C
Prep Date/Time: 7/7/2018 1:14:06PM
Prep Initial Wt./Vol.: 30 g
Prep Extract Vol: 5 mL

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1183454 [XXX39849]
Blank Spike Lab ID: 1457833
Date Analyzed: 07/09/2018 16:04

Spike Duplicate ID: LCSD for HBN 1183454 [XXX39849]
Spike Duplicate Lab ID: 1457834
Matrix: Soil/Solid (dry weight)

QC for Samples: 1183454001, 1183454002, 1183454003, 1183454004

Results by **AK103**

	Blank Spike (mg/Kg)			Spike Duplicate (mg/Kg)					
Parameter	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
Residual Range Organics	833	789	95	833	791	95	(60-120)	0.19	(< 20)
Surrogates									
n-Triacontane-d62 (surr)	16.7	82.7	83	16.7	85.4	85	(60-120)	3.20	

Batch Information

Analytical Batch: **XFC14369**
Analytical Method: **AK103**
Instrument: **Agilent 7890B R**
Analyst: **CMS**

Prep Batch: **XXX39849**
Prep Method: **SW3550C**
Prep Date/Time: **07/07/2018 13:14**
Spike Init Wt./Vol.: 833 mg/Kg Extract Vol: 5 mL
Dupe Init Wt./Vol.: 833 mg/Kg Extract Vol: 5 mL

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Method Blank

Blank ID: MB for HBN 1782130 [XXX/39850]
Blank Lab ID: 1457835

Matrix: Soil/Solid (dry weight)

QC for Samples:
1183454001, 1183454002, 1183454003, 1183454004

Results by **8270D SIM (PAH)**

Parameter	Results	LOQ/CL	DL	Units
1-Methylnaphthalene	12.5U	25.0	6.25	ug/Kg
2-Methylnaphthalene	12.5U	25.0	6.25	ug/Kg
Acenaphthene	12.5U	25.0	6.25	ug/Kg
Acenaphthylene	12.5U	25.0	6.25	ug/Kg
Anthracene	12.5U	25.0	6.25	ug/Kg
Benzo(a)Anthracene	12.5U	25.0	6.25	ug/Kg
Benzo[a]pyrene	12.5U	25.0	6.25	ug/Kg
Benzo[b]Fluoranthene	12.5U	25.0	6.25	ug/Kg
Benzo[g,h,i]perylene	12.5U	25.0	6.25	ug/Kg
Benzo[k]fluoranthene	12.5U	25.0	6.25	ug/Kg
Chrysene	12.5U	25.0	6.25	ug/Kg
Dibenzo[a,h]anthracene	12.5U	25.0	6.25	ug/Kg
Fluoranthene	12.5U	25.0	6.25	ug/Kg
Fluorene	12.5U	25.0	6.25	ug/Kg
Indeno[1,2,3-c,d] pyrene	12.5U	25.0	6.25	ug/Kg
Naphthalene	10.0U	20.0	5.00	ug/Kg
Phenanthrene	12.5U	25.0	6.25	ug/Kg
Pyrene	12.5U	25.0	6.25	ug/Kg
Surrogates				
2-Methylnaphthalene-d10 (surr)	81.5	58-103		%
Fluoranthene-d10 (surr)	81	54-113		%

Batch Information

Analytical Batch: XMS10879
Analytical Method: 8270D SIM (PAH)
Instrument: SVA Agilent 780/5975 GC/MS
Analyst: BMZ
Analytical Date/Time: 7/10/2018 3:20:00PM

Prep Batch: XXX39850
Prep Method: SW3550C
Prep Date/Time: 7/8/2018 7:42:24AM
Prep Initial Wt./Vol.: 22.5 g
Prep Extract Vol: 5 mL

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Blank Spike Summary

Blank Spike ID: LCS for HBN 1183454 [XXX39850]
Blank Spike Lab ID: 1457836
Date Analyzed: 07/10/2018 15:40

Matrix: Soil/Solid (dry weight)

QC for Samples: 1183454001, 1183454002, 1183454003, 1183454004

Results by **8270D SIM (PAH)**

Blank Spike (ug/Kg)

Parameter	Spike	Result	Rec (%)	CL
1-Methylnaphthalene	111	96.0	86	(43-111)
2-Methylnaphthalene	111	90.2	81	(39-114)
Acenaphthene	111	109	98	(44-111)
Acenaphthylene	111	101	91	(39-116)
Anthracene	111	104	93	(50-114)
Benzo(a)Anthracene	111	101	91	(54-122)
Benzo[a]pyrene	111	109	98	(50-125)
Benzo[b]Fluoranthene	111	107	96	(53-128)
Benzo[k]fluoranthene	111	106	96	(56-123)
Chrysene	111	106	96	(57-118)
Dibenzo[a,h]anthracene	111	101	91	(50-129)
Fluoranthene	111	102	92	(55-119)
Fluorene	111	101	91	(47-114)
Indeno[1,2,3-c,d] pyrene	111	104	94	(49-130)
Naphthalene	111	90.8	82	(38-111)
Phenanthrene	111	101	91	(49-113)
Pyrene	111	105	94	(55-117)
Benzo[g,h,i]perylene	111	112	101	(49-127)
Surrogates				
2-Methylnaphthalene-d10 (surr)	111	81.4	81	(58-103)
Fluoranthene-d10 (surr)	111	83	83	(54-113)

Batch Information

Analytical Batch: **XMS10879**
Analytical Method: **8270D SIM (PAH)**
Instrument: **SVA Agilent 780/5975 GC/MS**
Analyst: **BMZ**

Prep Batch: **XXX39850**
Prep Method: **SW3550C**
Prep Date/Time: **07/08/2018 07:42**
Spike Init Wt./Vol.: 111 ug/Kg Extract Vol: 5 mL
Dupe Init Wt./Vol.: Extract Vol:

Analytical Batch: **XMS10881**
Analytical Method: **8270D SIM (PAH)**
Instrument: **SVA Agilent 780/5975 GC/MS**
Analyst: **BMZ**

Prep Batch: **XXX39850**
Prep Method: **SW3550C**
Prep Date/Time: **07/08/2018 07:42**
Spike Init Wt./Vol.: 111 ug/Kg Extract Vol: 5 mL
Dupe Init Wt./Vol.: Extract Vol:

Print Date: 07/17/2018 9:00:45AM

Matrix Spike Summary

Original Sample ID: 1183455011
MS Sample ID: 1458137 MS
MSD Sample ID: 1458138 MSD

Analysis Date: 07/11/2018 13:04
Analysis Date: 07/10/2018 19:46
Analysis Date: 07/10/2018 20:07
Matrix: Soil/Solid (dry weight)

QC for Samples: 1183454001, 1183454002, 1183454003, 1183454004

Results by **8270D SIM (PAH)**

		Matrix Spike (ug/Kg)			Spike Duplicate (ug/Kg)					
Parameter	Sample	Spike	Result	Rec (%)	Spike	Result	Rec (%)	CL	RPD (%)	RPD CL
1-Methylnaphthalene	13.9U	124	109	87	124	115	93	43-111	5.40	(< 20)
2-Methylnaphthalene	13.9U	124	99.5	80	124	106	85	39-114	6.00	(< 20)
Acenaphthene	13.9U	124	126	101	124	132	106	44-111	4.70	(< 20)
Acenaphthylene	13.9U	124	125	89	124	128	92	39-116	2.40	(< 20)
Anthracene	13.9U	124	115	92	124	119	96	50-114	4.00	(< 20)
Benzo(a)Anthracene	13.9U	124	110	88	124	114	92	54-122	3.10	(< 20)
Benzo[a]pyrene	13.9U	124	96.2	77	124	99.8	81	50-125	3.60	(< 20)
Benzo[b]Fluoranthene	13.9U	124	102	82	124	106	85	53-128	4.00	(< 20)
Benzo[k]fluoranthene	13.9U	124	104	83	124	106	86	56-123	2.60	(< 20)
Chrysene	13.9U	124	116	93	124	119	96	57-118	3.10	(< 20)
Dibenzo[a,h]anthracene	13.9U	124	67.6	54	124	70.6	57	50-129	4.30	(< 20)
Fluoranthene	13.9U	124	118	95	124	122	98	55-119	3.30	(< 20)
Fluorene	13.9U	124	115	92	124	120	97	47-114	4.90	(< 20)
Indeno[1,2,3-c,d] pyrene	13.9U	124	65.1	52	124	68.1	55	49-130	4.60	(< 20)
Naphthalene	11.1U	124	99.3	80	124	107	86	38-111	7.20	(< 20)
Phenanthrene	13.9U	124	113	91	124	118	96	49-113	5.30	(< 20)
Pyrene	13.9U	124	122	98	124	126	102	55-117	3.70	(< 20)
Benzo[g,h,i]perylene	13.9U	124	116	94	124	119	96	49-127	2.00	(< 20)
Surrogates										
2-Methylnaphthalene-d10 (surr)		124	101	81	124	105	85	58-103	4.10	
Fluoranthene-d10 (surr)		124	107	86	124	111	89	54-113	3.00	

Batch Information

Analytical Batch: XMS10879
Analytical Method: 8270D SIM (PAH)
Instrument: SVA Agilent 780/5975 GC/MS
Analyst: BMZ
Analytical Date/Time: 7/10/2018 7:46:00PM

Prep Batch: XXX39850
Prep Method: Sonication Extr Soil 8270 PAH SIM 5ml
Prep Date/Time: 7/8/2018 7:42:24AM
Prep Initial Wt./Vol.: 22.65g
Prep Extract Vol: 5.00mL

Analytical Batch: XMS10881
Analytical Method: 8270D SIM (PAH)
Instrument: SVA Agilent 780/5975 GC/MS
Analyst: BMZ
Analytical Date/Time: 7/11/2018 1:25:00PM

Prep Batch: XXX39850
Prep Method: Sonication Extr Soil 8270 PAH SIM 5ml
Prep Date/Time: 7/8/2018 7:42:24AM
Prep Initial Wt./Vol.: 22.65g
Prep Extract Vol: 5.00mL

Print Date: 07/17/2018 9:00:46AM

R&M CONSULTANTS, INC. REVIEWED KET

1183454

CHAIN OF CUSTODY RECORD

Client:	R&M Consultants, Inc	Analytical Laboratory	SGS - Anchorage	DOD Project?:	No	Cooler ID:	N/A	Page	1 of 1

Project No. / NPDL No.:	18-054	Project Name:	COWI AWWU Water Line Realignment
Contact Name:	Christopher Fell	Phone Number:	907.441.1994
Reports To:	Christopher Fell	Email:	cfell@rmconsult.com
	Kristi McLean		kmclean@rmconsult.com

Invoice To: R&M Consultants, Inc
Attn: Accounting Department/Courtney Maillet
9101 Vanguard Drive, Anchorage, AK, 99507
cmaillet@rmconsult.com / 907.522.1707

PO #: 2508.01
Quote #: Open

RESERVED for lab use	Sample Identification	LocID	Sampler	Date (mm/dd/yy)	Time (hhmm)	Matrix/ Matrix Code	No. Containers	Sample Type (i.e. Grab(G), Comp.(C), etc)	GRO (AK101) MeOH 0-6°C	VOC (SW8260 and SW8260SIM) MeOH 0-6°C	DRO/RRO (AK102/103) 0-6°C	Metals (As,Ba,Cd,Cr,Pb,Hg, Ni,V,Se,Ag) (SW6020) 0-6°C	PCB (SW8082) 0-6°C	PAH (SW8270 SIM) 0-6°C	Remarks
(5) A	COWI18-SO-QC01	COWI18	CF	7/6/2018	0914	SO	1	G	X	X					Trip Blank
(1) A-C	COWI18-TH01-01	TH01	CF	7/6/2018	1000	SO	3	G	X	X	X			X	
	~~COWI18-TH01-02~~	~~TH01~~	~~CF~~	~~7/6/2018~~		~~SO~~	~~3~~	~~G~~	~~X~~	~~X~~	~~X~~			~~X~~	CP
(2) A-C	COWI18-TH02-01	TH02	CF	7/6/2018	1152	SO	3	G	X	X	X			X	
	~~COWI18-TH03-01~~	~~TH03~~	~~CF~~	~~7/6/2018~~		~~SO~~	~~3~~	~~G~~	~~X~~	~~X~~	~~X~~			~~X~~	CP
	~~COWI18-TH03-02~~	~~TH03~~	~~CF~~	~~7/6/2018~~		~~SO~~	~~3~~	~~G~~	~~X~~	~~X~~	~~X~~			~~X~~	CP
(3) A-C	COWI18-TH04-01	TH04	CF	7/6/2018	1512	SO	3	G	X	X	X			X	
	~~COWI18-TH05-01~~	~~TH05~~	~~CF~~	~~7/6/2018~~		~~SO~~	~~3~~	~~G~~	~~X~~	~~X~~	~~X~~			~~X~~	CP
(4) A-C	COWI18-TH08-01	TH08	CF	7/6/18	1509	SO	3	G	X	X	X			X	

Relinquished By (1): Christopher D. Fell	Date: 7/6/18	Time: 1643	Received By:	Turnaround Time, Deliverable Req., and/or Special Instructions
Relinquished By (2):	Date:	Time:	Received By:	Standard TAT, Level 2 PDF, Dataview EDB Run low level list on VOCs as well as the standard list
Relinquished By (3):	Date:	Time:	Received By:	Laboratory Check In Information
Relinquished By (4):	Date: 7/6/18	Time: 16:43	Received For By Laboratory: KET	Temp Blank °C: 4.4 D35 / Chain of Custody Seal (Circle): Intact / Broken / (Absent) HD

Page 69 of 71

e-Sample Receipt Form

SGS Workorder #: **1183454**

Review Criteria	Condition (Yes, No, N/A)	Exceptions Noted below
Chain of Custody / Temperature Requirements		n/a Exemption permitted if sampler hand carries/delivers.
Were Custody Seals intact? Note # & location	n/a	hand delivered
COC accompanied samples?	yes	
n/a **Exemption permitted if chilled & collected <8 hours ago, or for samples where chilling is not required		
Temperature blank compliant* (i.e., 0-6 °C after CF)?	yes	Cooler ID: 1 @ 4.4 °C Therm. ID: D35
		Cooler ID: @ °C Therm. ID:
		Cooler ID: @ °C Therm. ID:
		Cooler ID: @ °C Therm. ID:
		Cooler ID: @ °C Therm. ID:
If >6°C, were samples collected <8 hours ago?	n/a	
If <0°C, were sample containers ice free?	n/a	
If samples received without a temperature blank, the "cooler temperature" will be documented in lieu of the temperature blank & "**COOLER TEMP**" will be noted to the right. In cases where neither a temp blank nor cooler temp can be obtained, note "ambient" or "chilled".		
Note: Identify containers received at non-compliant temperature . Use form FS-0029 if more space is needed.		
Holding Time / Documentation / Sample Condition Requirements		Note: Refer to form F-083 "Sample Guide" for specific holding times.
Were samples received within holding time?	yes	
Do samples **match COC**** (i.e.,sample IDs,dates/times collected)?	no	See Below
**Note: If times differ <1hr, record details & login per COC.		
Were analyses requested unambiguous? (i.e., method is specified for analyses with >1 option for analysis)	yes	
		n/a ***Exemption permitted for metals (e.g,200.8/6020A).
Were proper containers (type/mass/volume/preservative***)used?	yes	
Volatile / LL-Hg Requirements		
Were Trip Blanks (i.e., VOAs, LL-Hg) in cooler with samples?	yes	
Were all water VOA vials free of headspace (i.e., bubbles ≤ 6mm)?	n/a	
Were all soil VOAs field extracted with MeOH+BFB?	yes	

Note to Client: Any "No", answer above indicates non-compliance with standard procedures and may impact data quality.

Additional notes (if applicable):

Sample 2A-C were not fully labeled. Samples were matched using collection time and logged in per the COC while waiting on client and PM approval.

S

Sample Containers and Preservatives

Container Id	Preservative	Container Condition	Container Id	Preservative	Container Condition
1183454001-A	No Preservative Required	OK			
1183454001-B	No Preservative Required	OK			
1183454001-C	Methanol field pres. 4 C	OK			
1183454002-A	No Preservative Required	OK			
1183454002-B	No Preservative Required	OK			
1183454002-C	Methanol field pres. 4 C	OK			
1183454003-A	No Preservative Required	OK			
1183454003-B	No Preservative Required	OK			
1183454003-C	Methanol field pres. 4 C	OK			
1183454004-A	No Preservative Required	OK			
1183454004-B	No Preservative Required	OK			
1183454004-C	Methanol field pres. 4 C	OK			
1183454005-A	Methanol field pres. 4 C	OK			

Container Condition Glossary

Containers for bacteriological, low level mercury and VOA vials are not opened prior to analysis and will be assigned condition code OK unless evidence indicates than an inappropriate container was submitted.

OK - The container was received at an acceptable pH for the analysis requested.
BU - The container was received with headspace greater than 6mm.
DM - The container was received damaged.
FR - The container was received frozen and not usable for Bacteria or BOD analyses.
IC - The container provided for microbiology analysis was not a laboratory-supplied, pre-sterilized container and therefore was not suitable for analysis.
PA - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt and the container is now at the correct pH. See the Sample Receipt Form for details on the amount and lot # of the preservative added.
PH - The container was received outside of the acceptable pH for the analysis requested. Preservative was added upon receipt, but was insufficient to bring the container to the correct pH for the analysis requested. See the Sample Receipt Form for details on the amount and lot # of the preservative added.

Appendix E: ADEC Laboratory Data Checklist

Laboratory Data Review Checklist

Completed By:

Christopher D. Fell, CPG

Title:

Senior Geologist

Date:

7/24/2018

CS Report Name:

Port of Alaska Modernization Program Petroleum and Cement Terminal: Environmental Waterline Study

Report Date:

August 2018

Consultant Firm:

R&M Consultants, Inc.

Laboratory Name:

SGS North America, Inc.

Laboratory Report Number:

1183454

ADEC File Number:

2100.38.535

Hazard Identification Number:

25938

1183454

1. Laboratory

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

   (•) Yes ( ) No Comments:

   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:

   No network or sub-contract alternate laboratories were used.

2. Chain of Custody (CoC)

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

   (•) Yes ( ) No Comments:

   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:

   The temperature was measured at 4.4°C when the cooler was checked in.

   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:

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:

Sample COWI18-TH04-01 jar labels were not fully filled out, but collection times between labels and COC matched and the sample was able to be identified.

e. Data quality or usability affected?

Comments:

Data quality and usability were are not considered affected.

4. Case Narrative

a. Present and understandable?

(•) Yes ( ) No Comments:

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

(•) Yes ( ) No Comments:

MS/MSD, LCS, and surrogate recovery had QC failures and are discussed in the following sections.

c. Were all corrective actions documented?

(•) Yes ( ) No Comments:

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

Comments:

Data quality and usability were are not considered affected.

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:

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

( ) Yes (•) No Comments:

EDB LOQs exceed the cleanup level, but the DL is below the cleanup level for migration to groundwater. EDB was detected in project sample COWI18-TH01-01.

e. Data quality or usability affected?

(•) Yes ( ) No Comments:

Data quality and usability are considered minimally affected for EDB as the LOQ exceeds the cleanup level for migration to groundwater, but DL is below the cleanup level for migration to groundwater

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:

Not applicable

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

( ) Yes ( ) No Comments:

Not applicable

v. Data quality or usability affected?

Comments:

Data quality and usability were are not considered affected.

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:

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

( ) Yes ( ) No Comments:

Not applicable

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:

Cis 1,3-dichloropropene was recovered above QC criteria in the LCS, but the analyte was not detected in project samples. Trichlorofluoromethane was recovered above QC criteria in the MS/MSD, but was not detected in project samples.

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:

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

Comments:

None.

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

( ) Yes ( ) No Comments:

Not applicable

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

Comments:

Data quality and usability were are not considered affected.

c. Surrogates – Organics Only

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

(•) Yes ( ) No Comments:

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:

Surrogate recovery of 4-bromofluorobenzene was below QC criteria in the MS/MSD sample. The sample was analyzed twice to confirm results.

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

( ) Yes (•) No Comments:

iv. Data quality or usability affected?

Comments:

Data quality and usability were are not considered affected.

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:

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:

iii. All results less than LOQ?

(•) Yes ( ) No Comments:

iv. If above LOQ, what samples are affected?

Comments:

Not applicable.

v. Data quality or usability affected?

Comments:

Data quality and usability were are not considered affected.

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:

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

RPD (%) = 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:

Only RRO was detected in both the primary and duplicate with a RPD of 17%.

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

Comments:

Data quality and usability were are not considered affected.

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

( ) Yes ( ) No (•) Not Applicable

i. All results less than LOQ?

○ Yes ○ No Comments:

Not applicable

ii. If above LOQ, what samples are affected?

Comments:

Not applicable

iii. Data quality or usability affected?

Comments:

Not applicable

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

a. Defined and appropriate?

○ Yes ◉ No Comments:

Not applicable

Appendix F: Geophysical Report

Logic Geophysics & Analytics LLC
Final Report

For Ground-Penetrating-Radar Surveys at the Port of Anchorage, Anchorage, Alaska

Date: 27 June 2018
Subject: Ground-Penetrating-Radar Surveys at the Port of Anchorage, Anchorage, Alaska: Final Report
To: Mr. Robert Pintner, R&M Consultants, Inc.
From: Dr. Esther Babcock, Logic Geophysics & Analytics LLC
Appendices: A: Figures

Contents

1. Executive Summary

Logic Geophysics & Analytics LLC (Logic Geophysics) is pleased to submit this report to R&M Consultants, Inc (R&M). This report summarizes the results from a ground-penetrating-radar (GPR) survey at the Port of Anchorage, Anchorage, Alaska. The objective of the survey was to locate a buried ship hull at the Port (Figure 1). This report includes explanations of the geophysical methods, survey design, data processing and interpretation, quality control, and associated uncertainty. Results include figures (Appendix A) highlighting the data anomalies interpreted as the buried ship.

Data collection occurred on June 22, 2018. Logic Geophysics collected GPR data and associated quality-control (QC) data at the area of concern (AOC), measuring 150 feet by 150 feet in size. The GPR system ties Global Navigation Satellite System (GNSS) data directly to the incoming geophysical data for real-world positioning of the surveyed grid and detected anomalies. The coordinate system for output data was World Geodetic System 1984 (WGS84) in latitude and longitude using decimal degrees.

The entire project was completed safely and on budget. Initial data processing produced both cross-section, or profile, data and depth slices that provide visualization of coherent data anomalies in map view. The data clearly reveal the buried ship hull, as the approximate location, width, and heading of the interpreted anomaly match closely those parameters from the ship derived using Google Earth. Logic Geophysics is providing a KMZ polygon outlining the interpreted hull location together with this report. We caution that Google Earth's projection is sometimes not accurate, but the coordinates themselves are derived from RTK-data quality and therefore reliable.

2. Objectives

The geophysical survey objectives for this project were as follows:

1) Collect GPR data over 1 identified AOC approximately 150 feet by 150 feet in size;
2) Identify location and extent of data anomalies indicative of a buried ship hull; and
3) Provide data processing and interpretation resulting in the location of the interpreted ship hull, communicated in a letter report (this document).

3. Methods

3.1 Overview of the method

A GPR transmitter emits electromagnetic (EM) energy (the "signal") into the subsurface at a specified central frequency. If conductivity is low, this signal travels as a wave. Where subsurface lithology changes, often so do electrical properties. Those changes in electrical properties can cause part of the propagating signal to reflect back to the surface. A co-located GPR receiver on the surface measures the reflected signal, which the system digitizes and records for later processing and subsequent interpretation. The units of the reflected signal are milli-Volts (mV).

For the purposes of this investigations, the electrical properties of the buried ship hull are considerably different than the background soil properties. The compacted fill within the hull is also likely to have differing electrical properties than the surrounding materials. As a result, reflections of the traveling GPR signal from the hull and the fill within it would likely be high amplitude relative to other reflection events at the AOC. Thus, the buried hull should provide an amenable target for the GPR system, depending on other site conditions.

3.2 Project Site

The project was located at the Port of Anchorage, near a concrete mixing facility. A ship hull is visible on the survey in the Google Earth imagery as late as 2007 (Figure 1). The ship measures about 45 feet wide and is laying at a heading of approximately 030º to 032º (true north). By 2010, the hull was buried beneath fill (Figure 1). Before burial, the port workers removed the ship's decking.

The site surface was about half gravel and half asphalt. The surface was mostly dry, with the exception of a puddle about 12 feet by 14 feet in size in the southwestern grid quadrant. In accordance with best practice for GPR surveys, we did not survey through the puddle, causing a corresponding gap in the grid (Figure 2b). In the northern portion of the grid, the external opening of the storm drain caused a data gap about 16 feet by 16 feet in size (Figure 2b).

3.3 Equipment used

Logic Geophysics employed Sensors & Software's pulseEKKOPro GPR imaging system using 200-MHz antennas mounted on a wheeled cart with a GNSS receiver affixed above the midpoint of the instrument (Figure 3). The 200-MHz antennas can typically provide imaging down to about 14 feet below ground surface, depending on soil conditions. The data logger, or Digital Video Logger (DVL), recorded the received EM signals for later processing but also displayed them during data collection for real-time quality control of incoming data (Figure 4).

3.4 Survey Design

Table 1 provides GPR data parameters during collection. We planned the exact grid location on-site, in conjunction with an R&M representative, to provide the optimal survey coverage considering the suspected target location, the site conditions, and the topography. An on-site

Port representative, present before the GPR survey, had personally buried the ship. He was able to provide us with his estimated location of the hull from memory, and we modified the survey coverage based on that information.

A GPR setting that deserves special mention is the stacking, set to "DynaQ" (see also Figure 4). One way to improve signal-to-noise ratio for common-offset reflection GPR data is to collect more than 1 trace at each measurement position, average them, and record the average trace. This method is commonly called "stacking." Stacking improves data quality because noise tends to deconstructively interfere, and thus go to zero, as stacks increase. On the other hand, signal, such as reflection events, tends to constructively add together. In the Sensors & Software instrument, "DynaQ" is an advanced patented technology that adjusts the data stacking real-time depending on system speed, essentially resulting in enhanced automatic stacking of the data. System testing shows that DyanQ dramatically improves data quality over conventional stacking.

Table 1: Data collection parameters

Parameter	Setting
Survey size	150 feet by 150 feet
Survey type	Reflection (common offset)
Antenna polarization	Broadside
Antenna orientation	Perpendicular
Central frequency	200 MHz
Acquisition setting	Odometer
Line spacing	2 feet
Along-line measurement (trace) spacing	0.15 feet
Time window	120 ns
First break offset	10%
Sampling interval	400 picoseconds
Antenna separation	1.5 feet
Stacking	DynaQ
Pulser voltage	1000 Volts

3.5 Location and Positioning

As mentioned, the DVL tied incoming GNSS NMEA-data strings from a Leica GS16 controller directly to the GPR data for real-world positioning of collected data. The Leica GS16 streamed GGA standard data packages to the GPR system at 1 Hz. All positioning for the geophysical data used GNSS real-time kinematic (RTK) surveying techniques for optimal positioning accuracy. The GS16 tied to the Anchorage airport base station to provide RTK data quality. The GNSS coordinate system is WGS84, latitude and longitude, in decimal degrees.

4. Data Quality Assurance and Quality Control (QA/QC)

4.1 Tests conducted

GPR data QA/QC checks included the following items:

1) Static data collection before daily acquisition, to verify data collection parameters and qualitatively assess data quality;
2) Dynamic system tests before and after data acquisition, to verify system response;
3) Real-time monitoring of GNSS data quality during QA/QC tests and subsequent acquisition (see Figure 4b);
4) Real-time monitoring of GPR data quality via the system's visualization of the DynaQ stacking Quality Factor (QF) (Figure 4 a and b); and

5) Post-collection assessment of frequency content and system noise.

The GPR static and dynamic testing allows the operator to qualitatively assess proper data collection, to monitor the GNSS data quality, and to examine the system for the presence of any interference and/or noise. We conducted the static tests after a 5-minute system warm-up. For the static test, the system acquisition mode was "free-run" rather than odometer mode. In free-run mode, the system records a data trace every 0.1 seconds, or as desired. Since DynaQ stacking cannot be used during free-run acquisition, the stacking setting was 4 stacks, rather than DynaQ, during QC tests (Table 1). For the dynamic tests, we pushed the GPR in transects close to or within the grid location to verify system response including responses from the known storm drain location (Figure 2a).

4.2 Real-time QA/QC

Before each line's collection begins, the DVL displayed the system settings to ensure no unintended changes have occurred that would negatively affect data quality. The DVL simultaneously displayed the starting GNSS data quality information to ensure positioning accuracy reliability (RTK scale, Figure 4).

Real-time GPR QA/QC is provided by visual monitoring of the incoming GPR and GNSS data in the DVL (Figure 4). The DVL processed the incoming data for visualization purposes, but to maintain data integrity stored only the raw data. With the real-time visualization of processed data, Logic's experienced GPR operator could readily detect problems with signal content or interference from external noise sources, such as VHF radios.

During data collection, the DVL displayed the real-time GNSS quality, ranging from RTK-Fixed to RTK to DGPS to GPS in descending order of accuracy (Figure 4). During data collection, the system also displayed the DynaQ QF color scale, from blue to green to yellow to red (Figure 4). Blue and green indicate higher data quality, while red and yellow indicate unacceptable data quality. Thus, the operator could immediately recollect any GPR line where the QF fell to the yellow level or below during acquisition.

4.3 Results

No unacceptable data quality results occurred during the real-time QA/QC of the incoming GPR and GNSS data. Throughout the GPR acquisition, we qualitatively assessed the data quality to be excellent relative to other data sets we have collected in urban environments. The DynaQ QF throughout our surveys was blue or green, indicating the highest data quality on the DynaQ scale (Figure 4). Concerning the GNSS quality, the incoming positioning data was RTK-Fixed quality throughout 98% of data collection.

The frequency distribution of the 200-MHz QA/QC data peaked at less than 200-MHz (Figure 5). The lowering of central frequency is expected when the antennas are coupled to a typical moist soil and indicates proper system functioning. High-frequency cultural noise can cause the relatively high-amplitude long "tail" to the average frequency spectrum plot (Figure 5). Overall, the high-frequency noise did not inhibit data interpretation.

5. Data Analysis

5.1 Initial Processing

After data collection, we downloaded the data from the DVL onto the processing computer. We used Sensors & Software EKKOProjects software for data processing and visualization. Figure

6 shows an example of profile data before and after processing. The data processing workflow followed the steps below:

1) Delete bad traces: We deleted traces with zero information content, excessive noise, or bad GNSS data. Besides deleting bad traces, we did not apply any corrections for positioning offsets, due to the high quality of the GNSS data as discussed previously.
2) Dewow: Dewow is a zero-phase filter generating the difference between the trace value and the average trace value over a defined window width. Dewow removes unwanted "wow" from the GPR trace while preserving high-frequency signal. Wow is a slowly decaying, low-frequency signal that may be induced on the trace due to the proximity of transmitter and receiver and the electrical properties of the ground. GPR data require the dewow process before viewing or carrying out further processing.
3) Repicking the "first break": Repicking the first break is a static shift to determine the time where the signal crosses the defined threshold for each trace, that is, the true "zero time." The algorithm shifted all traces equally in time to align the median value of the first break times with zero time. The algorithm threshold was 5 mV.
4) Background subtraction: This process is a 2-dimensional spatial filter. The filter calculated the average trace and subtracted the average trace from every data trace. This filter removed the direct arrival between the 2 antennas, the uppermost band of data, that can blank out very near-surface reflectors. It also removed other static noise in the data, likely caused by the proximity of the GNSS antenna.
5) Velocity analysis: Determining the correct radar wave velocity is essential for accurate determination of object depth and for migration processing (Step 6, below). We used a hyperbolic velocity calibration to fit a superimposed hyperbola to diffraction patterns in the data, such as those generated from the storm drain. The software then estimated the radar wave velocity from the parameters of the hyperbola. We repeated this process 20 times using different lines in the data set, then computed the average velocity to be 0.44 ± 0.07 feet per nanosecond.
6) F-K migration: The F-K migration applied a synthetic aperture image reconstruction process to each GPR line. The algorithm computes the Fourier transform of the GPR data into plane waves at a monochromatic frequency. This process superimposes reflection energy to the correct source point and moves dipping reflectors to their true subsurface position. For optimal results, migration requires the input velocity to be as accurate as possible. We used the velocity calculated in Step 5.
7) Gain: Since radar signal strength decreases with time due to unavoidable attenuation processes, applying a gain function boosted the later time signals for optimal visualization and interpretation. We used spreading and exponential compensation (SEC) gain, a composite of linear time gain and exponential signal recovery, to optimize late-time reflection events. This gain attempts to compensate both for spherical spreading losses and for the exponential ohmic dissipation of EM energy. SEC gain is the gain closest to physical reality and most commonly used for GPR data.

We derived depth estimates of targets using the "first-break," that is, the first deviation from zero position of the target reflection wavelet. Although many practitioners use the middle of the wavelet rather than the first break, research has shown that the first break provides the correct depth estimate while the middle pick does not.

5.2 Map Plotting

Typically, practitioners display GPR data in profiles, where the x-axis is position (in odometer mode) or trace number (in free-run mode) along the profile and the y-axis is depth or time. The plots are typically greyscale, but research has shown that color profile plots are more conducive

to interpretation. Therefore, we use a typical seismic color plot rather than greyscale, with the amplitude colors ranging from blue (negative) to white (zero) to red (positive). In processed profiles, the colors represent normalized amplitudes, which are unitless. The profile figures in this report do not include color bars, as is standard for GPR profile plots (Figure 6).

After processing, EKKOProjects gridded the individual profile data together to visualize in depth slices from a map view, rather than just a profile view. Processing the data as a series of depth slices enhances interpretation of GPR data, providing visualization of coherent anomalies associated with the targets such as the ship hull. The depth slices provide an image of the average normalized (no negative values) GPR amplitude values in the specified thickness, or depth range. Since the amplitudes are normalized, they are unitless. The relative color scale for the normalized amplitudes starts at blue for zero amplitudes, or background, and goes to red (hot) for potential targets (for example Figure 7).

Finally, we exported the depth slice or slices of interest and the line paths KMZ format to provide georeferenced map view of data collection and interpreted anomalies.

6. Results

6.1 Interpreted target location, dimensions, and depth

Interpretation of the ship hull location reveals an object approximately 46 feet wide lying at a heading of approximately 035º (true), which matches closely with the ship parameters interpreted from Google Earth imagery (Section 3.2). The interpreted hull location appears to change almost 2 feet in depth across the beam, making visualizing the entire breadth impossible in a single depth slice. This apparent change in depth may be real (that is, the ship is leaning), or it may be due to small changes in surface elevation. Another explanation is that the soil velocity has lateral heterogeneity for which our simple velocity estimate cannot compensate. Therefore Figure 7 shows the interpreted extent of the buried hull overlain on 4 different depth slices which each partially visualize the interpreted data anomaly. As mentioned in the executive summary, Logic Geophysics is providing the KMZ polygon outlining the interpreted hull location with this report.

6.2 Interpreted void spaces

A secondary objective of this project was to identify void spaces within the filled hull if possible. The target depth required use of the 200-MHz antennas, which limits the size of voids that the system can detect. Within the hull between 8 feet and 14 feet, the maximum effective depth of investigation, void sizes on the order of approximately 3 to 5 feet may generate interpretable data anomalies. Voids bigger than 5 feet should produce a visible response, while those less than 3 feet will not.

Voids may be present below the top of the hull in the locations show in Table 2. See Figure 6 for an example visualization of a possible void or collapse feature.

Table 2: Potential void locations identified from GPR data

Anomaly #	Latitude (DD.ddd)	Longitude(DD.ddd)
1	61.2333069 N	149.8927915 W
2	61.2332092 N	149.8929508 W
3	61.2330818 N	149.8929668 W
4	61.2332174 N	149.8927224 W

6.3 Sources of Error and Uncertainty Analysis

Several potential sources of error exist for these data and this analysis. Here we list 3 relevant sources of errors and methods for mitigating each.

1) *Velocity and depth errors*: For the GPR data, incorrect velocity can limit the efficacy of the migration and gridding algorithms. Furthermore, since all GPR data are measured in time, the time-to-depth conversions will be only as accurate as the velocity estimate. Factors affecting the reliability of the velocity and/or depth estimate include the following:
    1) Object size;
    2) Heading crossing angle of the GPR travel path over the object; and
    3) Surface relief.

    Mitigation: Logic Geophysics used diffraction patterns in the collected data for velocity hyperbola calculations. We used 20 diffraction features to generate a mean velocity and compensated the mean velocity for heading crossing angle. The heading crossing angle was most notably a factor for the velocity estimates using the storm drain (Figure 6). The heading crossing angle of the storm drain was easily calculated from the map view of the data result (Figure 6). After completion of the analysis, we applied the resulting velocity to the data for migration and time-to-depth conversion.

    We did not attempt to compensate for vertical relief, or surface topography, for these data as the surface within the grid area was relatively level, within an estimated <1 foot of variation.

    Uncertainty: The coefficient of variation (standard deviation divided by mean), for the GPR velocity estimates was approximately 17%. For the depth of the ship hull, this velocity uncertainty correlated to about 1 foot of uncertainty in depth.

    The estimated GPR velocity was about 50% higher than that typically seen at similar sites with a moist soil as the overburden. This high velocity may be a result of the fill material at the site, since it is not native soil. On the other hand, it may be a mis-parameterization of the GPR velocity produced by an unknown error. To address this uncertainty, we also performed the depth conversion and migrations an additional 5 times, with radar-wave velocities ranging from 0.29 feet per nanosecond to 0.49 feet per nanosecond. Analysis of those results revealed that the visualization with the mean velocity (0.44 feet per nanosecond) did provide the most coherent visualization of the interpreted data anomaly. Thus, the data-derived velocity is likely to be a reliable estimate. Nonetheless, the velocity analysis and its result remain the largest source of uncertainty in the data processing and interpretation.
2) *Size and position errors*: Errors in estimates of object size and object position are often linked. These errors can originate from several sources including the following:
    1) Horizontal resolution limitations;
    2) Spatial sampling density; and
    3) Positioning errors of the geophysical data within the grid.

    Mitigation: We attempted to minimize positioning, or travel path errors, by traveling between marked points during GPR surveys. During survey set-up, we marked the outer grid lines with a measuring tape and paint. Then, during acquisition, the operator placed a cone on the end of the line to be traveled, and aimed directly at that cone while traveling down the line. To mitigate problems associated with spatial resolution, we set the sampling density to about twice that required for 200-MHz data (Table 1).

    Uncertainty: Horizontal resolution limitations are an unavoidable consequence of the physics behind GPR. We can calculate the horizontal resolution to estimate uncertainty in target size estimates via the following equation:

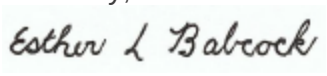
$$h_r = \sqrt{\frac{\lambda^2}{16} + \frac{\lambda z}{2}}$$

Calculation using our site conditions and antennas reveals that the horizontal resolution at the estimated depth of the hull is about 3 feet. This result implies a minimum uncertainty of ±3 feet in both object dimensions and object position.

7. Conclusions

Logic Geophysics conducted geophysical surveys at the Port of Anchorage, Anchorage, Alaska, successfully locating the buried ship hull after data processing and interpretation. Logic Geophysics & Analytics LLC is pleased to provide this report to R&M Consultants, Inc., to aid in your overall project objectives. Please contact me if you have any questions.

Sincerely,



Esther Babcock, Ph.D.
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Logic Geophysics & Analytics LLC
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Service Disabled Veteran Owned – Certified Alaska DOT DBE – Woman Owned Small Business

Appendix A

2007

2012

N

350 Feet

Ground-Penetrating Radar Survey for Locating a Buried Ship		
Location: Port of Anchorage, Anchorage, Alaska		**Client**: R&M
Site Overview from Google Earth Imagery		

LogicGeo

Fig.
1

a) QC line locations

b) Grid line layout

*Line locations shown in white

Ground-Penetrating Radar Survey for Locating a Buried Ship		
Location: Port of Anchorage, Anchorage, Alaska		**Client**: R&M
Line Locations for Quality Control Data and Grid Data*		

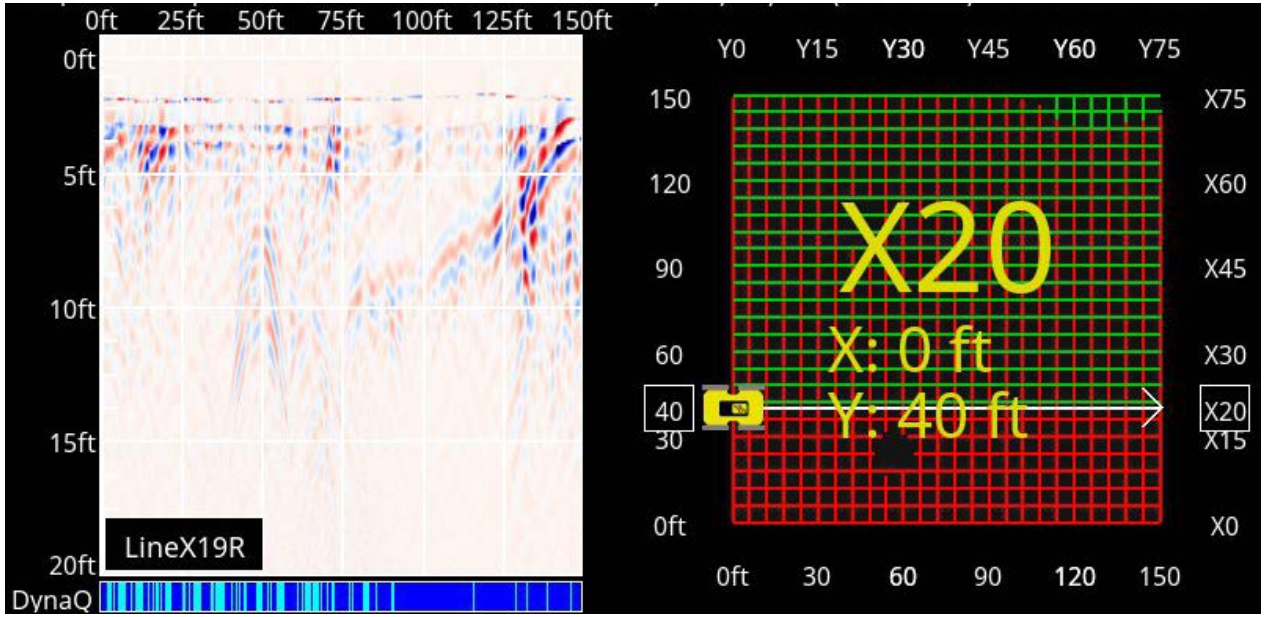
LogicGeo

Fig.
2

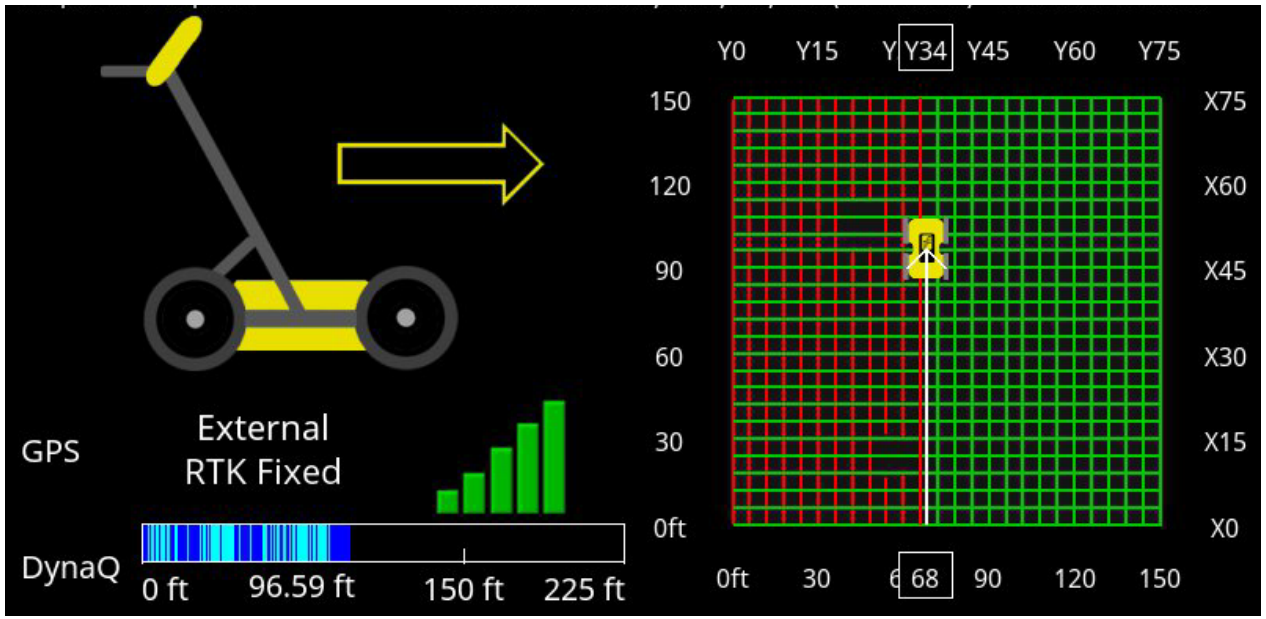
Ground-Penetrating Radar Survey for Locating a Buried Ship		
Location: Port of Anchorage, Anchorage, Alaska		**Client**: R&M
GPR Equipment On-Site		

LogicGeo

Fig. 3



a) The data logger display starting data collection; the left half shows the previous collected data in profile view, enable real-time quality control during acquisition; note the DynaQ color scale below the profile as described in the text. The right half shows the grid, collected lines, and current line position



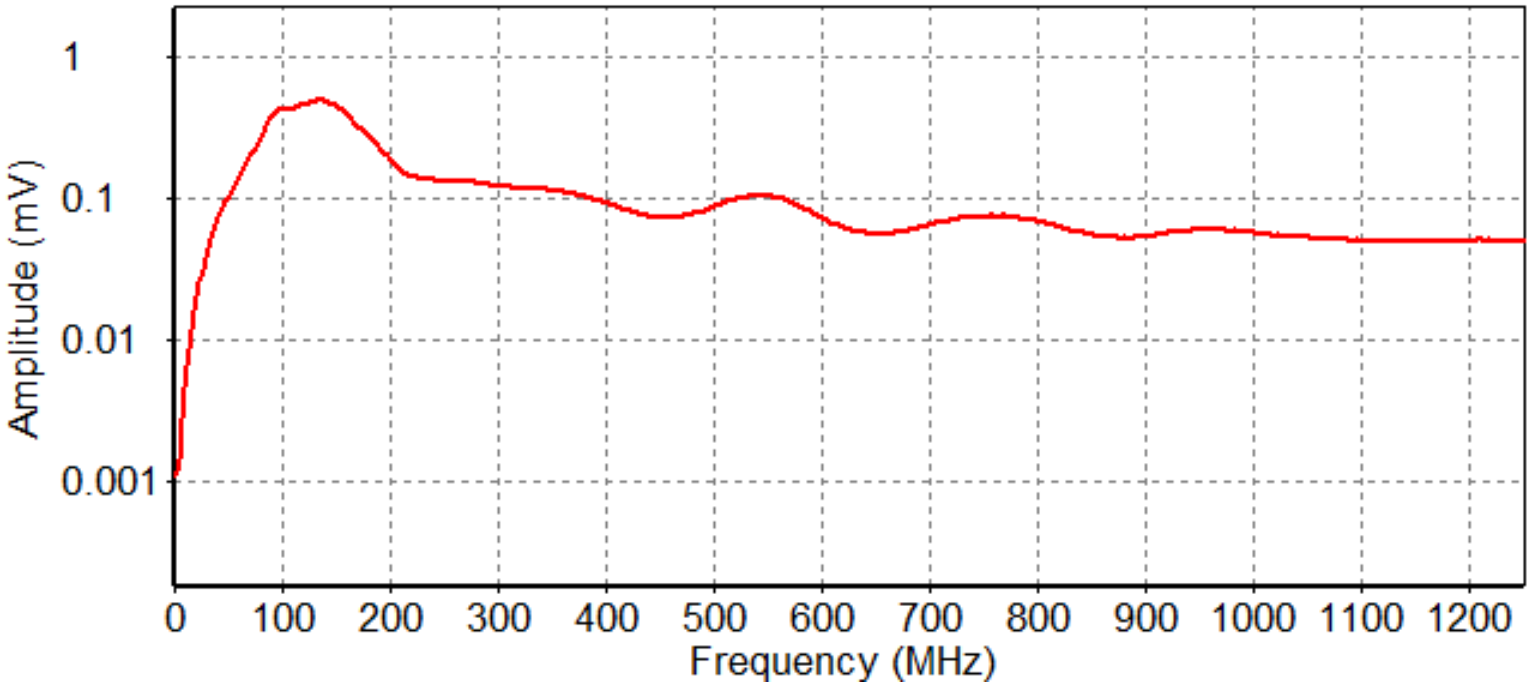
b) The data logger display during data collection; note the GPS and DynaQ data quality indicators on the left panel, lower side. The GNSS data quality is indicated both by the notation ("RTK Fixed") and the green bars (number of received satellites).

*Red lines are collected data; green lines have yet to be collected.

Ground-Penetrating Radar Survey for Locating a Buried Ship	
Location: Port of Anchorage, Anchorage, Alaska	**Client**: R&M
Data Logger Displays During Data Acquisition	

LogicGeo

Fig. 4

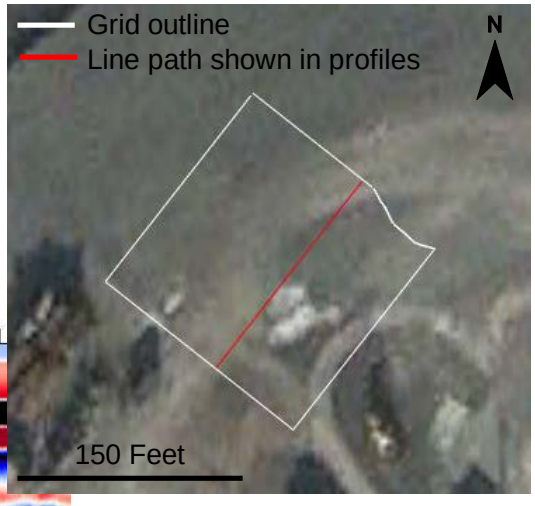


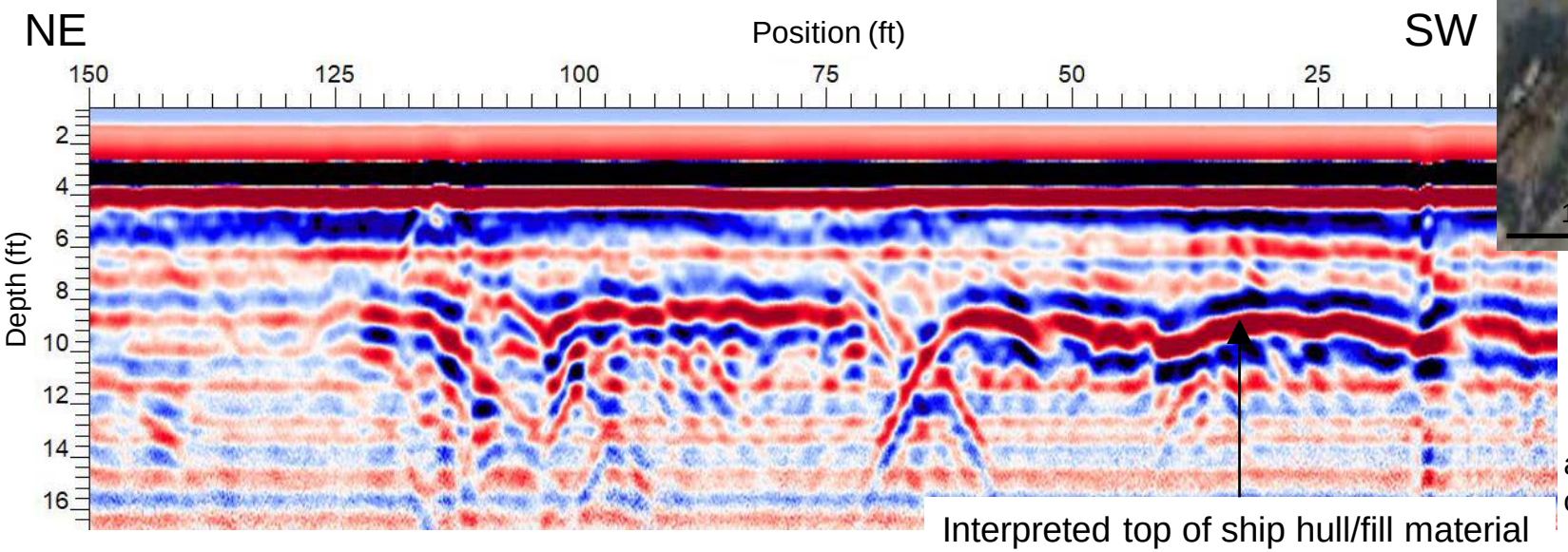
Ground-Penetrating Radar Survey for Locating a Buried Ship		
Location: Port of Anchorage, Anchorage, Alaska		**Client**: R&M
Average Frequency Spectrum Plot		

LogicGeo

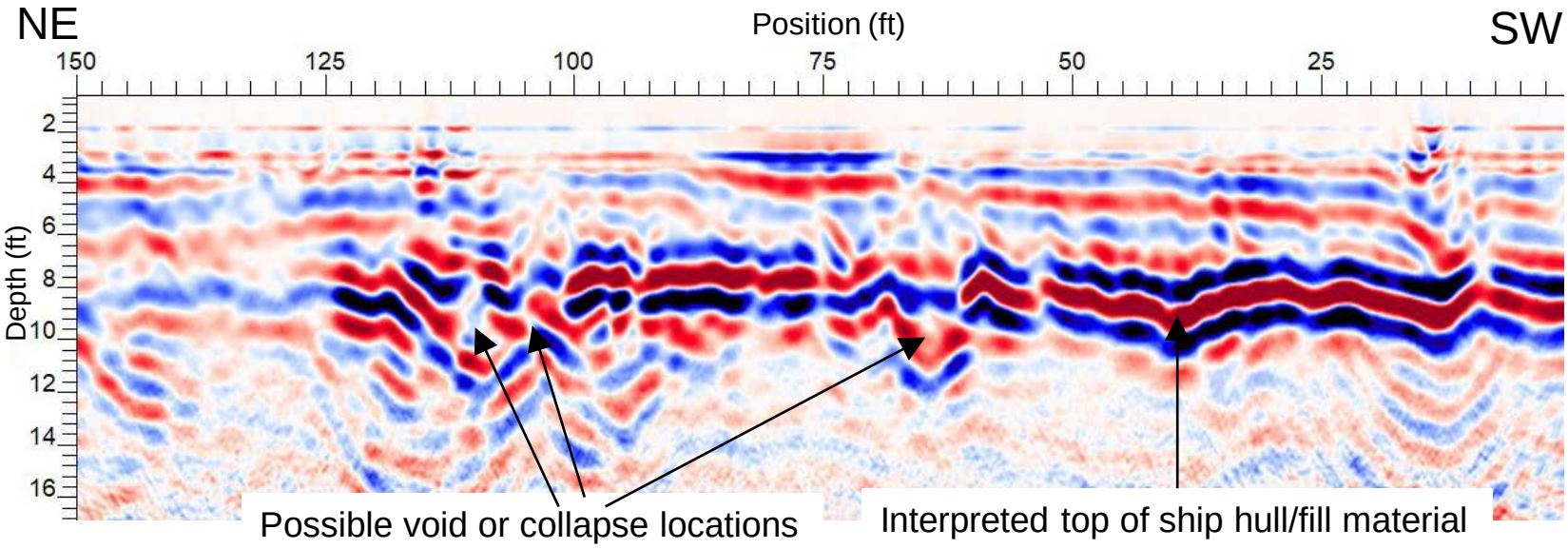
Fig.
5

*Note that all profile distances were measured from south to north





a) Data after dewow but before other processing

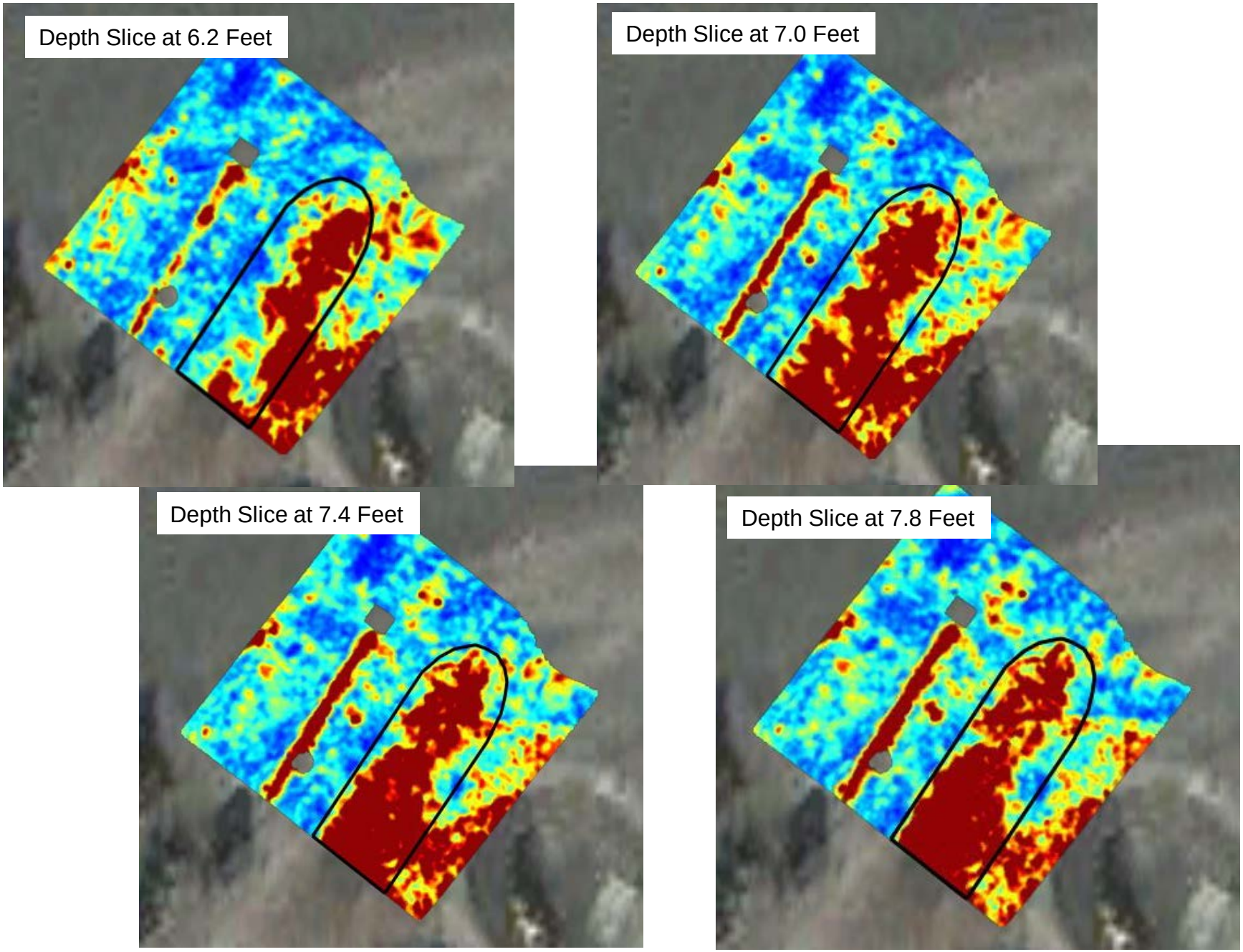


b) Profile data after processing

Ground-Penetrating Radar Survey for Locating a Buried Ship		
Location: Port of Anchorage, Anchorage, Alaska		**Client**: R&M
Example of Profile Data		

LogicGeo

Fig.
6



— Extent of data anomaly interpreted to be the buried hull. Note that the entire anomaly is not visible on this single depth slice; see text for explanation and next figure for additional visualization.

Ground-Penetrating Radar Survey for Locating a Buried Ship		
Location: Port of Anchorage, Anchorage, Alaska		**Client**: R&M
Interpreted Location of Buried Hull		

LogicGeo

Fig. 7