UNITED STATES AIR FORCE
JOINT BASE ELMENDORF-RICHARDSON
ALASKA

ENVIRONMENTAL RESTORATION PROGRAM

TREATABILITY STUDY IMPLEMENTATION REPORT
CG039 – POLELINE ROAD DISPOSAL AREA

FINAL

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TREATABILITY STUDY IMPLEMENTATION REPORT
CG039 – POLELINE ROAD DISPOSAL AREA

JOINT BASE ELMENDORF-RICHARDSON, ALASKA

Prepared for
Air Force Civil Engineer Center

Contract No. FA8903-09-D-8589 / Task Order 0016

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EXECUTIVE SUMMARY

The Air Force Civil Engineer Center (AFCEC) has implemented a treatability study at CG039 - Poleline Road Disposal Area pursuant to the process established in the Fort Richardson Federal Facility Agreement (1994) and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). The purpose of the treatability study was to assess the effectiveness of enhanced reductive dechlorination (ERD) and biogeochemical reductive dechlorination (BiRD), which AFCEC considers to be an innovative treatment technology, for treating contaminated groundwater at the site as part of a pilot scale study.

This study will evaluate whether the injection of emulsified vegetable oil (EVO), with and without ferrous sulfate, into a TCE-contaminated aquifer is able to enhance the natural degradation of trichloroethene (TCE) (known as ERD), speed up the cleanup process, and reduce overall life-cycle costs. Additionally, the treatability study tested how easily EVO can be injected into the ground and how far it traveled.

This work was conducted by CH2M HILL under subcontract to Weston Solutions, Inc. (WESTON) within the scope of the Joint Base Elmendorf-Richardson (JBER) Performance-Based Remediation (PBR) project authorized by AFCEC Contract Number FA8903-09-D-8589, Task Order 0016. Work was performed in accordance with the *Uniform Federal Policy – Quality Assurance Project Plan CG039 – Poleline Road Disposal Area Treatability Study Work Plan, Joint Base Elmendorf-Richardson, Alaska* (Work Plan).

CG039 is located in the eastern portion of JBER, near the Eagle River valley. Groundwater and soil contamination at the site resulted from the historical activities associated with four chemical disposal areas that were used from 1950 to 1972. During this time, chemical agent identification sets (CAISs) and other military debris were burned and disposed of in trenches. Chlorinated solvents, such as TCE, were used to neutralize the chemical agents in the CAIS. As a result of these historical activities, volatile organic compounds (VOCs), primarily TCE, have contaminated the groundwater at CG039.

This treatability study report provides an overview of the implementation activities and initial results for the site. This document includes injection well installation details, baseline soil and groundwater sampling results, and EVO injection data.

Well Installation and Development

Three areas of high TCE concentrations in groundwater (labeled target treatment zones) were identified at CG039. Two of the target treatment zones are located in the shallow aquifer near performance monitoring wells AP-3983R and AP-4550 (the wells used to evaluate the effectiveness of the injections). Performance monitoring well AP-3983R was installed as a replacement for well AP-3983, which had previously been destroyed. The third target treatment zone is located in the deep perched aquifer near performance monitoring well AP-4551. At each target treatment zone, two injection wells were installed upgradient of the designated performance monitoring well for a total of six injection wells. Additionally, at each of the shallow target treatment zones, a monitoring well to measure the distribution of EVO (known as

a radius of influence [ROI] well) was installed. All wells were installed and developed in accordance with the Work Plan. The horizontal location, ground surface elevation, and top of well casing elevation were surveyed for each of these wells.

Soil Sampling and Analysis

Eight soil samples were collected from soils within the target treatment zones during well installation. Samples were tested for grain size distribution, natural oxidant demand (NOD), and fraction of organic carbon (f_{oc}). Grain size distribution testing was conducted to better understand the subsurface hydrogeology and how that might affect the ability to inject EVO into the ground. NOD results were used to determine whether in situ chemical oxidation (ISCO) could be used as a treatment option at one of the target treatment zones instead of ERD.

The grain size testing indicates that the soil is composed primarily of silty sand with gravel to poorly-graded gravel with silt and sand.

The NOD results indicate that ISCO would be inefficient and expensive to implement; therefore, ISCO was not selected as a treatment option for this treatability study.

Baseline Groundwater Sampling and Analysis

Prior to performing the injections, baseline groundwater samples were collected and analyzed from each performance monitoring well and injection well within the three target treatment zones. All groundwater samples were analyzed for VOCs, which includes TCE. Additionally, groundwater from the three performance monitoring wells was analyzed for other chemical indicators, which can help assess the effectiveness of the treatment, including total organic carbon (TOC), dissolved mercury, dissolved iron, dissolved manganese, dissolved gases, sulfide, nitrate+nitrite, alkalinity, chloride, sulfate, and volatile fatty acids.

These baseline groundwater sample results indicate a slight variability in TCE concentrations within a given target treatment zone; however, TCE concentrations are generally similar to each other and to historical TCE concentrations. TCE concentrations within the AP-3983 target treatment zone and AP-4550 target treatment zone in the shallow aquifer showed more variability than TCE concentrations within the AP-4551 target treatment zone in the deep perched aquifer. The similarity of TCE concentrations throughout each target treatment zone suggests that the effects of EVO and EVO/ferrous sulfate injections should be relatively uniform within each target treatment zone.

EVO Injection

An EVO or EVO/ferrous sulfate solution (a mixture of EVO with or without ferrous sulfate and clean water) was injected into injection wells within a target treatment zone, as summarized below:

- **AP-3983 Target Treatment Zone:** A total of 10,788 gallons of EVO/ferrous sulfate solution (610 gallons of EVO and 1,300 pounds of ferrous sulfate mixed with 10,178 gallons of clean water) was injected into injection wells IW01-3983 and IW02-3983. Following the EVO

injections, an additional 250 gallons of clean water was injected to flush the EVO solution from each injection well.

- **AP-4550 Target Treatment Zone:** A total of 13,500 gallons of EVO solution (725 gallons of EVO mixed with 12,775 gallons of clean water) was injected into IW01-4550 and IW02-4550. Following the EVO injections, an additional 250 gallons of clean water was injected to flush the EVO solution from each injection well.

- **AP-4551 Target Treatment Zone:** A total of 2,730 gallons of EVO/ferrous sulfate solution (155 gallons of EVO and 320 pounds of ferrous sulfate mixed with 2,575 gallons of clean water) was injected into IW01-4551 and IW02-4551. Following the EVO injections, an additional 100 and 230 gallons of clean water was injected to flush the EVO solution from IW01-4551 and IW02-4551, respectively.

The silty sands and gravels within the shallow aquifer at CG039 easily accepted the injection of EVO. The injection rate within the shallow aquifer treatment zones ranged from approximately 20 to 35 gallons per minute (gpm) (the upper limit of the injection system capability). The lithology of the deep perched aquifer at CG039 consists of partially interconnected silty sand and gravel lenses within a basal till, overlying weathered bedrock. Soil variability within the deep perched aquifer was the cause for considerable variance in the injection rate (from 1 to 28 gpm) between the injection wells within the AP-4551 target treatment zone.

Before, during, and after the EVO injections, the wells within each target treatment zone were monitored to assess how far the EVO solution was traveling. Groundwater within the wells was monitored both visually (EVO is milky white) and with a water-level indicator and water quality meter. In the shallow aquifer, visual observations of EVO at monitoring wells confirmed that EVO had travelled at least 90 and 130 feet (in the downgradient direction) during injection at the AP-4550 and AP-3983 target treatment zones, respectively; lateral distribution of EVO was at least 15 feet. In the deep aquifer, visual observations of EVO in monitoring wells (EVO was observed laterally hours before it was observed downgradient) suggests that preferential flow pathways partially control the distribution of groundwater flow within the deep perched aquifer. This is consistent with the interpretation that the deep perched aquifer is composed of partially interconnected sand and gravel lenses within a larger till/weathered bedrock body.

The ability of the shallow aquifer to easily accept the injection of EVO suggests that a possible future full-scale implementation of EVO injections could deploy a lateral injection well spacing greater than the 15-foot spacing used in the treatability study. Additionally, because of the downgradient distribution within the shallow aquifer (130 feet from the injection of approximately 11,000 gallons of EVO solution), it is possible that a line of injection wells could be set at the upgradient edge of the hot spot (the area of highest TCE concentrations), and if enough EVO solution were injected, it could be distributed to treat the entire hot spot. The variability within the deep perched aquifer indicates that any possible future full-scale implementation of EVO injections should deploy an injection well spacing of not more than 15 feet.

REMAINING TREATABILITY STUDY ACTIONS

Remaining treatability study activities include the following:

- Quarterly groundwater performance monitoring, the results of which will be used to assess the performance of the EVO injections over time
- Data review and evaluation
- Preparation of the Treatability Study Completion Report, which will discuss the results of the quarterly performance monitoring and provide recommendations for any further action

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LIST OF ABBREVIATIONS AND ACRONYMS

°C	degree(s) Celsius
µg/L	microgram(s) per liter
µm	micrometer(s)
µS/cm	microSiemen(s) per centimeter
ADEC	Alaska Department of Environmental Conservation
AFCEC	Air Force Civil Engineer Center
AFCEE	Air Force Center for Engineering and the Environment
amsl	above mean sea level
bgs	below ground surface
BiRD	biogeochemical reductive dechlorination
CAIS	chemical agent identification set
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
COC	contaminant of concern
CRREL	Cold Regions Research and Engineering Laboratory
CSM	conceptual site model
DCE	dichloroethene
DNAPL	dense nonaqueous phase liquid
DO	dissolved oxygen
DPW	United States Army Directorate of Public Works
DQE	data quality evaluation
DQO	data quality objective
EB	equipment blank
EPA	United States Environmental Protection Agency
ERD	enhanced reductive dechlorination
ESF	Environmental Staging Facility
EVO	emulsified vegetable oil
FD	field duplicate
f_{oc}	fraction of organic carbon
ft/ft	feet per foot
g/kg	gram(s) per kilogram
gal	gallon(s)
gpm	gallon(s) per minute
HVE	high vacuum extraction
IDW	investigative-derived waste
ISCO	in situ chemical oxidation

JBER	Joint Base Elmendorf-Richardson
JBER-R	JBER-Richardson
LTM	long-term monitoring
MCL	maximum contaminant level
mg/kg	milligram(s) per kilogram
mg/L	milligram(s) per liter
MS	matrix spike
MSD	matrix spike duplicate
mS/cm	milliSiemen(s) per centimeter
mV	millivolt(s)
N	primary sample
NA	not analyzed
NAPL	nonaqueous phase liquid
NAVD	North American Vertical Datum
NC	not calculated
NM	not measured
NOD	natural oxidant demand
NTU	nephelometric turbidity units
ORP	oxidation reduction potential
OU	operable unit
PBR	Performance-Based Remediation
PCA	tetrachloroethane
PCE	tetrachloroethene
POL	petroleum, oil, and lubricants
PPE	personal protective equipment
psi	pound(s) per square inch
PVC	polyvinyl chloride
QC	quality control
ROD	Record of Decision
ROI	radius of influence
SC	site closeout
SOP	Standard Operating Procedure
SPCC	Spill Prevention, Control, and Countermeasure
SPSH	six-phase soil heating
SVE	soil vapor extraction
TB	trip blank
TCE	trichloroethene
TOC	total organic carbon

UFP-QAPP	Uniform Federal Policy-Quality Assurance Project Plan
USACE	United States Army Corps of Engineers
USAF	United States Air Force
UTM	Universal Trans Mercator
VOC	volatile organic compound
WESTON	Weston Solutions, Inc.
WGS	World Geodetic System

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1.0 INTRODUCTION

The Air Force Civil Engineer Center (AFCEC) has implemented a treatability study at CG039 - Poleline Road Disposal Area pursuant to the process established in the Fort Richardson Federal Facility Agreement (1994) and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). The purpose of the treatability study was to assess the effectiveness of enhanced reductive dechlorination (ERD) and biogeochemical reductive dechlorination (BiRD), which AFCEC considers to be an innovative treatment technology, for treating contaminated groundwater at the site as part of a pilot scale study.

This treatability study provides the details and documentation of the field and construction activities associated with the ERD and BiRD substrate injections, which AFCEC considers to be an innovative treatment technology (EPA, 1991) at CG039 – Poleline Road Disposal Area, located at Joint Base Elmendorf-Richardson (JBER), Alaska (Figure 1-1). Details provided in this document include injection well installation, baseline soil and groundwater sampling results, and emulsified vegetable oil (EVO) and EVO/ferrous sulfate injections. A Treatability Study Completion Report will be prepared following four quarters of performance monitoring to document results and conclusions of the treatability study, and will provide recommendations for future actions.

This study will evaluate whether the injection of EVO, with and without ferrous sulfate, into a trichloroethene (TCE)-contaminated aquifer is able to enhance the natural degradation of TCE (known as enhanced reductive dechlorination [ERD]), speed up the cleanup process, and reduce overall life-cycle costs. Additionally, the treatability study will test how easily EVO can be injected into the ground and how far it will travel.

The CG039 Treatability Study effort is administered by AFCEC. This Treatability Study Implementation Report has been prepared by CH2M HILL in support of Weston Solutions, Inc.'s (WESTON's) prime contract FA8903-09-D-8589 with AFCEC (formerly the Air Force Center for Engineering and the Environment [AFCEE]), Task Order 0016.

The fieldwork was conducted from July 11 through September 16, 2013, in accordance with the Final *Uniform Federal Policy – Quality Assurance Project Plan CG039 – Poleline Road Disposal Area Treatability Study Work Plan Joint Base Elmendorf-Richardson, Alaska* (Work Plan) (United States Air Force [USAF], 2013a).

The following sections describe the project overview and general characteristics that apply to CG039. Treatability Study implementation details and baseline sampling results for CG039 are presented in Sections 3 and 4.

1.1 Project Objectives

The objectives of the treatability study are as follows:

- Assess the effectiveness of in situ treatment for reducing TCE concentrations in groundwater at the site through (1) ERD using EVO, (2) BiRD using EVO with ferrous sulfate solution addition, and/or (3) in situ chemical oxidation (ISCO) using sodium permanganate. The

effectiveness of the treatability study substrate injections will be evaluated by calculating reductions in the concentration of TCE in each performance well as compared to the pre-injection baseline TCE concentrations.

- Evaluate the ability to distribute injectates into the subsurface using permanent injection wells.
- Evaluate amendment/oxidant dosing requirements and lateral spacing of injection points (radius of influence) required for full-scale application at CG039.
- Assess the ability of the substrate to sustain anaerobic biodegradation (biotic) processes and promote conditions for abiotic reduction of TCE.
- Assess the potential need for substrate replenishment or other contingency measures.
- Assess the potential need for additional oxidant injections.

The approach for the treatability study was described in the Work Plan (USAF, 2013a). The Work Plan describes the injection protocols, data quality objectives (DQOs), sampling methodologies, and analytical program for assessing conditions at CG039 to facilitate decisions about substrate selection and success of the selected remedies implemented in the treatability study.

1.2 Organization of Report

This report presents the details and documentation of the field and construction activities associated with the ERD substrate injections for the Treatability Study at CG039 and is organized into the following sections:

- **Section 1.0: Introduction** – presents project objectives and the organization of this report.
- **Section 2.0: Conceptual Site Model** – presents a summary of the site history, geology, hydrogeology, and nature and extent of contamination.
- **Section 3.0: Field Activities** – summarizes the field activities associated with implementation of the treatability study.
- **Section 4.0: Results** – presents results of the soil sampling, baseline groundwater sampling and injection monitoring.
- **Section 5.0: Conclusions** – presents observations from the implementation of the treatability study.
- **Section 6.0: Remaining Treatability Study Actions** – summarizes the remaining actions associated with the treatability study.
- **Section 7.0: References** – lists reference material used in preparation of this report.

Figures and appendixes follow Section 7.0.

2.0 CONCEPTUAL SITE MODEL

2.1 Site Location and Description

CG039 is located approximately 3 miles northeast of the main cantonment area of JBER-Richardson (JBER-R), and lies approximately 10 miles northeast of Anchorage, Alaska, 1 mile south of Eagle River and 0.6 mile north of the Anchorage Regional Landfill (Figure 1-1). Poleline Road is a gravel road that provides access to CG039. Poleline Road travels northeast-southwest along a power line route and the Eklutna Water Line. CG039 is a low-lying, flat area bordered by an 80-foot hill to the west, by wetlands to the south and southwest, and by low, wooded hills on the remaining borders.

2.2 Site History

CG039 was used as a munitions and chemical disposal area from approximately 1950 to 1972. Four separate burial areas were identified at CG039 (Figure 2-1): Areas A-1 and A-2 are suspected to contain buried munitions, and Areas A-3 and A-4 were used to dispose of chemical warfare decontamination kits and chemical agent identification sets (CAISs). Beginning in 1990, site investigations were conducted resulting in Pre-Record of Decision (ROD) removal actions that were conducted in 1993 and 1994 when contaminated debris, soil, and CAIS were removed from Areas A-3 and A-4 (United States Army Directorate of Public Works [DPW], 1996). Soils were excavated to a maximum depth of 14 feet below ground surface (bgs), where groundwater was encountered. Areas A-1 and A-2 were not excavated because of the potential for buried munitions.

Additional geophysical investigations were conducted in 1994, 1995, and 2002, and buried metallic debris was detected in Areas A-1 and A-2; an area is approximately 1.5 acres in size (DPW, 2008). In June 2003, fencing and warning signs were installed around Areas A-1 and A-2.

An ROD was signed for the site in 1997 (United States Army et al., 1997). The selected remedy for groundwater at CG039 as documented in the ROD included the following:

- High vacuum extraction (HVE)/air stripping of soil and groundwater in the hot spot (area greater than 1,000 micrograms per liter [µg/L] of 1,1,2,2-tetrachloroethane [1,1,2,2-PCA] and/or free-phase solvents)
- Natural attenuation of groundwater outside of the hot spot
- Institutional controls
- Long-term monitoring (LTM) of groundwater

A dual-phased HVE treatability study was conducted between March and October 1998. Because the HVE system was not as effective at treating groundwater as anticipated, and consistent with contingencies identified in the ROD, six-phase soil heating (SPSH) system treatability studies were conducted in 1997 and 1999. The SPSH treatability studies incorporated soil heating and

HVE to facilitate removal of contaminants from soil and groundwater. The SPSH was discontinued in 1999 and decommissioned in 2002 (DPW, 2003).

Nonaqueous phase liquid (NAPL) was first detected in 1996. NAPL was also observed in AP-3746 during sampling in May 2003, following a strong 7.9-magnitude earthquake that occurred in November 2002. As a result of the NAPL detected in AP-3746, a soil vapor extraction (SVE) system consisting of five vapor extraction wells installed at the base of the hill near AP-3746 was operated between May 2005 and January 2006 (ENSR Corporation [ENSR], 2006).

2.3 Geology and Hydrogeology

CG039 is located within a lowland area with a complex geology resulting from periods of repeated glaciation. Glacial sediments and glacial tills make up the aquifer material beneath the site, which consists of a range of material from clay to boulders (Woodward-Clyde, 1998). The unconsolidated material at the site was reworked by prehistoric glacial-melt-water rivers, resulting in the complex distribution of laterally and vertically discontinuous layers and lenses observed at the site (United States Army Corps of Engineers [USACE] Cold Regions Research and Engineering Laboratory [CRREL], 2003). Bedrock was encountered at a depth of approximately 69 feet bgs in borings in the southern portions of the site and at approximately 187 feet bgs in borings north of the site.

Local groundwater flowing in and adjacent to the main disposal area has been the ongoing subject of study and is fairly well documented in both the shallow and deep groundwater aquifers (USACE CRREL, 2000; USACE CRREL, 2003; and USACE CRREL, 2011). The groundwater hydraulics at the site appear to be driven primarily by recharge from the wetlands area and secondarily from surface infiltration across the site. Water infiltrating from the wetlands area recharges both the shallow and deep saturated intervals because of variability of the semiconfining aquitard in the area of the wetlands. Although the unconsolidated material over the bedrock is considered quite heterogeneous, several hydrostratigraphic units have been identified. A conceptual site model (CSM) of the site, including a cross section, is shown on Figure 2-2.

2.3.1 Shallow Aquifer

The upper (shallow) aquifer is present from the ground surface to a depth of approximately 40 feet bgs. This interval consists primarily of silty sands and gravels with frequent, discontinuous silt and clay lenses. The silt and clay lenses act as barriers to vertical flow, creating zones of perched groundwater. The shallow interval is normally saturated from approximately 20 to 40 feet bgs.

2.3.2 Intermediate Aquitard

The intermediate interval is a relatively impermeable till aquitard consisting of poorly sorted and silt-rich sand and gravel (USACE CRREL, 2003). The material has been previously described as a basal till (Woodward-Clyde, 1998) and diamicton (USACE CRREL, 2003). The intermediate interval is lithologically similar to the shallow interval but considerably denser (Woodward-

Clyde, 1998). Although the intermediate interval serves as somewhat of a barrier, hydraulic gradients suggest that downward flow is occurring through the intermediate interval from the shallow saturated interval to the deep saturated interval. Perched water zones have been encountered during drilling through the intermediate zone.

2.3.3 Deep Perched Aquifer

The deep perched aquifer is located within the relatively impermeable till aquitard that locally perches groundwater extending from approximately 95 to 126 feet bgs. This till is referred to as an aquifer because it has enough water to sample in some places; however, the area is more characteristic of an aquitard (USACE CRREL, 2011). It is most closely associated with the previously described intermediate aquitard. The deep perched aquifer is located above a layer of laminated glacial silt (termed the "basal silt") or directly on the bedrock surface. The deep perched aquifer produces only small volumes of water and has little seasonal water-level variation, suggesting this aquifer is not directly hydraulically connected to the shallow or regional aquifers. Groundwater and contaminants seep slowly through the till until they reach the bedrock or basal silt layer where a thin layer of perched groundwater is present. It is not known whether there is a pathway between the deep perched aquifer and regional aquifer, although based on the lack of groundwater variation, it is presumed that the mechanism of this connection would be a slow diffusive process through the low-permeability till (USACE CRREL, 2011).

2.3.4 Regional Aquifer

The regional aquifer is the primary aquifer across the Anchorage Bowl where groundwater migrates from the base of the Chugach Mountains toward Knik Arm. At CG039, the regional aquifer underlies the shallow and deep perched aquifers at depths of approximately 140 to 190 feet bgs. The flow direction in the regional aquifer is northwest according to groundwater elevation data at Poleline Road. Groundwater elevations within this aquifer fluctuate annually, with the highest levels in the fall or early winter months. This aquifer contains the most groundwater of the three aquifers discussed here and likely has the greatest flow velocities. Although the groundwater velocity of the regional aquifer has not been measured at Poleline Road, groundwater velocities from regional aquifer wells nearby on the JBER-R Main Cantonment area average 1.6 to 2.5 feet per day, according to data collected from USACE CRREL groundwater flow systems installed in regional aquifer monitoring wells (USACE CRREL, 2000). Average bulk hydraulic conductivities at Poleline Road were estimated by Woodward-Clyde (1996) to range from 0.03 to 284 feet per day, and were estimated by USACE CRREL (2003) to range from 0.6 to 121.4 feet per day.

Based on contaminant distribution and available elevation data, it appears that regional groundwater flow has a more prominent influence on wells located further to the north of the main disposal area (USACE CRREL, 2003). The regional aquifer is the only potential pathway for contaminants to migrate away from the Poleline Road Disposal Area. Currently, none of the wells screened within the regional aquifer at CG039 (AP-3748, AP-4345, AP-4350, AP-5246, and AP-4344 [see Figure 2-4]) have contaminant concentrations in excess of maximum contaminant levels (MCLs).

2.3.5 Contaminant Migration

Within the shallow aquifer and deep perched aquifer groundwater, contaminants follow the local northeast hydraulic gradient. A hydrologic modeling study conducted by USACE CRREL (2011) proposed the following potential migration pathways for shallow contaminants to migrate to the deep regional aquifer:

- The "mixing zone," where the intermediate aquitard is absent
- Vertical migration beyond the extent of the intermediate aquitard
- By a diffusive process through the intermediate aquitard

The intermediate aquitard is absent above bedrock within the mixing zone, which is located upgradient of the source area and adjacent to the wetland (Figure 2-2). As a result, groundwater can migrate downward in the mixing zone. AP-4353 (Figures 2-2, 2-3, and 2-4), located within this zone, is screened below the shallow aquifer and has seasonal groundwater elevation trends similar to the shallow aquifer (USACE CRREL, 2011). Based on chemical and groundwater elevation data, groundwater migrates vertically from the shallow aquifer and mixes with deeper perched groundwater.

Another migration pathway, termed the "vertical migration pathway," would allow contaminated groundwater from the shallow aquifer to migrate downward where the intermediate aquitard pinches out. The location of where this occurs is not known; however, existing chemical and boring data suggest it occurs north-northeast of AP-3747/AP-4019 (Figures 2-2, 2-3, and 2-4) (USACE CRREL, 2011).

As mentioned above, if contamination is migrating through the intermediate aquitard to the deep perched aquifer, there could be a slow diffusive pathway that would result in the introduction of this contamination to the regional aquifer (USACE CRREL, 2011).

These potential migration pathways are supported by hydraulic gradient measurements that indicate relatively strong downward flow from the shallow aquifer to the deep perched aquifer. Horizontal groundwater gradients measured from 2001 through 2003 were in the range of 0.01 to 0.03 foot per foot (ft/ft) for the shallow aquifer and 0.06 to 0.2 ft/ft in the deep perched aquifer. Groundwater flow at this site is complicated by the occurrence of perched zones and significant vertical flow. Groundwater velocities at the site are difficult to estimate because of the wide range of material types. It is expected, however, that groundwater moves relatively slowly, at velocities in the range of 10^{-2} to 10^{-3} feet per day (USACE CRREL, 2003).

2.4 Nature and Extent of Contamination

VOCs in groundwater (primarily TCE, tetrachloroethene [PCE], 1,1,2,2-PCA, benzene, carbon tetrachloride, and cis- and trans-1,2-dichloroethene [DCE]) and soil (PCA and PCE) posing a potential risk to groundwater were identified as contaminants of concern (COCs) in the ROD for Operable Units (OUs) A and B (ROD) (United States Army et al., 1997).

2.4.1 Soil

An estimated 95 to 99 percent of the soil contamination has been removed by previous remedial actions from the source area, thereby reducing the source of groundwater contamination at the site (DPW, 2008). More than 3,600 cubic yards of contaminated debris and soil were excavated from Areas A-3 and A-4 (the primary source) as part of the pre-ROD removal action, and were subsequently treated and disposed of offsite. The ROD identified 1,1,2,2-PCA and PCE in subsurface soils at concentrations that contribute to groundwater contamination and cause exceedances of state and federal regulatory levels. An additional 7,000 cubic yards of soil and shallow aquifer material (to 35 feet bgs) were treated with in situ technologies (HVE/air stripping and SPSH) in the 1990s.

2.4.2 Groundwater

Current concentrations of TCE, PCE, and 1,1,2,2-PCA, as well as several daughter products within and downgradient of the hot spot, remain above cleanup goals based on federal MCLs for drinking water and United States Environmental Protection Agency (EPA) risk-based concentrations. Dense NAPL (DNAPL) TCE, PCE, or 1,1,2,2-PCA has not been observed since an earthquake in 2002 and is currently not inferred to be present at CG039. As a rule of thumb, if the dissolved concentration for a given constituent is above 1 percent of its solubility, the presence of DNAPL could be inferred. The solubility of TCE, PCE, and 1,1,2,2-PCA are 1,100 milligrams per liter (mg/L), 150 mg/L, and 2,900 mg/L, respectively. The highest concentrations of TCE (2.3 mg/L), PCE (0.041 mg/L), and 1,1,2,2-PCA (0.618 mg/L) are all less than 1 percent of the each compound's solubility (EPA, 1994). Evaluation of daughter products and natural attenuation geochemical parameters suggest that reductive dechlorination is occurring within the hot spot (USAF, 2011). However, dilution appears to be the primary mechanism for reducing VOC concentrations outside the hot spot.

Shallow Aquifer

Historical TCE concentrations in the shallow aquifer are presented on Figure 2-3. In 2012, TCE was detected at concentrations of 280 µg/L in a shallow aquifer well upgradient of the hot spot (AP-4353), at 1,400 µg/L in a shallow aquifer well inside the hot spot (AP-4550), and at 88 µg/L in a shallow aquifer well (AP-3747) downgradient of the hot spot (USAF, 2013c). Monitoring well AP-3983 has not been sampled since 2009 when a TCE concentration of 2,320 µg/L was measured.

In 2012, PCE was detected at concentrations of 4.1 to 27 µg/L in shallow aquifer wells inside the hot spot and at 0.87 µg/L in a shallow aquifer well downgradient of the hot spot. 1,1,2,2-PCA was detected at concentrations of 100 to 620 µg/L in shallow aquifer wells inside the hot spot and at 0.81 µg/L in a shallow aquifer well downgradient of the hot spot.

Deep Perched Aquifer

Historical TCE concentrations in the deep aquifer are presented in Figure 2-4. In 2012, TCE was detected at concentrations ranging from not detected to 0.19J µg/L in deep perched aquifer wells downgradient of the hot spot (compared to the cleanup goal of 5 µg/L). Deep perched aquifer hot spot wells were not sampled during the 2012 LTM sampling event (USAF, 2013c). In 2009, TCE

was detected at a concentration of 884 µg/L in a deep perched aquifer well upgradient of the hot spot (AP-4017), at 1,810 µg/L in a deep perched aquifer well inside the hot spot (AP-4551), and at 2,270 µg/L in a deep perched aquifer downgradient (AP-4525).

PCE and 1,1,2,2-PCA were not detected at wells AP-5683 (deep perched aquifer) and AP-3748 (regional aquifer) located downgradient of the deep perched aquifer hot spot during the 2012 LTM sampling event.

3.0 FIELD ACTIVITIES

Field activities associated with the implementation of the treatability study were performed in accordance with the Work Plan (USAF, 2013a). The following tasks have been completed and are discussed in the following sections:

- Pre-treatability study activities
- Mobilization
- Decontamination
- Well installation
- Well development
- Soil sampling and analysis
- Baseline groundwater sampling and analysis
- Surveying
- Injection of EVO substrate and/or ISCO solution
- Injection monitoring
- Demobilization
- Management of investigative-derived waste (IDW)

A photographic log and field notes of the treatability study field activities are provided in Appendix A.

3.1 Pre-Treatability Study Activities

The following pre-treatability study activities were completed prior to the implementation of the substrate injections at CG039:

- The Work Plan was approved by EPA on September 4, 2013, and by ADEC on August 22, 2013.

- An Underground Injection Control notification was submitted to EPA by AFCEC.

- Subcontractors, equipment, and supplies were procured.

- JBER Utility Clearance was obtained and fully processed prior to well installation.

- A Spill Prevention, Control, and Countermeasure (SPCC) Plan was completed for the EVO that was stored onsite. The SPCC Plan is presented in Appendix B.

3.2 Mobilization

CG039 is located near an active military range. Ingress and egress to the site were coordinated with the JBER Range Control on a daily basis. The following two mobilizations to the site were conducted as part of the Treatability Study:

- The drilling subcontractor and CH2M HILL personnel mobilized to CG039 on July 11, 2013, to begin well installation activities.

- CH2M HILL personnel mobilized to CG039 on September 9, 2013, to begin substrate injection activities.

3.3 Decontamination

A temporary decontamination pad was set up at CG039 for decontamination of drilling equipment. All downhole equipment was decontaminated via steam cleaning prior to beginning drilling at a new location.

All nondedicated or disposable groundwater and soil sampling equipment was decontaminated prior to and after use by washing equipment with a phosphate-free, laboratory-grade detergent, triple-rinsed with deionized water, and air dried.

3.4 Well Installation

A total of six injection wells, two radius of influence (ROI) wells, and one replacement performance monitoring well were installed in the three target treatment zones at CG039. All wells were constructed in accordance with EPA guidance (EPA, 2008) and in accordance with Alaska Department of Environmental Conservation (ADEC) requirements using an air rotary drilling technique (See Standard Operating Procedures (SOPs) 14 and 15 of the Basewide UFP-QAPP [USAF, 2013b]). Well installation was performed in July with verbal approval of EPA and ADEC, prior to formal approval of the Work Plan (USAF, 2013a). Details of well installation at each target treatment zone are presented in the following subsections. The locations of the injection wells, ROI wells, and replacement performance monitoring well are shown on Figures 3-1 and 3-2. Boring logs and well construction diagrams are presented in Appendix C.

3.4.1 AP-3983 Target Treatment Zone

The AP-3983 Target Treatment Zone is the downgradient target treatment zone within the shallow aquifer. During the Treatability Study planning phase, it was discovered that performance monitoring well AP-3983 had been destroyed; therefore, a replacement performance monitoring well AP-3983R was installed near the location of the former AP-3983. Two injection wells (IW01-3983 and IW02-3983) were installed approximately 15 feet upgradient of AP-3983R and approximately 15 feet apart in a row perpendicular to the direction of groundwater flow. One ROI monitoring well (ROI-3983) was installed at a distance halfway between the two injection wells. Well installation details are provided in Table 3-1.

3.4.2 AP-4550 Target Treatment Zone

The AP-4550 Target Treatment Zone is the upgradient target treatment zone within the shallow aquifer. Two injection wells (IW01-4550 and IW02-4550) were installed approximately 15 feet upgradient of the performance monitoring well AP-4550 and approximately 15 feet apart in a row perpendicular to the direction of groundwater flow. One ROI monitoring well (ROI-4550) was installed at a distance halfway between the two injection wells. Well installation details are provided in Table 3-1.

3.4.3 AP-4551 Target Treatment Zone

The AP-4551 Target Treatment Zone is the target treatment zone within the deep perched aquifer. Two injection wells (IW01-4551 and IW02-4551) were installed approximately 15 feet upgradient of the performance monitoring well AP-4551 and approximately 15 feet apart in a row perpendicular to the direction of groundwater flow. In accordance with the Work Plan (USAF, 2013a), no ROI well was installed in conjunction with the injection wells at AP-4551. Well installation details are provided in Table 3-1.

3.4.4 Casing and Screen

Injection and monitoring wells were constructed with new, unused, decontaminated Schedule 80 and 40 polyvinyl chloride (PVC) casing and screen, respectively (Table 3-1), with internal flush threaded joints that conform to the ASTM International, International Standard F-480-88A, or the National Sanitation Foundation Standard 14 (Plastic Pipe System). Glue or solvent-welded joints were not used in well construction.

Injection well screens were constructed using a continuous 0.065-inch slot, wire-wound design to provide maximum inlet area consistent with strength requirements. Screens were fabricated by circumferentially wrapping a triangularly shaped wire around a circular array of internal rods or perforated individual channels. The wire configuration produces inlet slots with sharp outer edges, widening inwardly to minimize clogging. For maximum collapse strength, each juncture between the horizontal wire and the vertical rods were made by sonic welding. The ROI and replacement monitoring well screens were constructed using a 0.010-inch mill slot screen. A threaded PVC cap or point was placed at the bottom of each screen.

3.4.5 Filter Pack and Bentonite Grout

The filter pack material for the injection wells consisted of inert, washed, well-rounded 8/12 silica sand and filter pack for the ROI, and monitoring wells consisted of inert, washed, well-rounded 20/40 silica sand. The filter pack was free of roots, trash, and other deleterious material. The filter pack was placed a minimum of 2 feet above each well screen. The filter pack was tagged continuously during installation to ensure proper placement.

Compressed, uncoated 3/8-inch bentonite chips were used as a seal between the filter pack and cement bentonite grout, with a minimum thickness of 5 feet. Bentonite chips were allowed to hydrate for a minimum of 1 hour prior to the installation of the grout. Above the bentonite chip seal, a cement bentonite grout was installed to within 3 feet of the ground surface. The cement bentonite grout was allowed to hydrate for a minimum of 4 hours prior to the installation of the surface completion.

3.4.6 Surface Completion

Injection, ROI, and monitoring wells were set as aboveground completions. The casings extend approximately 3 feet above ground surface. The PVC well casings are protected with 6-inch-diameter steel aboveground protective casing (extending 3.5 feet above ground surface) surrounded by Enviroblocks. Each PVC riser is capped with an expansion plug, and the steel cap

on the protective casing is secured with a combination lock. The steel casing is set in a concrete pad that is flush with the existing road or ground surface.

Table 3-1: Summary of Well Construction Details

Field ID	Aquifer	Total Borehole Depth (feet bgs)	Borehole Diameter (inches)	Casing Diameter (inches)	Casing Type	Screen Slot Size (inches)	Screen Type	Screen Interval (feet bgs)
IW-01-3983	Shallow	40	6	2	PVC-80	0.065	Wire-wound, continuous-slot PVC	18 to 38
IW-02-3983	Shallow	40	6	2	PVC-80	0.065		20 to 40
IW-01-4550	Shallow	45	6	2	PVC-80	0.065		25 to 45
IW-02-4550	Shallow	45	6	2	PVC-80	0.065		24 to 44
IW-01-4551	Deep	96	6	2	PVC-80	0.065		91 to 96
IW-02-4551	Deep	96	6	2	PVC-80	0.065		90 to 95
AP-3983R	Shallow	40	4.5	2	PVC-40	0.010	Mill-slot	31 to 41
ROI-3983	Shallow	36	4.5	2	PVC-40	0.010	Mill-slot	26 to 36
ROI-4550	Shallow	40	4.5	2	PVC-40	0.010	Mill-slot	30 to 40

3.5 Well Development

Each well was developed no sooner than 24 hours following construction to remove fines from the filter pack and restore hydraulic connectivity to the aquifer. Well development consisted of using a combination of surge blocks, bailing, and pumping in accordance with the Basewide UFP-QAPP (USAF, 2013b). Development continued until the pH, temperature, specific conductance, dissolved oxygen, and oxidation reduction potential (ORP) of the produced groundwater had stabilized, and until the development water turbidity stabilizes at a level of less than 10 nephelometric turbidity units (NTU) or until ten casing volumes had been removed. Well development logs are provided in Appendix D. A summary of the well development details is provided in Table 3-2.

In accordance with SOP-26 in the Basewide UFP-QAPP, well development was considered complete after the water quality parameters stabilized or a minimum of 10 well casing volumes were removed from the well. During well development at CG039, several wells met the requirement that a minimum of 10 casing volumes be removed, prior to reaching the water turbidity of less than 10 NTUs (see Table 3-2). As a result, these wells had final turbidity readings higher than 10 NTUs upon completion of the well development. The distribution of EVO was visually widespread (see Section 4.3); therefore, it appears that these higher turbidity readings did not significantly impact the injection, distribution, and monitoring of EVO.

Table 3-2: Summary of Well Development

Well ID	Final Two Water Quality Parameter Measurements						Total Volume Removed (gal)	Calculated Well Casing Purge Volume (gal)	Calculated Borehole Purge Volume (gal)	Well Casing Volumes Removed	Borehole Volumes Removed
	pH	Specific Conductance (mS/cm)	Turbidity (NTU)	DO (mg/L)	Temperature (°C)	ORP (mV)					
AP-3983	7.20	0.351	11.9	3.00	5.01	40.9	153	37	340	41	4.5
	7.17	0.351	9.66	2.99	4.95	40.1					
Percent difference	0.4	0.0	20.8	0.3	1.2	2.0					
IW01-3983	6.75	0.279	39.4	0.24	5.83	40.6	210	32	297	66	7.1
	6.71	0.28	38.6	0.25	5.61	39.8					
Percent difference	0.6	0.4	2.1	4.1	3.8	2.0					
IW02-3983	7.24	0.278	22.4	0.52	5.39	39.7	308	34	316	91	9.7
	7.10	0.277	21.5	0.50	5.35	40.0					
Percent difference	2.0	0.4	4.1	3.9	0.7	0.8					
ROI-3983	6.72	0.345	12.7	0.17	6.15	23.7	130	28	258	46	5.0
	6.72	0.348	10	0.14	6.39	22.3					
Percent difference	0.0	0.9	23.8	19.4	3.8	6.1					
IW01-4550	6.34	0.342	37.9	0.34	5.8	7.4	155	37	343	42	4.5
	6.33	0.341	35.7	0.37	5.89	5.9					
Percent difference	0.2	0.3	6.0	8.5	1.5	22.6					
IW02-4550	7.15	0.491	9.14	1.16	4.68	-54.3	220	38	350	58	6.3
	7.11	0.491	7.22	1.19	4.75	-53.9					
Percent difference	0.6	0.0	23.5	2.6	1.5	0.7					
ROI-4550	6.79	0.556	276	IE	8.27	16.7	88	30	271	29	2.1
	7.18	0.557	NM	IE	7.71	19.0					
Percent difference	5.6	0.2	NC	NC	7.0	12.9					

Well ID	Final Two Water Quality Parameter Measurements						Total Volume Removed (gal)	Calculated Well Casing Purge Volume (gal)	Calculated Borehole Purge Volume (gal)	Well Casing Volumes Removed	Borehole Volumes Removed
	pH	Specific Conductance (mS/cm)	Turbidity (NTU)	DO (mg/L)	Temperature (°C)	ORP (mV)					
IW01-4551	7.41	0.467	16.6	0.6	6.06	-11	134	15	135	89	9.9
	7.43	0.467	15.7	0.59	5.89	-14.8					
Percent difference	0.3	0.0	5.6	1.7	2.8	29.5					
IW02-4551	7.46	0.509	3.69	0.58	6.52	42.1	143	8	72	179	19.9
	7.44	0.509	3.96	0.56	6.61	38.9					
Percent difference	0.3	0.0	7.1	3.5	1.4	7.9					

Notes:

ºC = degrees Celsius
DO = dissolved oxygen
gal = gallon(s)
IE = instrument error
mg/L = milligram(s) per liter
mS/cm = milliSiemen(s) per centimeter
mV = millivolt(s)
NC = not calculated
NM = not measured
NTU = nephelometric turbidity units
Temp = Temperature

3.6 Soil Sampling and Analysis

Subsurface soil samples were collected from soil cores recovered during well installation. The soil samples were collected from within the targeted contaminated aquifer at the boring location. The samples were analyzed for natural oxidant demand (NOD), fraction of organic carbon (f_{oc}), and grain size distribution. Ten soil samples were collected from within the three target treatment zones. Analysis of NOD and f_{oc} were used to assess the applicability of using ISCO within each targeted treatment zone. Table 3-3 presents the soil sample locations, depths, and analyses. The analytical results are presented in Section 4.1.

Table 3-3: Soil Samples and Analyses

Field Location	Sample ID	Sample Type	Depth (feet bgs)	NOD (ASTM D7262)	f_{oc} (SW9060)	Grain Size (ASTM D422)
IW01-3983	13Q2CG039-IW01398301-SO-0	N	25 to 30	X	X	X
IW01-3983	13Q2CG039-IW01398302-SO-0	N	30 to 35	X	X	X
IW01-3983	13Q2CG039-IW01398303-SO-0	N	35 to 40	X	X	X
IW01-4550	13Q2CG039-IW01455001-SO-0	N	30 to 35	X	X	X
IW01-4550	13Q2CG039-IW01455002-SO-0	N	35 to 40	X	X	X
IW01-4550	13Q2CG039-IW01455003-SO-0	N	40 to 45	X	X	X
IW01-4550	13Q2CG039-IW01455003-SO-1	FD	40 to 45	X	X	
IW01-4551	13Q2CG039-IW01455101-SO-0	N	91 to 96			X
IW02-4551	13Q2CG039-IW02455101-SO-0	N	91 to 96	X	X	
ROI-3983	13Q2CG039-ROI398301-SO-0	N	25 to 30	X	X	X
ROI-3983	13Q2CG039-ROI398302-SO-0	N	30 to 35	X	X	

Notes:
FD = field duplicate
N = primary sample

3.7 Baseline Groundwater Sampling and Analysis

Groundwater sampling was conducted at six newly installed injection wells (IW-01-3983, IW-02-3983, IW-01-4550, IW-02-4550, IW-01-4551, and IW-02-4551) and three performance monitoring wells (AP-3983R, AP-4550, and AP-4551) prior to substrate injection to establish baseline conditions and assess the variability of TCE concentrations within the target treatment zones. Additionally, groundwater samples were analyzed for VOCs, total organic carbon (TOC), dissolved mercury, dissolved iron, dissolved manganese, dissolved gases, sulfide, nitrate+nitrite, alkalinity, chloride, sulfate, and volatile fatty acids. Field quality control (QC) samples were collected during the baseline groundwater sampling. The rationale and objective of the field QC samples are presented in Worksheet #20 of the Work Plan (USAF, 2013a). Field QC samples for CG039 included two FDs, two matrix spike/matrix spike duplicates (MS/MSDs), one equipment blank (EB), and one trip blank (TB).

Table 3-4 presents the groundwater sample locations and analyses. Groundwater sampling logs are presented in Appendix E.

Table 3-4: Baseline Groundwater Samples and Analyses

Location	Sample ID	Matrix	Sample Type	Collection Date	E310.1	E300.0M	E300.0	E353.2	E376.2	RSK-175	SW6010B	SW7470A	SW9060	SW8260C
AP-3983R	13Q3CG039-AP4353-GW-0	Groundwater	N	15-Aug-13	X	X	X	X	X	X	X	X	X	X
IW01-3983	13Q3CG039-IW013983-GW-0	Groundwater	N	16-Aug-13										X
IW02-3983	13Q3CG039-IW023983-GW-0	Groundwater	N	16-Aug-13										X
AP-4550	13Q3CG039-AP4550-GW-0	Groundwater	N	19-Aug-13	X	X	X	X	X	X	X	X	X	X
AP-4550	13Q3CG039-AP4550-GW-1	Groundwater	FD	16-Aug-13	X	X	X	X	X	X			X	X
IW01-4550	13Q3CG039-IW014550-GW-0	Groundwater	N	16-Aug-13										X
IW02-4550	13Q3CG039-IW024550-GW-0	Groundwater	N	16-Aug-13										X
AP-4551	13Q3CG039-AP4551-GW-0	Groundwater	N	15-Aug-13	X	X	X	X	X	X	X	X	X	X
IW01-4551	13Q3CG039-IW014551-GW-0	Groundwater	N	16-Aug-13										X
IW02-4551	13Q3CG039-IW02-4551-GW-0	Groundwater	N	19-Aug-13										X
IW02-4551	13Q3CG039-IW02-4551-GW-1	Groundwater	FD	19-Aug-13										X

Notes:

FD = field duplicate
N = primary sample
E310.1 = Alkalinity
E300.0M = Volatile fatty acids
E300.0 = Chloride and sulfate
E353.2 = Nitrate+nitrite
E376.2 = Sulfide
RSK-175 = Dissolved gases
SW6010C = Dissolved iron and manganese
SW7470A = Dissolved mercury
SW9060 = Total organic carbon
SW8260C = Volatile organic compounds

3.8 Surveying

Following the installation of injection, monitoring, and ROI wells, the horizontal location, ground surface elevation, and top of casing elevation was surveyed by Lantech, an Alaska-licensed surveyor. The accuracy of the horizontal plane survey is ±1 foot and was measured to a reference point on the well casing. The vertical plane survey measurements at the ground surface and on the northern side of the top of the inner casing are accurate to ±0.01 foot. The point at which the elevation was measured on the inner casing was recorded so that future water level measurements can be consistently made from the same location. Survey activities were conducted in accordance with the Basewide UFP-QAPP (USAF, 2013b). Survey data are provided in Table 3-5.

Table 3-5: Well Survey Data

Well Name	WGS84 (G1674) UTM Zone 6N North-Meters	WGS84 (G1674) UTM Zone 6N East-Meters	Measuring Point Elevation NAVD 88 (feet amsl)
AP-3983R	6799362.751	360168.230	307.40
IW01-3983	6799358.304	360168.424	307.50
IW02-3983	6799360.168	360164.432	307.75
IW01-4550	6799339.522	360158.697	309.08
IW02-4550	6799336.461	360161.918	308.77
IW01-4551	6799338.593	360161.650	309.33
IW02-4551	6799336.022	360165.223	308.26
ROI-3983	6799359.141	360166.473	307.35
ROI-4550	6799338.047	360160.336	309.35

Notes:

amsl = above mean sea level
NAVD = North American Vertical Datum
UTM = Universal Transverse Mercator
WGS = World Geodetic System

3.9 Injection of EVO Substrate

As described in the Work Plan, the decision to inject sodium permanganate at either the AP-3983 target treatment zone or the AP-4551 target treatment zone was based on the results of the NOD soil samples collected during installation of the injection wells. The full results of the NOD samples and substrate selection rationale are discussed in Section 4.1. Analysis of the NOD results revealed a very heterogeneous oxidant demand in the subsurface. As a result, it was determined that sodium permanganate would not be injected as part of the Treatability Study.

An EVO substrate manufactured by Terra Systems was selected for injection at the three target treatment zones. The EVO substrate was a custom blend of 60 percent SRS-SD (0.6-micrometer [µm] droplet size) and 40 percent SRS-FR (5-µm droplet size). Each SRS solution contains 60 percent soybean oil and 4 percent potassium or sodium lactate, with the remainder being water, surfactants, and organic and inorganic nutrients (Appendix F). The EVO substrate was

supplied by the manufacturer in 275-gallon totes. Six totes were delivered to the site and stored inside two lined connex storage containers. The secondary containment inside the connex storage container consisted of an 8- by 10- by 1-foot wooden frame lined with a 20-mil plastic liner. Three EVO totes were placed within each lined connex storage container.

Ferrous sulfate heptahydrate manufactured by Alpha Chemical was selected as an addition to the EVO substrate solution at two target treatment zones to assess the effectiveness of BiRD. Ferrous sulfate heptahydrate is a highly soluble solid in the form of green vitreous granules that contains 20 percent iron (Appendix F). The ferrous sulfate was supplied in 50-pound bags, and 1,650 pounds of ferrous sulfate was delivered to the site.

A 21,000-gallon water storage tank was staged onsite and filled with water from an offsite fire hydrant via tanker truck. The EVO substrate was mixed with water at approximately a 5.5 percent concentration using a tote-mounted injection system (see Photographs 15, 16, and 19 in Appendix A). The injection system, powered by a submersible pump, used a Dosatron proportional chemical dispenser (capable of mixing up to a rate of 40 gallons per minute [gpm]), to mix a 5 percent solution of EVO and water. Because a 5.5 percent solution was the desired ratio, the injections were done in 275-gallon batches, in which an additional 2.9 gallons of EVO were added to the batch of injection water to make up the 0.5 percent solution deficiency. At target treatment zones AP-3983 and AP-4551, approximately 33 pounds of ferrous sulfate was added to each 275-gallon batch to attain an equivalent 5,000 mg/L sulfate in the injection solution. Injections were typically performed one well at a time until the injection volume at a given well was met. However, at some locations, injection batches were alternated between injection wells until the injection volumes were met. The following sections describe the injection specifics at each target treatment zone.

3.9.1 AP-4550 Target Treatment Zone

The AP-4550 target treatment zone was chosen to be the first injection zone because it is the shallow upgradient target treatment zone, thereby allowing the most possible monitoring locations for the presence of EVO breakthrough. Prior to injecting the EVO substrate at each injection well, approximately 100 gallons of water was injected into each well to help determine the possible injection rates and pressures at each injection well. At the AP-4550 treatment zone, it was decided that injections would take place one at a time to gather the most information on injection hydraulics and ROI.

The EVO substrate was injected into IW01-4550 first and then into IW02-4550. A total of 6,750 gallons of EVO solution (350 gallons of EVO and 6,400 gallons of water) was injected into IW01-4550 at a rate of approximately 20 gpm. A total of 6,750 gallons of EVO solution (375 gallons of EVO) was injected into IW02-4550 at a rate of approximately 15 gpm. Following the substrate injections, each injection well was flushed with approximately 250 gallons of water. Table 3-6 provides a summary of the injection volumes, mass of EVO, and mass of ferrous sulfate.

3.9.2 AP-4551 Target Treatment Zone

The AP-4551 target treatment zone is located within the deep perched aquifer and was the second target treatment zone to have substrate injected. In accordance with the Work Plan, the AP-4551 target treatment zone was injected with an EVO and ferrous sulfate solution in 275-gallon batches to track the ferrous sulfate additions.

Substrate injections began at IW01-4551 and after one batch breakthrough of EVO had occurred at IW02-4551. Because breakthrough had occurred at IW02-4551, it was decided to inject a batch at IW02-4551 to determine the injection rate at IW02-4551. Because of the discrepancy in injection rates between IW01-4551 (<3 gpm) and IW02-4551 (40 gpm), it was decided to finish the substrate injection at IW02-4551 and then continue injecting at IW01-4551. A total of 1,350 gallons of EVO/ferrous sulfate solution (75 gallons of EVO and 160 pounds of ferrous sulfate) was injected into IW01-4551 at a rate of approximately 2 gpm. A total of 1,380 gallons of EVO/ferrous sulfate solution (80 gallons of EVO and 160 pounds of ferrous sulfate) was injected into IW02-4551 at a rate of approximately 40 gpm. Following the substrate injections, IW01-4551 was flushed with approximately 100 gallons of water, and IW02-4551 was flushed with approximately 230 gallons of water. Table 3-6 provides a summary of the injection volumes, mass of EVO, and mass of ferrous sulfate.

3.9.3 AP-3983 Target Treatment Zone

The AP-3983 target treatment zone, located in the shallow aquifer downgradient from AP-4550, was the final target treatment zone to be injected with an EVO/ferrous sulfate solution. In accordance with the Work Plan, the AP-4551 target treatment zone was injected with an EVO and ferrous sulfate solution in 275-gallon batches to track the ferrous sulfate additions.

Substrate injection batches were alternated between IW01-3983 and IW02-3983. A total of 5,388 gallons of EVO/ferrous sulfate solution (305 gallons of EVO and 650 pounds of ferrous sulfate) was injected into IW01-3983 at a rate of approximately 40 gpm. A total of 5,400 gallons of EVO/ferrous sulfate solution (305 gallons of EVO and 650 pounds of ferrous sulfate) was injected into IW02-3983 at a rate of approximately 40 gpm. Following the substrate injections, each injection well was flushed with approximately 250 gallons of water. Table 3-6 provides a summary of the EVO injection volumes mass of EVO, and mass of ferrous sulfate.

Table 3-6: EVO Injection Summary

Field Location	Total Injection Volume (gallons)	Volume of EVO (gallons)	Mass of EVO (pounds)	Mass of Ferrous Sulfate (pounds)
IW01-3983	5,388	305	2455	650
IW02-3983	5,400	305	2455	650
IW01-4550	6,750	350	2817	none
IW02-4550	6,750	375	3018	none
IW01-4551	1,350	75	604	160
IW02-4551	1,380	80	644	160

3.10 Injection Monitoring

Injection monitoring was conducted during injection to confirm effective delivery of ERD substrate. Injection volumes were accounted for in two ways: (1) rough estimates of the volume of the solutions injected were kept by counting batches (each batch was approximately 275 gallons [see Section 3.9]), and (2) an accurate measurement of the volume of the solutions was kept on an electronic totalizing flow meter mounted inline between the injection system and the wellhead. Flow rates were measured using the instantaneous flow rates function on each electronic totalizing flow meter. Attached to each injection wellhead was a pressure gauge that was used to measure injection pressures. Performance monitoring wells (AP-3983R, AP-4550, and AP-4551) and ROI wells (ROI-3983 and ROI-4550) were monitored for ORP, turbidity, specific conductance, temperature, and visual observation (that is, the substrate is milky white) immediately before, during, and after injections by taking grab samples periodically for measurement using a water quality meter. Depth to groundwater measurements were collected in performance, ROI, injection, and nearby wells twice daily. The ground surface around each injection well was continually monitored for any evidence of surfacing of EVO solution. Parameters were monitored in accordance with the frequency detailed in Table 3-7. Results of injection monitoring are presented in Sections 3.9 and 4.3.

Table 3-7: Injection Monitoring Parameters

Parameter	Frequency
Total volume injected per well	Hourly
Flowrate per well	Hourly
Substrate volume per well	Hourly
Injection pressure at well head	Hourly
Temperature, specific conductance, and color observation	Hourly
ORP and turbidity	Twice daily
Depth to water in nearby wells	Twice daily
Evidence of surfacing	Continually

3.11 Demobilization

Following completion of treatability study activities, equipment was demobilized, and the treatability study area was cleaned and returned to its previous condition to the extent possible.

3.12 Management of IDW

Wastes generated during treatability study activities include general refuse (expended personal protective equipment [PPE], paper towels, plastic bags, and plastic water containers) and IDW (soil drill cuttings, purge water from well sampling, and wastewater from decontamination activities).

Consistent with the Basewide UFP-QAPP (USAF, 2013b), wastes were taken to the Environmental Staging Facility (ESF), which is located at Building 955 on Warehouse Street

near the intersection with Otter Lake Road. Access to the facility is coordinated through the current operations contractor, AECOM. Specific wastes were handled as described below:

- General refuse and expended PPE was disposed of daily in JBER refuse waste containers at the ESF.

- Soil cuttings were placed into a labeled 55-gallon drum during soil boring advancement and were transported to the ESF. The drum was labeled with date, project name, well/boring number, contents, depths of material, corresponding analytical sample numbers, analysis to be performed, and the contractor point of contact.

  - Soil was characterized for appropriate treatment and disposal using soil cuttings sampling results (IDW VOC analytical results are presented in laboratory reports M2352 and M2364 in Appendix G). The analytical results were provided to the JBER ESF operator. Twenty 55-gallon drums containing soil cuttings from the installation of monitoring and injection wells at CG039 are staged at the ESF awaiting disposal.

- Decontamination and purge water was collected in 15-gallon containers, transported to the ESF, transferred into open-top 55-gallon drums, and labeled. Decontamination water was then batch treated with other IDW water. After treatment, the water was sampled for constituents in the JBER water discharge permit and discharged to the sanitary sewer after verifying that constituents were below permit requirements. Treated IDW from CG039 discharged to the sanitary sewer is considered to be exempt from the CERCLA Off-Site Rule as a de minimis release.

3.13 Deviations from the Work Plan

The treatability study field activities were conducted in accordance with the Work Plan (USAF, 2013a). Because of drilling difficulties and scheduling associated with laboratory turnaround times, the following deviations to the soil sampling plan outlined in the Work Plan (USAF, 2013a) occurred:

- Three soil samples were collected from IW01-3983 instead of two soil samples.

- Two soil samples were collected from ROI-3983 instead of one soil sample from IW02-3983.

- Three soil samples were collected from IW01-4550 instead of two soil samples from IW01-4550 and one soil sample from IW02-4550.

- One soil sample was collected from IW01-4551 and analyzed only for grain size distribution.

- One soil sample was collected from IW02-4551 and analyzed only for NOD and f_{oc}.

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4.0 RESULTS

The results of the soil sampling, baseline groundwater sampling, and injection monitoring are presented in the following sections.

4.1 Soil Analytical and Geotechnical Results

Ten subsurface soil samples and one duplicate were collected for laboratory analysis. The soil samples were analyzed for NOD, f_{oc}, and grain size distribution (details of sample collection are summarized in Section 3.6). Analytical and grain size distribution results are presented in Table 4-1. Laboratory analytical reports and grain size testing reports are provided in Appendix G.

4.1.1 Natural Oxidant Demand

Ten subsurface soil samples collected from the three target treatment zones were analyzed using ASTM D7262 (48-hour permanganate NOD). NOD results were used to evaluate the applicability of using sodium permanganate as a treatment option at either of the AP-3983 or AP-4551 target treatment zones. The following decision logic (presented in the Work Plan [USAF, 2013a]) was used to evaluate whether the subsurface at a given target treatment zone was suitable to the use of sodium permanganate:

> "If the concentration of NOD in soil is less than 10 grams per kilogram (g/kg) within the target treatment zone, then an ISCO substrate could be considered for use within that target treatment zone.
>
> If the concentration of NOD in soil is greater than 10 g/kg within the target treatment zone, then an ISCO substrate would not be considered for use within that target treatment zone.
>
> If both the shallow downgradient and deep target treatment zones meet the requirements for the use of an ISCO substrate, then the target treatment zone that shows the least amount of anaerobic reductive dechlorination (based on the concentrations of TCE daughter products and geochemical parameters) would be selected for the use of an ISCO substrate.
>
> If a target treatment zone is considered to be unsuitable for the use of an ISCO substrate, then EVO with ferrous sulfate would be considered for a treatment option."

To avoid interference between treatment zones, only target treatment zones AP-3983 and AP-4551 were considered for ISCO treatment (because AP-4550 is directly upgradient of AP-3983). Regardless, NOD samples were collected from all three treatment zones to assess the heterogeneity of NOD in the subsurface. Analytical results for NOD analyses are presented in Table 4-1. The analytical results show that NOD within the subsurface is quite heterogeneous, varying both with depth within a target treatment zone and between target treatment zones. NOD within the subsurface ranged from 1.16 to 29.6 g/kg. NOD results from the AP-3983 target treatment zone ranged from 5.77 to 29.6 g/kg. The only sample collected from the AP-4551

target treatment zone had a NOD result of 1.93 g/kg. Overall, the results suggest that NOD is heterogeneous in the subsurface across the site, with some zones of low NOD and some zones of high NOD; this heterogeneity is not a desired condition for use of sodium permanganate. Based on the heterogeneity, it was decided that sodium permanganate would not be used for the treatability study.

4.1.2 Fraction Organic Carbon

Results of f_{oc} sampling were used to corroborate NOD sample results when deciding on the use of ISCO as part of the treatability study. Like the NOD sample results, the f_{oc} sample results show a wide range from 59.4 J milligrams per kilogram (mg/kg) to 49,100 mg/kg. Generally, samples with high NOD results had high f_{oc} results, and samples with low NOD results had low f_{oc} results. These data are consistent with a heterogeneous distribution of carbon in the subsurface. The f_{oc} results are presented in Table 4-1.

4.1.3 Grain Size Distribution

Grain size distribution was conducted to better understand the subsurface hydrogeology and how it might relate to injection hydraulics. The grain size distributions show that the aquifers in each target zone are fairly consistent—composed primarily of sands and gravels, ranging from silty sand with gravel to poorly-graded gravel with silt and sand. Soil descriptions for each sample are shown in Table 4-1.

Table 4-1: Soil Sampling Results

Field Location	Sample ID	Sample Type	Depth (feet bgs)	NOD (g/kg)	f_{oc} (mg/kg)	Soil Description
IW01-3983	13Q2CG039-IW01398301-SO-0	N	25 to 30	5.77	659	Silty sand w/ gravel
IW01-3983	13Q2CG039-IW01398302-SO-0	N	30 to 35	6.23	3,010	Poorly-graded gravel w/ silt and sand
IW01-3983	13Q2CG039-IW01398303-SO-0	N	35 to 40	22.7	566	Silty sand w/ gravel
IW01-4550	13Q2CG039-IW01455001-SO-0	N	30 to 35	3.1	78 U	Silty gravel w/ sand
IW01-4550	13Q2CG039-IW01455002-SO-0	N	35 to 40	2.24	83.4 J	Poorly-graded gravel w/ silt and sand
IW01-4550	13Q2CG039-IW01455003-SO-0	N	40 to 45	1.19	59.4 J	Well-graded gravel w/ silt and sand
IW01-4550	13Q2CG039-IW01455003-SO-1	FD	40 to 45	1.16	76.1 U	NA
IW01-4551	13Q2CG039-IW01455101-SO-0	N	91 to 96	NA	NA	Silty sand w/ gravel
IW02-4551	13Q2CG039-IW02455101-SO-0	N	91 to 96	1.93	1760	NA
ROI-3983	13Q2CG039-ROI398301-SO-0	N	25 to 30	29.6	49,100	Poorly-graded gravel w/ silt and sand
ROI-3983	13Q2CG039-ROI398302-SO-0	N	30 to 35	3.27	573	NA

Notes:

FD = field duplicate
J = estimated quantity
N = primary sample
NA = not analyzed
U = not detected

4.2 Baseline Groundwater Sampling Results

Prior to the injection of EVO into the subsurface, groundwater samples were collected from six newly installed injection wells (IW-01-3983, IW-02-3983, IW-01-4550, IW-02-4550, IW-01-4551, and IW-02-4551) and three performance monitoring wells (AP-3983R, AP-4550, and AP-4551) to establish baseline conditions and assess the variability of TCE concentrations within the target treatment zones. Additionally, groundwater samples were analyzed for VOCs, TOC, dissolved mercury, dissolved iron, dissolved manganese, dissolved gases, sulfide, nitrate+nitrite, alkalinity, chloride, sulfate, and volatile fatty acids. Complete analytical results are presented in Appendix H (Table H-1) along with the laboratory analytical reports and the data quality evaluation (DQE) report.

TCE concentrations measured in groundwater samples collected during the baseline groundwater sampling show that TCE concentrations are generally consistent within each target treatment zone and with historical values. TCE concentrations within the AP-3983 target treatment zone and AP-4550 target treatment zone located in the shallow aquifer show more variability than TCE concentrations with the AP-4551 target treatment zone located within the deep perched aquifer. A summary of TCE concentrations is shown in Table 4-2.

Table 4-2: Baseline Groundwater Sampling Results - TCE

Field Location	Sample ID	Sample Type	TCE (µg/L)
AP-3983R	13Q3CG039-AP3983R-GW-0	N	1,880
IW01-3983	13Q3CG039-IW013983-GW-0	N	987
IW02-3983	13Q3CG039-IW023983-GW-0	N	1,160
AP-4550	13Q3CG039-AP4550-GW-0	N	1,500
	13Q3CG039-AP4550-GW-1	FD	1,490
IW01-4550	13Q3CG039-IW014550-GW-0	N	1,330
IW02-4550	13Q3CG039-IW024550-GW-0	N	3,200
AP-4551	13Q3CG039-AP4551-GW-0	N	2,300
IW01-4551	13Q3CG039-IW014551-GW-0	N	2,690 J
IW02-4551	13Q3CG039-IW02-4551-GW-0	N	2,620 J
	13Q3CG039-IW02-4551-GW-1	FD	2,640

Notes:
FD = field duplicate
J = estimated quantity
N = primary sample

In addition to TCE, the following analytes were detected at concentrations above MCLs/ADEC Table C groundwater cleanup levels: 1,1,2,2-tetrachloroethane, 1,1,2-trichlorethane, 1,1-dichloroethene, cis-1,2-dichloroethene, tetrachloroethene, and trans-1,2-dichlorothene. See Table H-1 in Appendix H for complete analytical results.

4.3 Injection Monitoring Results

Injection monitoring was conducted to confirm the delivery of ERD substrate to the subsurface. The injection monitoring process was described in Section 3.10, and substrate injection details were presented in Table 3-6. Results of the EVO distribution monitoring are discussed in the following section and are summarized in Tables 4-3 and 4-4.

Table 4-3 presents a summary of the injection dates, injection order within each target treatment zone, injection volume, substrate volume, injection rate, injection pressure, and observations from the injections at IW01-3983, IW02-3983, IW01-4550, IW02-4550, IW01-4551, and IW02-4551. EVO did not surface during injections.

Baseline water quality parameters were collected from monitoring wells AP-3983, ROI-3983, AP-4550, ROI-4550, and AP-4551 prior to beginning injections at the associated target treatment zones. Visual breakthrough was observed in both AP-3983 and ROI-3983 following injections at the AP-4550 target treatment zone and prior to injections at the AP-3983 target treatment zone; therefore, pre-injection water quality parameters were not measured. At AP-4551 target treatment zone, visual breakthrough was observed at AP-4551 and IW02-4551 soon after injections began; therefore, additional water quality parameters were not measured. A summary is provided in Table 4-4.

During injection, the observed ROI (in the downgradient direction) was at least 90 feet at the AP-4550 target treatment zone and approximately 130 feet at the AP-3983 target treatment zone. Because of lack of crossgradient monitoring locations, observations of lateral distribution of EVO are limited to the 15 feet between the injection wells at each target treatment zone. Lateral distribution of EVO was at least 15 feet. The lack of nearby deep monitoring wells means that the observed ROI could not be confirmed to be greater than 15 feet in the AP-4551 target treatment zone. A map of EVO distribution associated with each target treatment zone is shown on Figure 4-1.

Depth to water was measured at nearby wells at least twice daily (before and after) during the injections at each target treatment zone. Within the shallow aquifer, injection activities at the AP-3983 target treatment zone resulted in an approximate 1-foot increase in water levels 90 feet upgradient at AP-4550 target treatment zone wells. No influence was seen in the deep perched aquifer during injections into the shallow aquifer and vice versa. Within the deep perched aquifer, a 0.5-foot increase in water level was seen in AP-4551 during injections. Water level measurements are provided in an Excel file on the CD included with this report.

Table 4-3: Injection Monitoring Results

Injection Well	Date	Injection Order	Injection Start Time	Approximate Total Injection Time (min)	Total ERD Injection Volume (gallons)	Volume of EVO (gallons)	Injection Rate (gpm)		Injection Pressure (psi)		Observations
							Max	Min	Max	Min	
AP-3983 Target Treatment Zone											
IW01-3983	9/14/13 to 9/15/13	Alternating batches	11:00	230	5,388	305	35	30	0	0	Visual breakthrough was observed at all AP-3983 Target Treatment Zone wells during injections at AP-4550 Target Treatment Zone. Visual breakthrough observed at AP-3989.
IW02-3983	9/14/13 to 9/15/13	Alternating batches	11:00	230	5,400	305	35	30	0	0	
AP-4550 Target Treatment Zone											
IW01-4550	9/10/13	1st	10:45	410	6,750	350	25	19	8	4	Visual breakthrough observed at AP-4550, ROI-4550, IW02-4550 and at AP-3983 Target Treatment Zone wells (AP-3983R, Roi-3983, IW01-3983, and IW02-3983)
IW02-4550	9/11/13	2nd	11:05	445	6,750	375	20	13	10	8	At time of injection, visual breakthrough was already observed in all monitoring locations.
AP-4551 Target Treatment Zone											
IW01-4551	9/12/13 to 9/13/13	1st	11:00	650	1,350	75	2	<1	12	12	Visual breakthrough observed at IW02-4551.
IW02-4551	9/12/13	2nd	11:50	100	1,380	80	40	28	2	0	Visual breakthrough observed at AP-4551.

Table 4-4: Water Quality Measurements

Observation Location	Date	Time	Temperature (^{0}C)	pH	Conductivity (uS/cm)	ORP (mV)	Turbidity (NTU)	Visual Observations
AP-3983 Target Treatment Zone								
AP-3983R	09/13/13	1030	Visual breakthrough of EVO solution during injections at AP-4550 Target Treatment Zone, milky white, no water quality parameters taken					
ROI-3983	09/13/13	1030						
AP-4550 Target Treatment Zone								
AP-4550	09/10/13	935	6.52	6.54	209	-6.5	Over range	Gray, cloudy
		1155	5.64	6.7	209	-45	Over range	Gray, cloudy
		1356	6.66	7.03	256	-79.3	Over range	Visual breakthrough, milky white
ROI-4550	09/10/13	940	6.3	6.94	332	-35.9	66.4	Slightly cloudy
		1200	6.85	6.75	349	-40	465	Cloudy, visual breakthrough
		1350	6.62	7.09	447	-95.7	Over range	Visual breakthrough, milky white
AP-4551 Target Treatment Zone								
AP-4551	09/12/13	1043	6.01	6.47	303	40.3	649	Gray, cloudy
		1555	Visual breakthrough of EVO solution, milky white, no water quality parameters taken					
IW02-4551	09/12/13	1050	5.98	6.76	263	17.1	98.9	
		1145	Visual breakthrough of EVO solution, milky white, no water quality parameters taken					

Note:

µS/cm = microSiemen(s) per centimeter

5.0 CONCLUSIONS

5.1 Treatment Substrate Selection

The results of soil NOD and f_{oc} analyses show a substantial variability in subsurface soils. Overall, the results suggest that NOD is heterogeneous in the subsurface across the site, with some zones of low NOD and some zones of high NOD. Since NOD heterogeneity is not a desired condition for use of sodium permanganate, it was decided that sodium permanganate would not be used for the treatability study. As a result, the selected treatment alternatives were EVO and EVO with ferrous sulfate.

5.2 TCE Variability within a Target Treatment Zone

Baseline groundwater samples were collected from the injection wells and performance monitoring wells within each target treatment zone prior to the injection of EVO substrate to assess the variability of TCE concentrations within each target treatment zone. While there is some variability in TCE concentrations within a target treatment zone, TCE concentrations are generally similar (within an order of magnitude) to each other and to historical TCE concentrations. The lack of variability in TCE concentrations within each target treatment zone suggests that the effects of ERD treatment caused by EVO substrate injection within the aquifer should be relatively uniform within each target treatment zone.

5.3 Substrate Injection Hydraulics

5.3.1 Shallow Aquifer

The shallow subsurface lithology at CG039 consists largely of sands and gravels with some silt and easily accepts the injection of EVO. At target treatment zone AP-4550, the injection rate ranged from 15 to 20 gpm at a wellhead pressure of between 7 to 10 pounds per square inch (psi). The injection rate at target treatment zone AP-3983 was only limited by the injection system capabilities (injection of up to 40 gpm) and was injected at a conservative 35 gpm at wellhead pressures of 0 psi. During injection, the observed ROI (in the downgradient direction) was at least 90 feet at the AP-4550 target treatment zone, and approximately 130 feet at the AP-3983 target treatment zone. Because of lack of crossgradient monitoring locations, observations of lateral distribution of EVO are limited to the 15 feet between the injection wells at each target treatment zone. Lateral distribution of EVO was at least 15 feet.

Because there is practically no difference in lithology between the AP-4550 target treatment zone and the AP-3983 target treatment zone, the differences in maximum injection rate and pressure are likely related to well construction and/or well development. The ability of the shallow aquifer to accept the injection of EVO suggests that a possible future full-scale implementation of EVO injections could deploy a lateral injection well spacing greater than the 15 feet spacing used in the treatability study. Additionally, because of the downgradient distribution (130 feet from the injection of approximately 11,000 gallons of EVO solution), it is possible that a line of injection wells could be set at the upgradient edge of the hot spot, and if enough EVO solution were injected, it could be distributed to treat the entire hot spot.

5.3.2 Deep Perched Aquifer

The lithology of the deep perched aquifer consists of partially interconnected silty sand and gravel lenses within a basal till/weathered bedrock. At target treatment zone AP-4551, the injection rate ranged from 1 gpm at a wellhead pressure of 12 psi at IW01-4551 to 28 gpm at a wellhead pressure of 1 psi. Following injection of one 275-gallon batch at IW01-4551, EVO breakthrough was visually observed at IW02-4551 but not at AP-4551. Visual EVO breakthrough did not occur at AP-4551 until 2 hours following completion of the injection of 1,380 gallons at IW02-4551, at which point the second batch of EVO had been injected at IW01-4551. Based on the time lag in the breakthrough of EVO downgradient as compared to laterally, it is possible that preferential flow pathways partially control the distribution of groundwater flow within the deep perched aquifer. This is consistent with the interpretation that the deep perched aquifer is composed of partially interconnected sand and gravel lenses within a larger till body, overlying weathered bedrock.

Because the injection well boring logs show practically no difference in lithology within the target treatment zone and the well completion diagrams indicate installation at approximately the same depth (within 1 foot), the difficulty of EVO injection at IW01-4551 is most likely related to the nature of the deep perched aquifer, which consists of partially interconnected sand and gravel lenses within a larger till body, overlying weathered bedrock. The non-uniform ability of the aquifer to accept the injection of EVO and the observed ROI suggest that any possible future full-scale implementation of EVO injections within the deep perched aquifer should deploy an injection well spacing of not more than 15 feet.

6.0 REMAINING TREATABILITY STUDY ACTIONS

This Treatability Study Implementation Report outlines the implementation of the treatability study, including injection and monitoring well installation activities, baseline groundwater sampling, soil analysis and substrate selection, and injection field activities.

Remaining treatability study activities include the following:

- Quarterly groundwater performance monitoring
- Data review and evaluation
- Preparation of the Treatability Study Completion Report, which will discuss the results of the quarterly performance monitoring and provide recommendations for any further action

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7.0 REFERENCES

ENSR Corporation (ENSR). 2006. *Final Summary Report: OUB Soil Vapor Extraction Treatment System, Fort Richardson, Alaska.* November.

United States Air Force (USAF). 2013a. *Uniform Federal Policy – Quality Assurance Project Plan CG039 – Poleline Road Disposal Area Treatability Study Work Plan Joint Base Elmendorf-Richardson, Alaska.* Final. September.

United States Air Force (USAF). 2013b. *Basewide Uniform Federal Policy-Quality Assurance Project Plan (UFP-QAPP).* Joint Base Elmendorf-Richardson. Final. March.

United States Air Force (USAF). 2013c. *2012 Annual Report Monitoring of CERCLA Regulated Sites, Joint Base Elmendorf-Richardson, Alaska*. Pre-Draft.

United States Air Force (USAF). 2011. "Memorandum to the Site File for Long Term Monitoring at the Poleline Road Disposal Area, Operable Unit B." From Gary Fink, Chief of Environmental Restoration. March.

United States Army Corps of Engineers (USACE), Cold Regions Research and Engineering Laboratory (CRREL). 2011. *Poleline Road Disposal Area Hydrologic Analysis and Modeling Summary Report.* December.

United States Army Corps of Engineers (USACE), Cold Regions Research and Engineering Laboratory (CRREL). 2003. *Hydrogeology of the Poleline Road Disposal Area, Operable Unit B, Fort Richardson, Alaska.*

United States Army Corps of Engineers (USACE), Cold Regions Research and Engineering Laboratory (CRREL). 2000. *Groundwater data from Fort Richardson, Alaska, for the period April 1997 to March 2000.* Draft.

United States Army Directorate of Public Works (DPW). 2008. *Five-Year Review Report, Second Five-Year Review for Fort Richardson, Alaska.* February.

United States Army Directorate of Public Works (DPW). 2003. *Five-Year Review Report, First Five-Year Review Report for Fort Richardson, Alaska.* February.

United States Army Directorate of Public Works (DPW). 1996. *Remedial Investigation Report Operable Unit B Poleline Road Disposal Area*. Fort Richardson, Alaska. September.

United States Army, U.S. Environmental Protection Agency (EPA), and Alaska Department of Environmental Conservation (ADEC). 1997. *Final Record of Decision for Operable Units A and B, Fort Richardson Anchorage, Alaska*. August.

United States Environmental Protection Agency (EPA). 2008. *Design and Installation of Monitoring Wells*. U.S. Environmental Protection Agency, Science and Ecosystem Support Division, Athens, Georgia. SESDGUID-101-R0. February.

United States Environmental Protection Agency (EPA). 1999. *Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents*. U.S. Environmental Protection Agency. EPA 540-R-98-031. OSWER 9200.1-23P. July.

United States Environmental Protection Agency (EPA). 1994. *DNAPL Site Characterization.* Publication 9355.4-16FS, EPA/540/F-94/049, PB94-963317. September.

United States Environmental Protection Agency (EPA). 1991. *Guidance for Increasing the Application of Innovative Treatment Technologies for Contaminated Soil and Ground Water* OSWER Directive 9380.0-17. June.

Woodward-Clyde. 1998. *Long-Term Groundwater Monitoring Workplan, Operable Unit B, Poleline Road Disposal Area, Fort Richardson, Alaska.* April.

Woodward-Clyde. 1996. *Groundwater Flow Model Report, derived from Remedial Investigation Report, Operable Unit B, Poleline Road Disposal Area, Fort Richardson, Alaska.* September.

Figures

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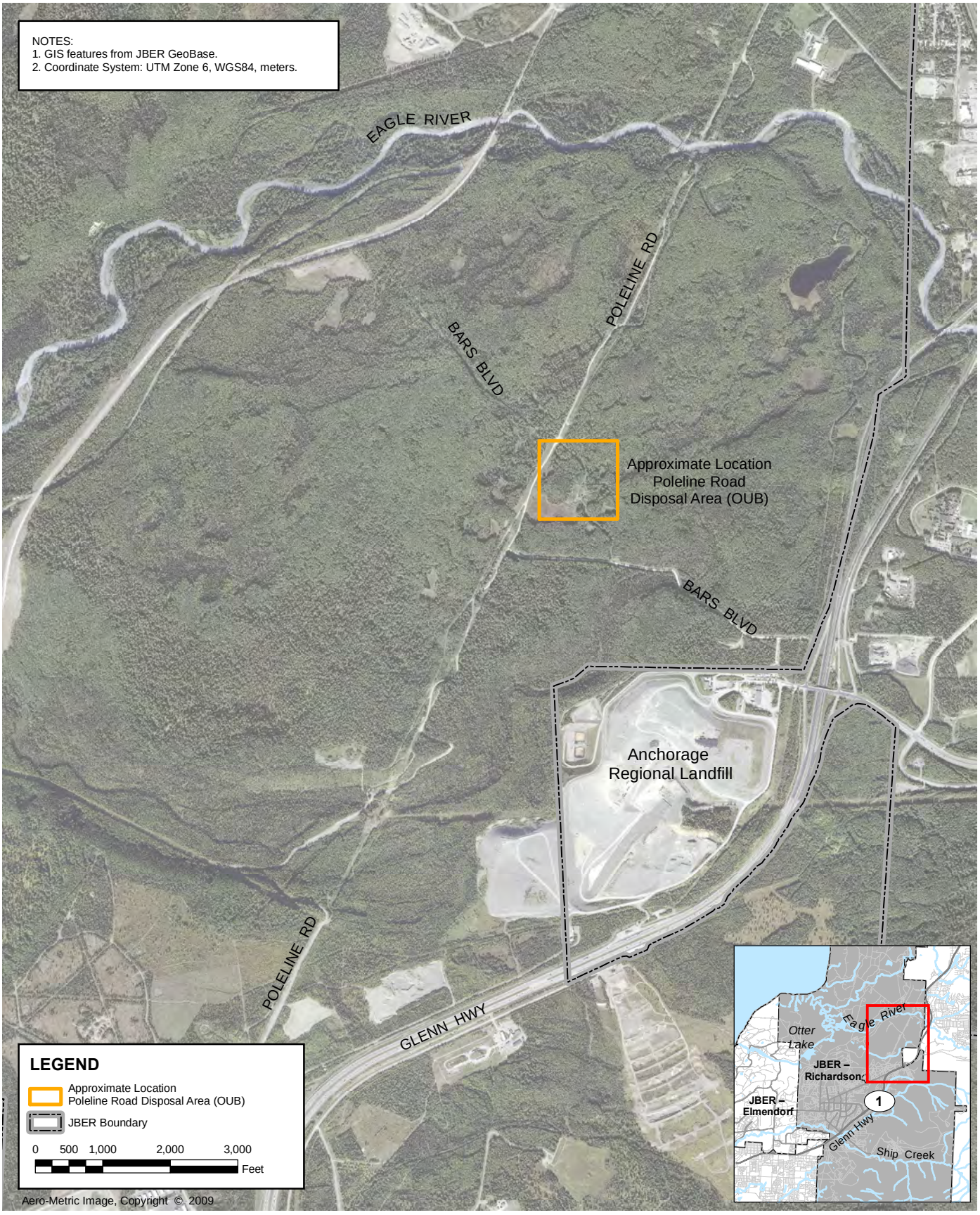

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W E
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SITE LOCATION

Figure
1-1

Treatability Study Implementation Report, CG039
Poleline Road Disposal Area
Joint Base Elmendorf-Richardson, Alaska

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N W E S

SITE MAP

Figure **2-1**

Treatability Study Implementation Report, CG039
Poleline Road Disposal Area
Joint Base Elmendorf-Richardson, Alaska

A

A'

Approximate Zone of Soil Heating

Approximate Area of Excavation

AP-4354
AP-4353
AP-3981
AP-3985
INJECTION WELLS
AP-4552
AP-4551
HILL
INJECTION WELLS
AP-3983R
AP-3989
AP-4525
AP-4019
AP-3747

Wetland
Peat
No Contamination

Shallow Aquifer

Approximate Area of EVO Treatment

Intermediate Aquitard
(Dense matrix of silts, sands, and gravels with perched zones of saturation)

Bedrock

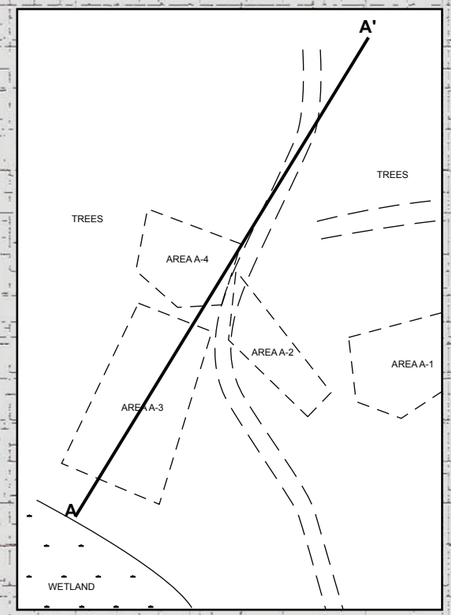
Bedrock

Elevation (Feet)

370
340
310
280
250
220
190
160
130
100

0 50 100 150 200 250 300 350 400 450 500 550 600 650 700

Longitudinal Scale (Feet)



Legend

- Interpreted Groundwater Flow Direction
- Low Permeability Lens
- Potentiometric Surface

Note: This site model is conceptual, and based on site data, interpreted data, and professional judgement. Therefore, the contaminated zones and geologic features depicted in this figure should be used only for conceptual purposes.

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CONCEPTUAL SITE MODEL

Treatability Study Implementation Report, CG039
Poleline Road Disposal Area
Joint Base Elmendorf-Richardson, Alaska

Figure
2-2

NOTES:
1. Coordinate System: UTM Zone 6, WGS84, meters.
2. Only available TCE data collected from October 2009 through September 2012 (draft, not reviewed or approved by EPA/ADEC) are shown.
3. **Bold blue** = regulatory exceedance when compared against RAO or MCL, EPA 40 CFR 141/143, ADEC 18AAC75, and ADEC 18AAC80.
4. All non-detect values from 2010 to present are reported as the PQL.
5. Approximate groundwater flow directions were based on 2012 Long-Term Monitoring groundwater elevation data.
6. Groundwater plume contoured using most current TCE groundwater data at each monitoring well.
7. TCE = trichloroethene
   EVO = emulsified vegetable oil
   J = estimated quantity
   MCL = maximum contaminant level
   ND( ) = no analyte detected (brackets indicate the level of detection)
   NS = not sampled
   PQL = practical quantitation limit
   ROD = Record of Decision
   RAO = Remedial Action Objectives
   ROI = Radius of Influence
   SVE = Soil Vapor Extraction
   µg/L = micrograms per liter

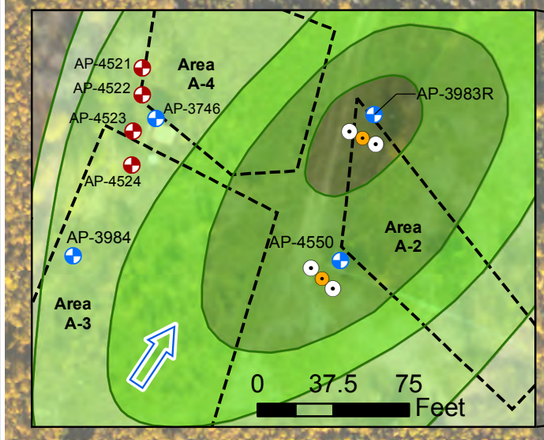
Cleanup Level Values

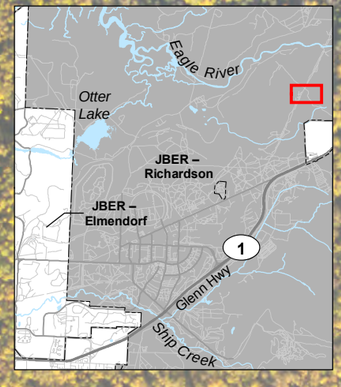
Chemical of Concern	ROD RAO
Trichloroethene	5 µg/L

BARS BOULEVARD
POLELINE ROAD
TA-411 TRAILS
TA 412 TRAILS
POLE LINE ROAD

AP-3747 TCE (µg/L) Sep-12 88
AP-4352 TCE (µg/L) Oct-09 NS
AP-3989 TCE (µg/L) Sep-12 610
AP-3744 TCE (µg/L) Sep-12 42
AP-3983R TCE (µg/L) Oct-09 2,320
AP-3982 TCE (µg/L) Sep-12 ND(0.2)
AP-3984 TCE (µg/L) Oct-09 248
AP-4347 TCE (µg/L) Sep-12 ND(0.620)
AP-3985 TCE (µg/L) Oct-09 424
AP-3981 TCE (µg/L) Sep-12 ND(0.2)
AP-3745 TCE (µg/L) Sep-12 55
AP-4354 TCE (µg/L) Oct-09 0.590J
AP-4518 TCE (µg/L) Oct-09 ND(1.00)
AP-4353 TCE (µg/L) Sep-12 280
AP-4550 TCE (µg/L) Sep-12 1,400
AP-4519 TCE (µg/L) Oct-09 348J
AP-3749 TCE (µg/L) Oct-09 ND(1.00)

Area A-1
Area A-2
Area A-3
Area A-4





LEGEND

- Monitoring Well Location (Shallow)
- Injection Well Location
- ROI Well
- SVE Well
- Disposal Area
- Building (Facility ID)
- General Groundwater Flow Direction (Approximate)

TCE Contour Interval

- 5 to 100 µg/L
- 100 to 500 µg/L
- 500 to 1000 µg/L
- 1000 to 2000 µg/L
- Greater than 2000 µg/L

N W E S

0 100 200 400 600 Feet

HISTORICAL TCE CONCENTRATIONS IN GROUNDWATER - SHALLOW AQUIFER OCTOBER 2009 THROUGH SEPTEMBER 2012

Treatability Study Implementation Report, CG039 – Poleline Road Disposal Area
Joint Base Elmendorf-Richardson, Alaska

Figure **2-3**

Date: 07 Nov 2013 Drawn by: jcarr R:\AFCEE_JBER_20001102\MapFiles\TSIR\CG039\Figure_2-3_CG039_PolelineRd_GWShallow.mxd

NOTES:
1. Coordinate System: UTM Zone 6, WGS84, meters.
2. Only available TCE data collected from October 2009 through September 2012 (draft, not reviewed or approved by EPA/ADEC) are shown.
3. **Bold blue** = regulatory exceedance when compared against RAO or MCL, EPA 40 CFR 141/143, ADEC 18AAC75, and ADEC 18AAC80.
4. All non-detect values from 2010 to present are reported as the PQL.
5. Approximate groundwater flow directions were based on 2007 Long-Term Monitoring groundwater elevation data.
6. Groundwater plume contoured using most current TCE groundwater data at each monitoring well.
7. TCE = trichloroethene
   EVO = emulsified vegetable oil
   J = estimated quantity
   MCL = maximum contaminant level
   ND( ) = no analyte detected (brackets indicate the level of detection)
   NS = not sampled
   PQL = practical quantitation limit
   ROD = Record of Decision
   RAO = Remedial Action Objectives
   µg/L = micrograms per liter

Cleanup Level Values

Chemical of Concern	ROD RAO
Tetrachloroethene	5 µg/L
Trichloroethene	5 µg/L
1,1,2,2-Tetrachloroethane	5.2 µg/L

AP-4350 Sep-12
TCE (µg/L) ND(0.62)

AP-4345 Oct-09
TCE (µg/L) ND(1.00)

AP-5246 Sep-12
TCE (µg/L) ND(0.2)

AP-4344 Sep-12
TCE (µg/L) ND(0.2)

AP-5683 (AP-4019R) Sep-12
TCE (µg/L) 0.19J

AP-3748 Sep-12
TCE (µg/L) ND(0.2)

AP-4019 Oct-09
TCE (µg/L) 0.360J

AP-4525 Oct-09
TCE (µg/L) 2,270

AP-4011 Oct-09
TCE (µg/L) 15.5

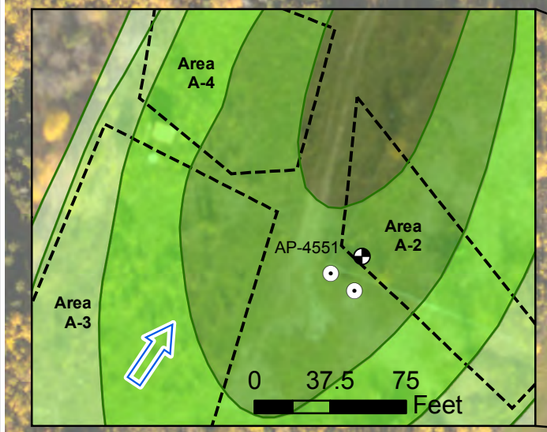
AP-4551 Oct-09
TCE (µg/L) 1,810

AP-4353 Sep-12
TCE (µg/L) 280

AP-4349 Nov-10
TCE (µg/L) 0.390J

AP-4017 Oct-09
TCE (µg/L) 884

BARS BOULEVARD
TA411 TRAILS
POLE LINE ROAD
TA412 TRAILS
Area A-1
Area A-2
Area A-3
Area A-4

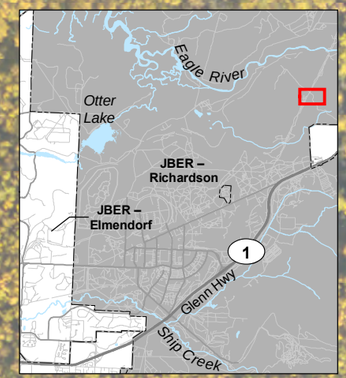


LEGEND

- Monitoring Well Location (Deep)
- Injection Well Location
- Disposal Area
- Building (Facility ID)
- General Groundwater Flow Direction (Approximate)

TCE Contour Interval

- 5 to 100 µg/L
- 100 to 500 µg/L
- 500 to 1000 µg/L
- 1000 to 2000 µg/L
- Greater than 2000 µg/L



N W E S

0 75 150 300 450 Feet

HISTORICAL TCE CONCENTRATIONS IN GROUNDWATER - DEEP AQUIFER OCTOBER 2009 THROUGH SEPTEMBER 2012

Treatability Study Implementation Report, CG039 – Poleline Road Disposal Area
Joint Base Elmendorf-Richardson, Alaska

Figure **2-4**

Date: 07 Nov 2013 Drawn by: jcarr R:\AFCEE_JBER_20001102\MapFiles\TSIR\CG039\Figure_2-4_CG039_PolelineRd_GWDeep.mxd

NOTES:
1. Coordinate System: UTM Zone 6, WGS84, meters.
2. **Bold blue** = regulatory exceedance when compared against RAO or MCL, EPA 40 CFR 141/143, ADEC 18AAC75, and ADEC 18AAC80.
3. Approximate groundwater flow directions were based on 2013 Long-Term Monitoring groundwater elevation data.
4. Groundwater plume contoured using historical (October 2009 through September 2012) TCE groundwater data at each monitoring well.
5. TCE = trichloroethene
   MCL = maximum contaminant level
   ROD = Record of Decision
   RAO = Remedial Action Objectives
   ROI = Radius of Influence
   µg/L = micrograms per liter

Cleanup Level Values

Chemical of Concern	ROD RAO
Trichloroethene	5 µg/L

BARS BOULEVARD

AP-4352

AP-3747

AP-3983R
TCE (µg/L) 1,880

AP-3744

AP-3982

IW-02-3983
TCE (µg/L) 1,160

AP-3989

AP-3746

Area A-4

IW-01-3983
TCE (µg/L) 987

AP-4550
TCE (µg/L) 1,500

AP-4347

AP-3984

IW-01-4550
TCE (µg/L) 1,330

Area A-3

Area A-2

Area A-1

AP-3985

IW-02-4550
TCE (µg/L) 3,200

AP-3745

AP-3981

AP-4518

AP-4354

AP-4353

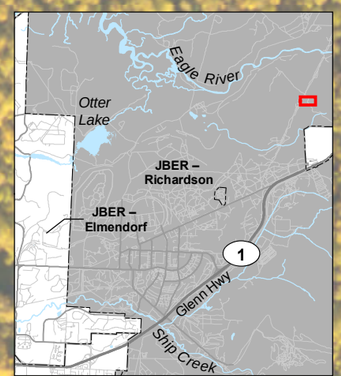
AP-4519

LEGEND

- Monitoring Well Location (Shallow)
- Injection Well Location
- ROI Well
- Disposal Area
- Building (Facility ID)
- General Groundwater Flow Direction (Approximate)

TCE Contour Interval

- 5 to 100 µg/L
- 100 to 500 µg/L
- 500 to 1000 µg/L
- 1000 to 2000 µg/L
- Greater than 2000 µg/L



N W E S

0 50 100 200 300 Feet

TREATABILITY STUDY BASELINE TCE RESULTS -SHALLOW AQUIFER

Figure 3-1

Treatability Study Implementation Report, CG039 – Poleline Road Disposal Area
Joint Base Elmendorf-Richardson, Alaska

Date: 02 May 2014 Drawn by: jcarr R:\AFCEE_JBER_20001102\MapFiles\TSIR\CG039\Figure_3-1_CG039_PolelineRd_BaselineShallow_TCE.mxd

NOTES:
1. Coordinate System: UTM Zone 6, WGS84, meters.
2. **Bold blue** = regulatory exceedance when compared against RAO or MCL, EPA 40 CFR 141/143, ADEC 18AAC75, and ADEC 18AAC80.
3. Groundwater plume contoured using historical (October 2009 through September 2012) TCE groundwater data at each monitoring well.
4. TCE = trichloroethene
   J = estimated quantity
   MCL = maximum contaminant level
   ROD = Record of Decision
   RAO = Remedial Action Objectives
   µg/L = micrograms per liter

Cleanup Level Values

Chemical of Concern	ROD RAO
Tetrachloroethene	5 µg/L
Trichloroethene	5 µg/L
1,1,2,2-Tetrachloroethane	5.2 µg/L

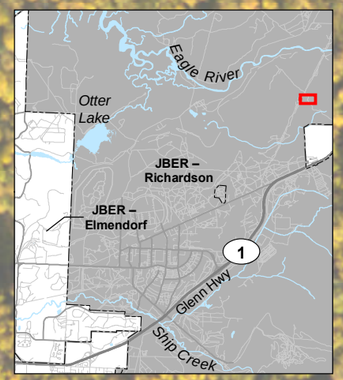
AP-4344
AP-3748
AP-5683 (AP-4019R)
AP-4019
AP-4525
AP-4011
AP-4551
TCE (µg/L) 2,300
IW-01-4551
TCE (µg/L) 2,690 J
IW-02-4551
TCE (µg/L) 2,640
AP-4017
AP-4353
AP-4349
Area A-1
Area A-2
Area A-3
Area A-4
POLE LINE ROAD

LEGEND

- Monitoring Well Location (Deep)
- Injection Well Location
- Disposal Area
- Building (Facility ID)
- General Groundwater Flow Direction (Approximate)

TCE Contour Interval

- 5 to 100 µg/L
- 100 to 500 µg/L
- 500 to 1000 µg/L
- 1000 to 2000 µg/L
- Greater than 2000 µg/L



N W E S

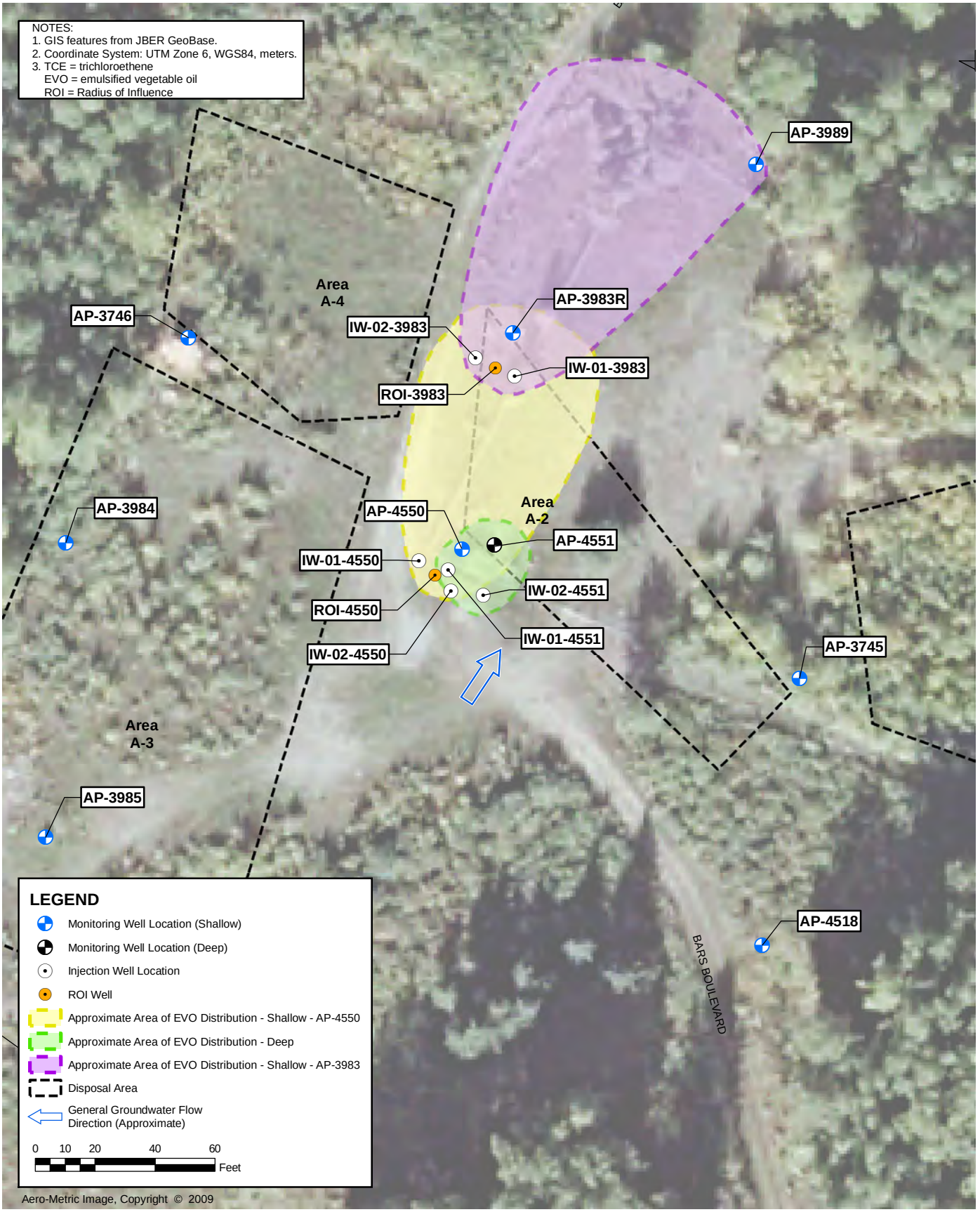
0 50 100 200 300 Feet

TREATABILITY STUDY BASELINE TCE RESULTS -DEEP AQUIFER

Figure **3-2**

Treatability Study Implementation Report, CG039 – Poleline Road Disposal Area
Joint Base Elmendorf-Richardson, Alaska

Date: 02 May 2014 Drawn by: jcarr R:\AFCEE_JBER_20001102\MapFiles\TSIR\CG039\Figure_3-2_CG039_PolelineRd_BaselineDeep_TCE.mxd



Date: 12 Dec 2013 Drawn by: jcarr R:\AFCEE_JBER_20001102\MapFiles\TSIR\CG039\Figure_4-1_CG039_PolelineRd_Distribution_EVO.mxd

N
W E
S

EVO INJECTION DISTRIBUTION

Treatability Study Implementation Report, CG039
Poleline Road Disposal Area
Joint Base Elmendorf-Richardson, Alaska

Figure
4-1

Appendix A
Photographic Log and Field Notes

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Photograph A-1: CG039-R0I-3983, interval 25 to 30 feet bgs (July 2013)

Photograph A-2: CG039-R0I-3983, interval 30 to 35 feet bgs (July 2013)

Photograph A-3: CG039-IW-01-3983, interval 25 to 30 feet bgs (July 2013)

Photograph A-4: CG039-IW-01-3983, interval 30 to 35 feet bgs (July 2013)

Photograph A-5: CG039-IW-01-3983, interval 35 to 40 feet bgs (July 2013)

Photograph A-6: CG039-IW-01-4550, interval 30 to 35 feet bgs (July 2013)

Photograph A-7: CG039-IW-01-4550, interval 30 to 35 feet bgs (July 2013)

Photograph A-8: CG039-IW-01-4550, interval 35 to 40 feet bgs (July 2013)

Photograph A-9: CG039-IW-01-4550, interval 40 to 45 feet bgs (July 2013)

Photograph A-10: Air rotary equipped direct-push rig (July 2013)

Photograph A-11: Air rotary equipped direct-push rig (July 2013)

Photograph A-12: Air rotary equipped direct-push rig (July 2013)

Photograph A-13: CG039-IW-01-4551, interval 91 to 96 feet bgs (July 2013)

Photograph A-14: CG039-IW-02-4551, interval 91 to 96 feet bgs (July 2013)

Photograph A-15: Injection at AP-4550 and AP-4551 Target Treatment Zones (September 2013)

Photograph A-16: Injection System set up on EVO totes stored in connex (September 2013)

Photograph A-17: In-line totalizing flow meter (September 2013)

Photograph A-18: Injection wellhead assembly set up at IW01-4550 (September 2013)

Photograph A-19: Injection system with Dosatron mounted on EVO tote (September 2013)

Photograph A-20: Injection system with Dosatron mounted on EVO tote (September 2013)

Photograph A-21: Injection system set up on site (September 2013)

Photograph A-22: 21,000-gallon water storage tank (September 2013)

Photograph A-23: Site overview (September 2013)

Photograph A-24: Injection batch mixing tank (September 2013)

Photograph A-25: Injection at AP-3983 Target Treatment Zone (September 2013)

Photograph A-26: Wellhead injection assembly at AP-3983 (September 2013)

Photograph A-27: Injection at AP-3983 Target Treatment Zone (September 2013)

Photograph A-28: Totalizing flow meters (September 2013)

Photograph A-29: Batch injection at AP-3983 Target Treatment Zone (September 2013)

JBER-R CG039 7.11.13

0800 Jennifer Frame (JF) and Annika Seay (AS) meet Travis Drewry (TD), Sean Lee (SL), and Elliott Wilson (EW) at trailer site. Hold H&S Meeting - discuss possible traffic, wildlife, mosquitos, isolated area as potential hazards at site. TD, SL, and EW begin to move equipment to site. JF and AS discuss procedure of calling Range Control each morning, as well as ice samples and procedure for van while JF is away the next few days. Also waiting for WP delivery from office. AS uploads drilling logs from iPad, JF takes care of work emails. AS does SBO for drillers loading the flat bed trailer.

0905 - drillers make first run down to CG039 to drop off rig.

1045 - drillers back onsite. Pickup second load to run down to CG039 for staging

1115 - drillers offsite - head to Poleline road

1205 - speak w/ TD, states they will be back to field trailer in ~15 mins.

1315 - drillers onsite. S. Lee offsite

1340 - T. Drewry head to CG039; A. Seay & J. Frame will be heading down shortly

1355 - J. Frame & A. Seay onsite. R. Horn is also onsite working to determine where power lines for the nearby hi-voltage ~~gene~~ (JMF) transformers (approximately 50' SE of proposed well locations) are run in from (Either Poleline Rd (West) or Eagle River side (E)). Need to confirm if potential concerns for EOD &/or utilities.

- Get ok from Scott Kendall (USACE) regarding EOD & utilities. Relay to TD & begin setting up on ROI well associated w/ AP-4550

1600 - S. Lee back onsite

1645 - begin drilling @ CG039-ROI-4550. Well will ~~be~~ (JMF) installed @ an estimated 20-40' bgs; will assess as we go. ~~Boring~~ (JMF) will log lithology electronically & complete well installation diagram (hardcopy) ~~when~~ (JMF) @ time of install

1800 - complete drilling for day. Make plans to meet at trailer in morning.

1830 Leave site/base

Annika Seay 7.11.13

JBER-R CG039 7-12-13

0720 Annika Seay (AS) meets Rich Horn (RH) at trailer site.
0730 Travis Drewry (TD) and Sean Lee (SL) arrive at trailer site.
0752 Range controlled informed 4 ppe, 3 vehicles headed to Pole Line.
TD, SL, AS mob. to fuel vehicles
0815 Mob. to CG039
0845 Arrive at CG039 - had to drive very slow due to military using road.
0855 Rich Horn arrives on site.
0910 Drilling starts where it left off yesterday, at 18'. Air rotary drilling.
0915 Rich Horn leaves site to retrieve WL indicator
0920 encountering some water at 23'
1000 Rich Horn back on site. AS & RH take WL @ AP-4550 WL = 19.6' from BTOC; ~~WL ~ 16.9' bgs~~. TD = 42.85' from TOC, ~~TD 40.6' bgs~~
Call Corey Schwabenlander (CS) to discuss findings in regards to ROI - 4550. CS advises to drill to 45' and take a WL, then call back to determine where the screen should be placed.
Mike Landon communicates with AS about IDW sampling and samples needed for CG039 wells.
1040 RH checks deeper well AP-4551. Overcasing slid down borehole.
WL AP4551 = 95.74 BTOC = 93.2 BGS
TD AP4551 = 98.0 BTOC ≈ 95.45 BGS
1100 Daily field meeting
1130 Minor leak from air compressor - drillers caught spill before significant amount (~~<~~1 gal) was lost to the ground. Rich Horn calling JBER envir. spill contact. This compressor is the same kind that gave issues at Dieldrin site. Rich Horn left message for envir. spill person Roseanna Dickens (JBER environmental compliance person)
Drillers will be picking up new compressor ~~before taking~~ after CAS lunch.
1140 Drillers leave for lunch. RH attempts WL - only getting to 30' then hitting obstruction. Will have to remove inner casing to retrieve WL
1150 RH and AS take lunch
1315 Arrive at trailer site after lunch – work on emails and paperwork. Emails pertain to spill. Wait for drillers to retrieve new air compressor.
1445 Arrive back on site, drillers have new compressor.
RH takes WL at shallow well AP-4550 WL ~ 20.67 BTOC
~ 3 hours no air for drilling, after well sat (~ 2-3 hrs)
Drillers working on removing casing - having issues.
1540 Drillers have been having lots of issue extracting rods – rods move up ~ 4 ft and then won't budge. Several theories are considered but the cause of the condition is unclear.

JBER-R CGØ39 7.12.13

1540 (cont'd) drillers are pulling up inner and outer casing.
1552 Drill bit is recovered
1605 After all the casing is removed, water level is 19.03' bgs
TD ~ 22' after sloughed in. Will redrill to depth at sample hole.
IDW drums: 1) drum from initial attempt at ROI - 4550
2) Second attempt
1700 Air compresser developed small leak from overheating - placed duck pond under to catch coolant. Injection collar broke on rig. Work is stopped for the day. TD and SL do inventory of tools. RH and AS clean up for day. Leave site.
1730 RH stays at trailer to do paperwork. AS leaves base for day.

7.12.13

JBER-R CGØ39 7-13-13

0730 Annika Seay (AS) arrives at trailer site. Picks up van and leaves ~~base~~ site to refuel. Communicates with Rich Horn (RH) about activity and RH informs he will call ~~base~~ range control. Range control did not answer and the mailbox was full.

0815 AS arrives at site and meets Travis Drewry (TD) and Sean Lee (SL) from GeoTek; RH arrives right behind AS. Hold H&S meeting - topics: watch for traffic on Poleline; some wildlife seen this morning as well. Air compressor will be watched for any leaks. If equipment malfunctions we will have to cease work for day. Drillers have replaced faulty valve on rig this morning and checked air compressor.

0900 Start up air compressor to begin work. Starting at 13' - where we left off when redrilling began yesterday.

Date	Time	Bottom of interval Depth	Comments
7-12-13	~~AS~~ 1700	13'	
7-13-13	0900	18'	5' added
	0915	23'	5' added (chitting water again)
	0920	28'	5' added (chitting water @ 23')
	0925	33'	5' added
	0935	38'	5' added (encountering water)
	0945	40'	

0945 Reach depth. Cleaning out hole.

1010 RH takes WL. TD = 41.5'. 1" water at bottom of well; or, it is just wet at the bottom.

1015 TD and SL leave site to go to yard to retrieve well caps.

1040 RH takes WL after well has been sitting. Water has come up ~1" more (~2" in well). Rich re-calls Range control and checks in.

1110 TD and SL back on site. Begin to set well. Place 5' Bentonite in well and hydrate

1145 RH, TD, SL, AS take lunch

1300 Lunch over, back to site

1340 RH takes WL @ RoI - 4550 35.55' bgs = WL, ~5' water

1400 Grout mix: 2 bags cement (portland) 1/2 bag Quik Gel, 30 gal water. mixing in progress.

1415 Setting tremmy pipe to grout. Discussed with SL letting the pressure settle in the pipe to avoid pressurized grout spewing out into his face (in reference to a near miss) Well has already become pressurized. Drillers allow it to set before adding tremmy pipe. Grout is set, tremmy pipe pulled without incident.

JBER-R CGØ39 7.13.13

1435 Pulling outer well casing
1445 lowering tremmy pipe for more grouting after outer casing has been pulled
1450 Tremmy pipe pulled without incident. Grouting from surface.
1500 TD and SL set up decon pit to decon rods.
1525 Check WL at ROI-4550 WL ≈ 29.3' and rising.
1545 Rod decon
1600 RH leaves site and heads back to trailer to look up historic boring logs for site. AS stays on site.
1625 AS takes WL ≈ 22.8' bgs. Placed stake back at ROI-4550.
1650 Site is cleaned up; equipment staged at next well. AS called Range control to inform of site departure. TD, SL, AS mob. to CH yard.
1710 All meet at trailer. Discuss ending activities for day with RH.
1730 Leave base for day.

7.13.13

JBER-R CG039 7-15-13

0730 Annika Seay (AS) arrives at CH yard - gets van ready for day's work.
0745 Travis Drown (TD) calls and informs AS he left his base pass in the work truck at the CH yard. AS will take him pass.
0800 AS meets TD and Sean Lee (SL) at Richardson gate - gives TD his base pass. AS calls Range control to inform of day's work. Range control does not answer and they do not have any room left on their voicemail. AS texts Rich Horn (RH) to inform him of this and that AS will be heading to site. RH responds that he is at the office printing documents for today's work.
0830 AS arrives at site; TD and SL follow shortly. Begin setting up for day. TD and SL inspect equipment.
0845 Elliot Wilson (EW) visits site, drops off equipment.
0900 AS takes WL at ROI-4550. 23.6' BTOC ≈ 21.6' bgs. EW leaves site.
0915 Hold H&S meeting. Discuss staying away from dust clouds during drilling and when mixing grout. TD & SL provide respirator masks for daily work. Stacey Ré calls requesting help finding a telephone number.
0930 Begin drilling at AP-3983R

Date	Time	Depth	Comments	Time	Depth	Comments
7-15-13	0942	8'	3' lead, 5' added	1125	38'	5' added, out of water
	1015	13'	5' added	1200	41'	3' to total depth
	1028	18'	5' added			
	1039	23'	5' added			
	1055	28'	water @ 25' 5' added			
	1108	33'	5' added; in water			

0950 Rich Horn (RH) on site. Jeremiah Knuth calls to check on project.
1015 Drilling in very dry, compact silts. Out of it by 18'
1055 Hitting water at 25'. RH takes field meeting call.
1105 Drilling cuttings mostly water at 33'. So far, 3 drums have been filled at this site.
1200 40' (~41') complete. AS takes WL. Only ~ 1" water at bottom of well for now. TD & SL begin to set well.
1210 RH and AS sampling of ROI-3983, which will be the next well set.
1220 Bentonite is set; will let hydrate ~ 1 hour. Go over equipment for next well with TD.
1245 take lunch ~~for~~ drillers. AS & RH go to CH trailer to find out about sample bottles and answer emails.
1330 TD and SL finish lunch, head to CH yard to get supplies for Macro core sampling.
1355 TD and SL head to site and begin mixing grout. AS and RH meet up at trailer with sample manager Mike Landon and discuss

JBER-R ~~CGΦ36~~ CGΦ39 7-15-13

added samples for ROI-3983

1500 Grout mix is 2 bags Portland cement, 1 bag bentonite. Use tremmy pipe ~~1315~~ AS to grout well.

1510 RH takes WL ≈ 19.48 BTOC; 18.3' bgs

1530 Grout is setting on well; TD and SL begin decon. RH leaves site for day - heads back to office trailer to address emails.

1610 Mob. to ROI-3983 and set up rig.

1640 Begin drilling at ROI-3983

1730 Drilling stops at 18'. TD & SL set up for macro
WL from AP-3983R 19.86 BTOC, ≈ 18.5' bgs

1815 Leave site for day. Call Range control to check out - no one answers, voicemail is full.

1830 Arrive at trailer site, Retrieve IDW labels from trailer. Lock up van for the night. Call Range control again. Get answer and check out for the day. Leave base.

7-15-13

JBE-R CGΦ39 7-16-13

0730 Annika Seay (AS) meets Travis Drewry (TD) at CH trailer yard. Jenn Frame (JF) and Sean Lee (SL) on way. Begin to set up van for day.

0800 Communicate with Rich Horn (RH) about contacting Range Control and sample collection for day. JF arrives at site. SL has flat tire; will meet crew at site. Hold H&S meeting. Similar topics from last few days at site discussed. Pack van with coolers.

0830 Arrive at site. Talk w/ RH about sample collection and well development.

0915 Begin at RO I-3983 18' (where we left off yesterday). Range control has been called and informed that we are here. Drilled to 23'; setting up macro core for sampling.

1000 JF AS JF leaves site for errand.

1015 AS notices more coolant has leaked into the overflow bucket TD and SL have placed under the air compressor. Nothing to cause alarm as of now, but it will continue to be watched as work progresses. TD checks compressor.

1025 SL arrives on site.

1035 - JF back onsite

1040 - collect sample 25-30' (13Q2CG039-ROI398301-SO-Φ)

1045 - collect sample 30-35' (13Q2CG039-ROI398302-SO-Φ)

1135 Depth reached - hole cleaned out. JF takes DTW ≈ 38.3' from BTOC, ≈36 bgs

1140 - set screen (25-35').

1215 - 26.69' BTOC, 21.3' bgs

1220 - TD, SL, JF, AS take lunch

1320 - head back to site

1335 - Arrive at site; TD & SL mix grout; JF talks to Stacey Ré (SR) about groundwater monitoring issues.

1410 - begin grouting well.
JF takes ~~CAB~~ TD of RO I-3983 & WL. WL = 17.58' bgs
TD = 35.5

1500 - decon rods and grouter. Mob. to IW-3983

1550 - JF ~~AS~~ AS leaves site to meet Stacey Ré and Kristen Stevens off of Rough Road - the battery for sampling has died. She is taking them jumper cables.

1600 Begin drilling IW-3983

1645 Nut came off of bolt on diverter; found and TD fixed. Resume drilling

JBER-R CG039 7-16-13

Time	Date	Depth	Comments
	7-16-13	5'	Lead
		10'	5' added
1715		15'	5' added
1730		20'	5' added

1730 Clean up site for day. Drillers are having issues with the divertor. Took water out of drums and put in water drum.
1800 Leave site for day. Check out with Range Control.
1815 Arrive at trailer site. Leave ROI samples at tor sample Management Leave site for day

7-16-13

JBER-R CGΦ39 7.16.13 17 AS

0730 Annika Seay (AS) and Jennifer Frame (JF) arrive at trailer site. Begin packing van for the day. Travis Drewry (TD) and Sean Lee (SL) arrive.

0745 Hold H&S meeting. Main topic: traffic on Pipeline. JF had a near-miss incident yesterday with a vehicle driving around a blind corner on the wrong side of the road. Army is using the road a lot this week - we need to be extra watchful of them, as they are not of us.

0800 Head to Pipeline site - call Range control. No one answers. Re Head to turn back for ice for samples.

0830 Retrieve ice - Rich Horn (RH) calls JF. They discuss yesterday's incident on road. AS calls Range control and checks in.

0845 Head out to site. Drillers are already there setting up for day.

0900 Arrive on site.

0915 AS takes WL @ RO I 3983 ~ 17.6' bgs. 20.98' BTOC

0925 Resume drilling IW-01-3983

Date	Time	Depth AS	Comments
7.17.13	0925	25' ~~added~~	5' added

0935 Pull Rods to begin macrocore. Several calls with RH about sampling IW-01-3983 from 25-40' discreet and not sampling IW-02-3983 at all.

1100 Collect sample 25-30' (13Q2CGΦ39-IW-Φ1-398301-30-0)

1120 collect sample 30-35' (13Q2CGΦ39-IW-Φ1-398302-30-0)

1145 - collect sample 35-40' (13Q2CG039-IW-01-398303-30-0)

1230 - Take lunch. Drillers get more water and supplies.

1330 - AS and JF complete SBO while waiting for drillers to get supplies

1430 - meet back at site. Begin pulling casing and clearing hole.

1520 - JF samples drum from TUΦ58 dated 7-11-13; will have drum taken to IDW yard.

1545 - set screen (20-40') took WL = dry. Begin grout mix. 4 & bags Portland, ~~4 25 bag~~ 1/2 bag bentonite, 30 gal water. Grout well and add sand. Begin cleanup for day. JF checks out with Range control.

1845 - Leave base.

7.17.13

JBER-R CG039 7.18.13

0730 Annika Seay (AS) arrives at CH trailer site.
0800 Travis Drewry (TD), Sean Lee (SL), Jennifer Frame (JF) arrive at CH trailer site. Crew mobs to site. JF checks in with Range Control.
0830 Hold H&S meeting. Traffic on Poleline is still major concern. Crew decides to have a daily 'safety officer,' a different crew member will look for any potentially unsafe behavior or safety concern to discuss at the next day's safety meeting. This will help keep H&S fresh on everyone's mind as we have been at this site a while and will be here a little longer.
0900 JF calls Range Control about traffic issues on Poleline. Is forwarded to another source who is not happy to receive her call. JF immediately calls and informs Rich Horn (RH) of phone call to unhappy source. Drillers are mixing grout and preparing to complete IW-01-3983.
0945 Pulling outer casing of well and beginning grouting. 4 bags Portland, 1/2 bag bentonite. 30 gal water.
1000 Grouting complete. AS takes WL = 18.15' bgs
TD & SL begin clean up of mob. drums (IDW) for AS to sample. Decon equipment.
Mob to IW-02-3983
1040 Collect IDW03 sample (Drum 3)
1100 Collect IDW04 sample (Drum 4)
1130 TD, SL, JF, AS take lunch.
1245 Back on site.
1255 Begin at IW-01-3983

Date	Time	Depth	Comments
7.18.13	1325	5'	lead rod
	1335	10'	5' added
	1345	15'	5' added
	1400	20'	5' added
	1410	25'	5' added
	1430	30	5' added
	1445	35'	5' added
	1500	40'	5' added

1515 Begin pulling inner casing. Set well. Start sand and grout
1600 AS takes JF to CH yard. JF off site for day. Rich Horn (RH) on site.
1630 AS arrives; RH informs that well bridged and a screen broke. RH calls Corey Schwabenlander. Corey not available — RH leaves message. TD & SL will send rod back down to get additional 1'. Drillers pump air into hole and clear out the last 1'. TD after blow out = 40.2', 3/4 bucket of pel-plug
1720 Begin setting well. Le 1/2 bags sand
1830 Take WL at IW-01-3983 18.0' bgs
1850 Arrive at CH trailer drop samples off

JBER-R CG039 7.18.13

1900 Leave ~~base~~ base AI for the day.

JBER-R CG039 7.17.13

0730 Annika Seay (AS) and Jennifer Frame (JF) arrive at trailer site. Begin loading trailer.

0800 Travis Drewry (TD) and Sean Lee (SL) arrive at site. Take air compressor to re-fuel. AS and JF head to site.

0810 JF checks in with Range Control.

0830 - JF & AS onsite CG039

0838 - drillers onsite, conduct H&S briefing. Topics include slip trips, fall hazards - identified potential hazard ~~as~~ (JWF) with air hose from compressor (tends to coil up causing tripping hazards), will check throughout day to ensure coiling does not occur & footpath is clear. Proper PPE mod level D outside of support zone.

- need to complete grouting of IW02-3983.

0915 Begin mixing grout (2 bags Portland, 3/4 bag bentonite, 15 gal water) AS and JF make labels for IDW samples for day.

0925 AS communicates with Rich Horn (RH) about footage drilled 7.17.13. Inquires about assistance with completing IW EPA form.

0950 Gets answer from RH about completing IW EPA form - he informs AS to not fill out

1030 AS takes WL at IW-01-3983 WL = 17.8' bgs, ~~TD = ~40.2'~~ Collect IDW SO06 (AS) sample. Demob & decon from IW02 3983. Will setup on IW01-4550 after lunch.

1130 - offsite for lunch & pickup of additional poly bungtop drums for decon water.

1240 - return to CG039. Setup on ~~TD~~ (JWF) (JUF) IW01-4550.

1328 - begin drilling

TIME	DEPTH (bgs) ~~INTERVAL~~ (JWF)	comments
1330	0-5'	lead rod
1353	5-10'	add 5'
1404	10-15'	add 5'
1413	15-20'	add 5'
1433	20-25'	add 5' * water @ 20' ?
1448	25-30'	add 5'

1458 - ~~pull out~~ (JWF) trip out inner rod & switch to ~~desorate with~~ (JUF) macro core to collect samples from 30-45' bgs.

1600 - receive sample 30-35' & collect (13Q2CG039-IW01455001-SO-0)

1630 - collect sample 35-40' (13Q2CG039-IW01455002-SO-0)

1650 - collect sample 40-45' (13Q2CG039-IW01455003-SO-0)

1655 - collect Dup sample 40-45' (13Q2CG039-IW01455003-SO-1)

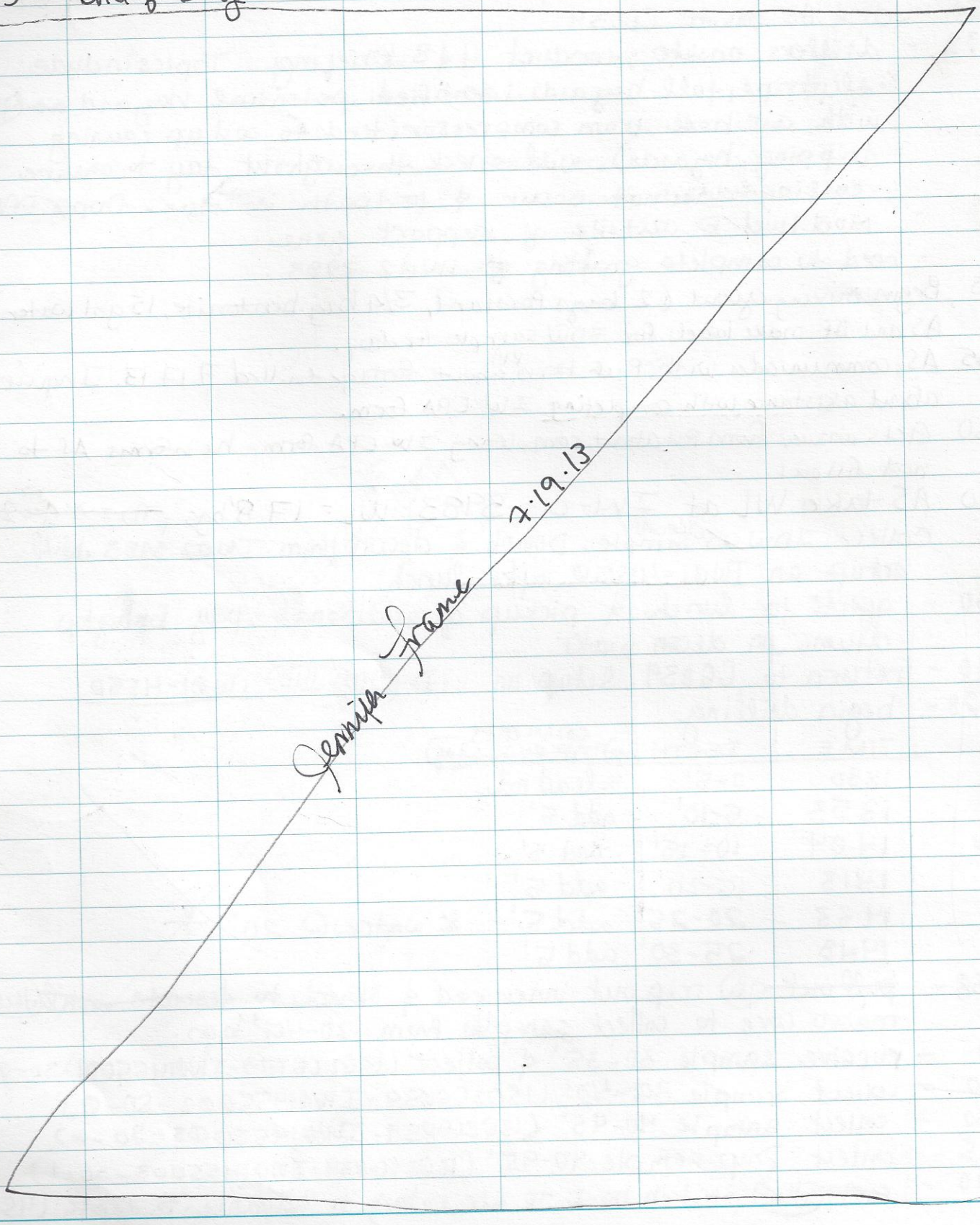
1700 - ~~return~~ (JUF) switch back to air rotary to advance to depth (45' bgs)

to set well.

1800 - get to depth & stop for day. will set well tomorrow.

1830 - call Range Control to check out. Return to field office & replace ice for samples to be shipped out on Monday.

1845 - End of Day



JBER-R CG039 7·20·13

0800 - Meet with drillers (T. Drewry & S. Lee) onsite Field Trailer. Conduct H&S briefing. Topics include good house keeping, slip, trip, fall hazards, biological hazards (mosquitos, horseflies, bears, moose), safe driving practices especially on Poleline Rd. Proper PPE
0835 - onsite Poleline Rd. Call to check in w/ Range control. They will be closing early today (weekend hours).
0845 - onsite CG039. Discuss procedures for todays events. Will complete install of IW01-4550.
0915 - continue on IW01-4550.
0948 - Set screen (25-45' bgs) ~~& collect DTW~~ (JUF) add sand & bentonite seal
1000 - prep to sample IDW Drums 5, 7 & 8
1030 - Collect sample [IDW drum #5] (13Q2 CG039-IDW05-SO-0)
1105 - add bentonite & 15 gals. water. Wait 1 hr. ~~head to lunch~~ (JUF)
1138 - off to lunch. Pick-up supplies from field office
1285 - back onsite. ~~Grout well & begin decon.~~ (JUF)
1315 - grout well & begin decon. Will need to ~~rem~~ (JUF) temporarily roll back fence ~~section~~ (JUF) on SW corner of Area A-2 to access next Injection well (IW01-4551). Well is positioned ~2.5' South of fence line & rig cannot access w/ all necessary equipment. CH2M takes pictures before to ensure fencing is properly re-assembled after well installation.
1510 - ~~purge~~ (JUF) ~~we~~ drillers use sump pump to transfer decon water into 2 15 gal bung drums. ~~Purge~~ (JUF) water will be brought to POL Yard at end of day for disposal.
1610 ~~to 30~~ (JUF) - drillers head to POL Yard to dispose of decon water (30 gals).
1630 - Head to field trailer repack ice for remainder of weekend.
1645 - End of day

Jennifer Frame 7-20-13

JBER-R CG039 7.22.13

0800 - meet drillers onsite field trailer. T. Drewry informs us that ~~S. Lee will not be~~ (JUF) S. Lee has not responded to calls/texts. Will prep and wait to hear from him.

0815 - J. Frame & A. Seay head to ~~pick up~~ (JUF) fuel van

0830 - T. Drewry informs us that S. Lee will not be onsite today. Mike Kelly will replace for day. Will meet us down at CG039 in ~ 45 mins.

0845 - J. Frame & A. Seay, T. Drewry onsite CG039. Begin prep for days event

0915 - E. Wilson, B. Gonzalez & M. Kelly onsite. ~~Conduct~~ (JUF) B. Gonzalez & E. Wilson will assist w/ setup while M. Kelly is being briefed on Health & Safety plan, applicable AHAs. Conduct Daily H&S first. Topics include Pinch points, good housekeeping, Proper PPE, sun protection, bears, moose, wolves, porcupine, mosquitos, horseflies.

0930 - M. Kelly & J. Frame go over H&S plan & AHAs while others prep

1008 - E. Wilson & B. Gonzalez gloves. Begin drilling @ IW01-4551.

TIME	DEPTH (bgs)	COMMENTS
1033	0-5'	lead rod
1042	5-10'	add 5'
1122	10-15'	add 5'
1135	15-20'	add 5'
1148	20-25'	add 5'
1159	25-30	add 5' — stop for lunch. will get fuel on truck.

1320 - return to CG039

TIME	DEPTH (bgs)	COMMENTS
1353	35-40'	add 5'
1407	40 45'	add 5'

Time	Depth
1420	45-50
1435	50-55
1445	55-60
1525	60-65
1545	65-70
1705	70-75

1445 Hose (air) has become clogged. Drillers work to unclog. AS ~~HAs~~ takes sample at IDW-07

~~1505~~ AS Air hose is leaking - drillers use duct tape to cover 1505 leaks in hose. Cyclone is compacted with soil - drillers work to unlodge and resolve.

1525 Begin drilling again

Time	Depth	comments
~~1705~~	75-80	5' added
1743	85-90'	5' added → stop here for day. Will

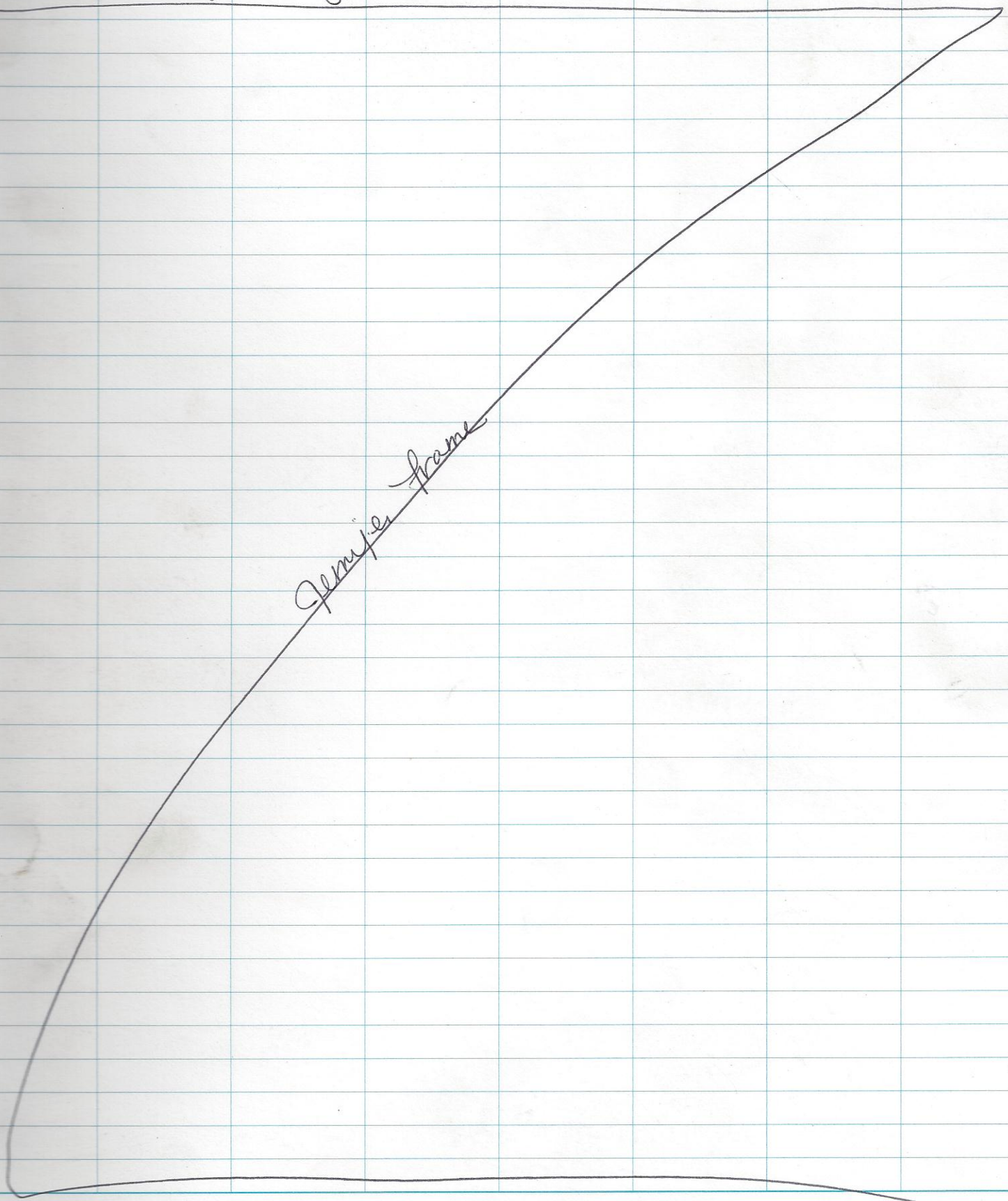
JBER-R CG039 7-22-13

continue w/ remaining 6' tomorrow.

1800 - leave CG039

1906 - checkout w/ Range control

1915 - End of day



JBER-R CG039 7.23.13

0800 - Meet Drillers (E.Wilson, B. Gonzalez, M. Kelly, S. Lee, T. Drewry), CH2M H&S & FTL staff (J. Knuth, R. Horn, J. Painter) & field crew J. Frame & A. Seay. at field trailer. Additional GeoTek staff today due to surface completion needs. Crew of 3 (E.W, B.G & M.K) will ~~complete~~ JUF begin completions for newly installed ROI & IWs @ CG039. J. Painter conducts H&Z Comm training with all crews.

0830 - crews head to Boreline Road. Set up for macrocore

0935 - M. Whitney onsite. GeoTek ~~crew~~ JUF 2nd crew (E.W., B.G., S.L.) ~~@~~ JUF work on well completions

1015 - M. Whitney offsite

1130 Have drillers do inventory on chemicals. We can all go over MSDS of each chemical to know hazards (per JP). Must be done soon.

1230 Lunch Break. JF and JP off site for day.

1330 AS and RH meet at trailer; call Corey and Andy about drilling 5 feet more feet to definitely hit weathered bedrock. Andy suggests we do this - communicate w/ TD. Main concern is losing rod in ground.

1420 Arrive on site (AS and RH). Attempt WL at IW-01-4551, ~~Dry~~ ~~TD~~ AS WL = 90.2' bgs, TD = 96' bgs. RH decides drillers should continue with WP - 96' bottom of well. SL off site for day.

1150 (late entry) sample 91-96' @ AS 13Q2CG039-ID4551-SO-0

1430 AS collects IDW01-SO-0 (CG039 Drum 7) sample Decants water from IDW08

1515 AS collects IDW08-SO-0 (CG039 Drum 8) sample

1535 TD informs AS he has cleared the hole to 97', Begins pulling casing. Adds 5' screen.

1605 EW called asking what well TD completed 7.16.13

1640 AS takes WL @ IW-01-4551; dry.

1645 Begin pouring sand (3 1/4 bags)

1715 Add 3/4 bucket pel-plug + 5 gal water to hydrate. ~~Begin mixing grout~~ AS

1740 Discuss grouting tonight vs. first thing tomorrow. Tomorrow wins out due to being late in the day.

1800 Leave site for the day - check out with Range control.

X AS ices samples and leaves for Kristen ~~Stewart~~ Stevens (KS) in trailer. AS

1830 AS, TD, Mike Kelly leave for day.

JBER-R CG039 7.24.13

0730 Annika Seay (AS) arrives at CH trailer. Puts water in cooler on ice; gets gel ice for samples.

0800 Travis Drewry (TD) and Sean Lee (SL) arrive at trailer.

0815 Hold Health and Safety meeting. Main topic: heat and sun exposure. Discussed observations made by Josh Painter during audit yesterday. Discussed HAZ comm concerning chemicals kept at site.

0830 Mob. to site. TD and SL communicate with their PM and then begin grout mixing: forgot to bring 4 bags Portland, 3 1/2 bags bentonite, 30 gal water. +2 bags Portland +1/4 bag bentonite 15 gal water

0845 AS realizes she forgot field book at CH trailer; retrieves notebook.

0915 AS back on site; RH and Jeremiah Knuth communicate with all on site that hydroaxing will take place today. Be aware if work needs to stop so they can clear brush and trees. Elliott Wilson (EW) and Mike Kelly (MK) on site for well development activities today. EW and TD discuss site activities at CG039, RH calls to communicate with RH.

0930 AS takes WL at IW01455I. 88.31 bgs.

1000 TD and SL begin grouting IW01455I.

1010 AS takes WLs at:

		WL	TD
(middle)	ROI 3983	17.1' bgs	34.8' bgs
(outside)	AP-3983R	17.9' bgs	41' bgs
(fence)	IW-01-3983	17.33' bgs	37.8' bgs
(road)	IW-02-3983	17.7 bgs	39.15' bgs

1030 (approx time) EW and MK begin purging wells.

1040 Jeremiah Knuth (JK) arrives on site to assist with development. EW will be leaving site soon so the work van is used for battery power.

1105 JK leaves site to retrieve external battery and turbidity meter. Van battery would not work for low flow cell. MK is using his work truck

1110 Grout for casing complete. Total: 6 bags Portland cement, 1 bag bentonite, 45 gal water. Begin mixing more grout.

1135 JK back on site with battery and turbidity meter.

1150 Take WL at AP 3983: 21.72' BTOC

Calculate flow rate: 0.3 gal/min.

Time	DTW	pH	COND	DO	Temp	ORP	turb
1200	21.73'	7.03	0.369	224	7.36	37.7	445

Rite in the Rain

JBER-R CGØ39 7.24.13

1215 Surge 35-38' interval for 3 min
1218 Purge @ 0.3 gal/min. Setting on pump 10.5
1228 Surge 36-35' interval for ~3 min
1233 Start purge @ ~0.3 gal/min
1244 end purge ~719 NTU turbidity
1249 continue surge of 38-41' interval
1300 Hydroax arrives on site, begins clearing.
1315 AS makes lunch run; TD & SL take lunch. JK and MK remain on site.
~~1345~~ 1400 AS returns. Communicates with Rich Horn and Kristen Stevens about resampling of 5 IDW drums and sampling 7 more. KS will print
1430 labels; AS will gather bottleware
1500 Begin drilling CGØ39-IW-02-4551

Time	Depth	Comments
1513	~~lead~~ 5'	Lead rod
1525	10'	added 5'
1533	15'	added 5'
1540	20'	added 5'
1600	25'	Water at 20', added 5'
1610	30'	added 5'
1623	35'	added 5'
1640	40'	added 5'
1655	45'	added 5'
1712	50'	added 5'
1730	55'	added 5'
1740	60'	5' added
1800	65'	5' added
1815	70'	5' added
1830	75'	5' added

1600 AS begins collecting resamples for VOCs and moisture samples for IDW01-IDW05. Moisture samples collected for IDW07-IDW08.
1840 ~~1640~~ Cease drilling at 75'. Will pick up tomorrow. Clean up for day
AS

1900 AS checks out of range control. Calls RH, informs of day's activities.
1930 AS arrives at CH yard. Drops sample coolers off in trailer.
1940 Leave base for the day.

Amanda Sam 7.24.13

JBER-R CG039 7.25.13

0730 Annika Seay (AS) arrives at CH trailer. Ices samples and completes paperwork for samples.

Collected yesterday:		Time collected	Date collected
IDW01RE	SVOCS & moisture	1610	7.24.13
IDW02RE		1620	
IDW03RE		1635	
IDW04RE		1630	
IDW05RE		1700	
IDW07	moisture	1655	
IDW08	moisture	1645	

0800 Travis Drewry (TD), Sean Lee (SL), and Mike Kelly (MK) arrive at trailer.

0810 Hold Health and Safety meeting. Discuss wearing face shields during rod decon. Elliott Wilson (EW) provided the shields yesterday. Slips, trips, falls main hazard. Stay hydrated. Continue to be cautious of traffic.

0815 Jeremiah Knuth (JK) arrives at CH trailer.

0820 AS, TD, SL, MK mobe to site. AS heads back to trailer after dumping trash to retrieve forgotten sample cooler. Checks in w/ Range Control.

0850 AS arrives at site. TD and SL are setting up for day's work. MK runs errand, takes supplies to EW.

0915 JK arrives at site; begins setting up for well development activities.

0920 Continue drilling at IW-02-~~4550~~ cuttings 4551, (Ceased at 75' yesterday)

Time	Depth	Comments
0930	80'	5' added
0950	85'	5' added
1005	90'	5' added

1005 TD informs AS the ~~Hinge well~~ is staying open well. Will drill 1' more and then ~~collect~~ drive AT sample.

1040 Pull ~~tasing~~ rods AT. Prepare to pull sample.

1115 TD informs AS he has met refusal at 92.5'. Cannot progress. AS calls RH. TD will pull what he has of ~~sa~~ cuttings a sample. AS will photograph and log; put what is available in jcars. RH will call Andy and then call AS back with final decision. Water is observed from ~89-90'. Drill through boulder/rock. Go back down and resample - full 5' from 91-96'. TD has reservations about continuing. TD calls EW. Note: Photo taken indicates 91-96'; all that was recovered

was 91-92.5', JK talks with RH. Crew will meet w/ RH at lunch to discuss going further at IW-02-4551.

1320 Leave site for lunch. At lunch discuss situation with RH. Decided to try to drill thru rock to depth. RH will be coming out to the site. No more sampling will be done.

1320 Finish lunch and head back to the site.

1350 TD sends hammer back down hole.

1400 Set back in sending down hammer - winch line came loose and jammed. TD working to dislodge it.

1405 RH on site

1445 Winch line dislodged

1500 Begin AS continue at IW-02-4551

1525 Reach 95'. RH calls Corey Schwabenlander (CS). Water was encountered from 90-93', then dried up for last 2' of interval. CS advises to set screen from 89-94'. TD and SL begin process of pulling rod (cleaning out hole first), and will then progress to setting the well.

1600 AS takes IDW drum samples

Drum	Time Collected	Methods
IDW09	1600	VOCs & Moisture
IDW10	1610	↓
IDW11	1620	↓
IDW12	1625	↓
IDW13	1630	↓
(late entry) IDW06RE	1925	↓

1730 Pouring sand in well after setting 5' screen. 5 bags used. Add Pel-Plug (3/4 bucket + 5 gal water)

1845 Leave site for day

1900 Arrive at CH yard. AS checks out with Range control. Leaves samples at trailer for Mike Landon.

1915 AS leaves base for day. Calls JK to inform she has purge equipment in the van.

AS 7.25.13

JBER-R CGΦ39 7.26.13

0745 Annika Seay (AS), Travis Drewry (TD), and Sean Lee (SL) Meet at CH trailer site.
0900 Hold Health and Safety meeting. Might be working in the rain - discuss what would be a 'stop work' situation in rainy atmosphere.
0920 Rich Horn (RH) arrives at trailer. Discuss yesterday's work and plans for today. Also discuss the next site in the project.
0830 AS calls to check in with Range Control. AS, TD, SL mobe to site,
0845 Arrive at site; AS returns to trailer to retrieve supplies. TD and SL begin to mix grout.
0910 AS returns to site. TD and SL are mixing grout. AS reviews final well installation in WP. Updates paperwork and makes HAZCOM list.
16 bags cement, 3/4 bag bentonite, 45 gal water. Casing is grouted.
Casing grouted. Will obtain more water at lunch break to continue grouting
1000 Pull casing.
1040 AS takes WL. WL ~~88.5~~ 88.5' bgs TD = 94.3' bgs
TD and SL begin cleanup and mobing to IW-02-4550.
1110 Decon rods. TD and AS go over Hazcom lists AS compiled.
1130 TD, SL, AS take lunch.
1230 Head back to site after lunch. TD and SL take air compressor to refuel. AS heads to site; waits outside gate for them to return.
1305 TD and SL return with fuel for the compresson. SL takes water tank to refill. TD ~~sets~~ sets up at IW-02-4550. AS places call to RH to confirm sampling will not take place at this well since we sampled IW-01-4550 from 30-45'. RH confirms that is correct. AS calls Dave Britch at IDW yard to let him know we will have a large batch of drums headed to the IDW yard tomorrow. Dave confirms Rich Horn has relayed this to him.
1350 AS samples IDW drums 14-18

Drum	Time	Method
IDW14	1420	SW8260C, Moisture
IDW15	1430	SW8260C, Moisture
IDW16	1440	SW8260C, Moisture
IDW17	1450	SW8260C, Moisture

1400 TD Begins drilling at IW-02-4550. SL arrives back on site.
1500 Hitting water @ 23'
1600 Drilled to depth. Begin clearing hole.
1620 AS collects IDW18 sample. RH on site.
1630 AS collects IDW20 sample.
1635 Begin setting well. Screen 25-45'.

JBERR CG039 7.26.13

1445 RH and AS leave site to check out new site (AVMA). Make plans for staging area.

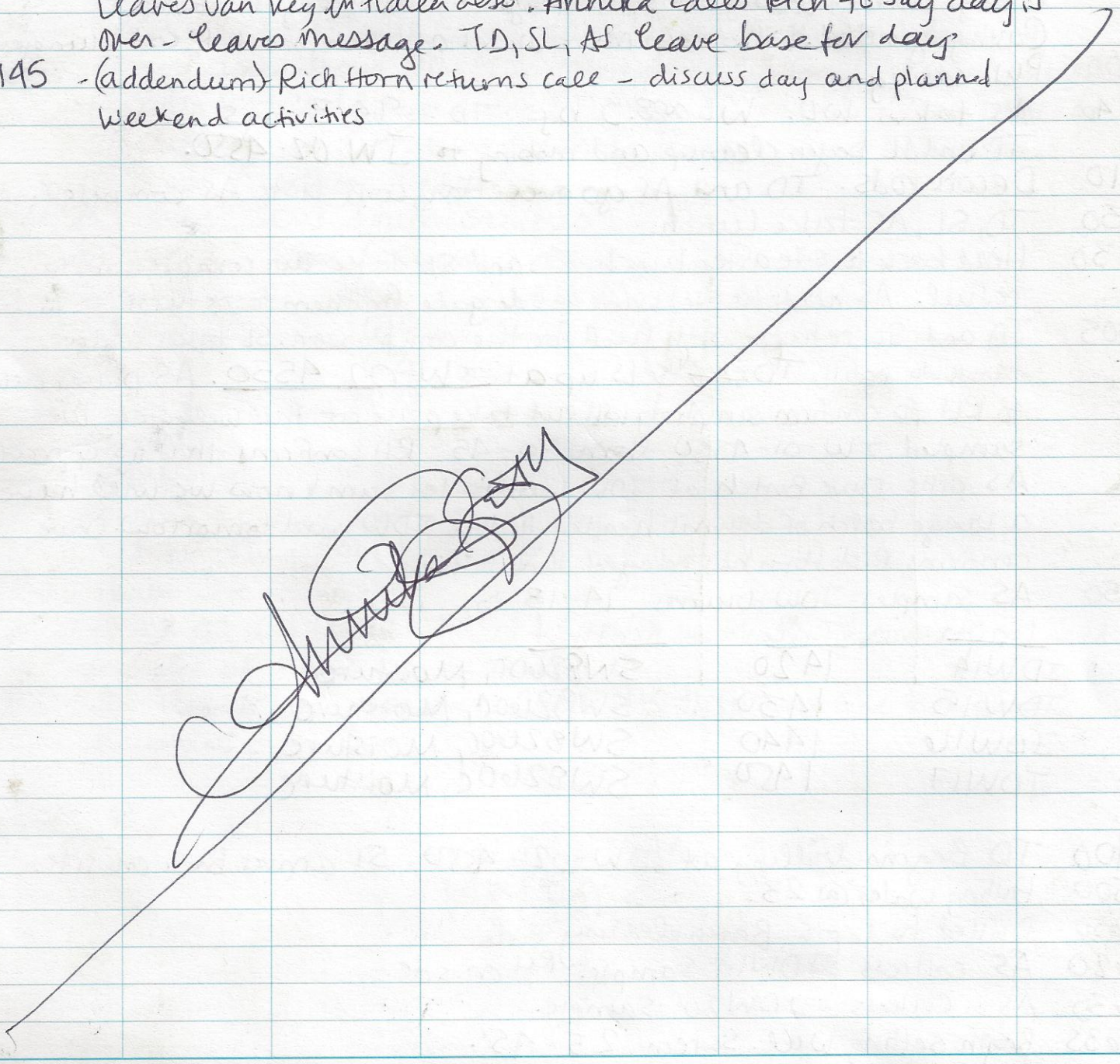
1730 AS arrives back at CG039. TD & SL are working on well completion.

1745 AS takes water level; WL = 20.1' bgs TD = 44.2' bgs ~~TD and SL begin mixing grout as pel-plug hydrates.~~ AS Pel-plug hydrate will grout tomorrow morning Begin clean up of site. Prep for mobing tomorrow.

1852 Call Range Control and check out while TD & SL refuel Zoomboom. Leave site for the day.

1930 Arrive at CH trailer. AS drops IOW samples at trailer. Leaves van key in trailer also. Annika calls Rich to say day is over - leaves message. TD, SL, AS leave base for day

1945 - (addendum) Rich Horn returns call - discuss day and planned weekend activities



JBER-R CGØ39 7-27-13

0745 Annika Seay (AS) arrives at CH trailer site. Glen Rawson (GR) and Sean Lee (AS) arrive shortly thereafter,

0800 Hold Health and safety meeting. Today is a mob. to new site day, so the main hazards are heavy lifting, overhead loads, awkward positioning, slips trips and falls, caution on Poleline when driving with very weighted loads, and other matters concerned with mobilization. GR and SL head to site to begin mixing grout for the 2 wells that are being completed this morning. AS calls Range Control to check in and follows behind after re-icing samples from yesterday. Range Control out at 1700 today.

0900 GR and SL have grout mixed and are beginning to pull casing of IW-02-4550. SL informs AS that 3 bags portland, 1 bag bentonite, and 15 gal water provided enough grout to complete IW-02-4550 and IW-02-4551. GR and SL begin deconning grout mixer and cleaning up site.

		WL BTOC	ID BTOC
1000	AS takes WLS		
1005	IWØ1-4550	22.65'	47.4'
1010	IWØ1-~~4550~~ 4551	93'	N/A (4ft stick up, not enough line)
1015	IWØ2-4551	90.1'	95.8' (sharpie feel down outer casing)
1025	IWØ2-4550	23.5'	47.6'

1040 GR and SL continue cleanup. Moving IDW drums onto trailer. AS breaks down work station

1115 AS take sample from IDW18 (SW846 8015C & moisture) GR and SL secure IDW drums to trailer.

1140 Trailer is packed with drums - set out for IDW yard. AS follows behind ~~GR~~ and SL. GR is driving truck and trailer; SL in ~~Zoom Boom~~.

1210 AS arrives at CH trailer and drops samples while GR and SL continue to IDW yard to drop off IDW drums.
AS takes lunch.

1310 AS finishes lunch; starts working on paperwork.

1330 AS hears from SL that they are back on site. AS heads to site.

1350 AS arrives on site. GR and SL are packing up a load to take to the next site.

1400 GR, SL, AS leave site to take load to new site (AVMA). GR drives

1500 Load dropped. Head to yard to collect AS rods. Go back to Poleline to get another load for AVMA site.

1640 AS is very low on fuel in van - takes off site to refuel.

1700 AS back on site. Calls Range Control to let them know we are still on base but will be gone by this evening. SL and GR take another load to the new site (AVMA).

JBER-R CGØ39 7.27.13

1730 GR & SL arrive at site. Begin unloading. Left at CGØ39 to clean up: well completions, grout mixer, rig, some trash to clean up. Fence needs to be fixed back in place. Miscellaneous

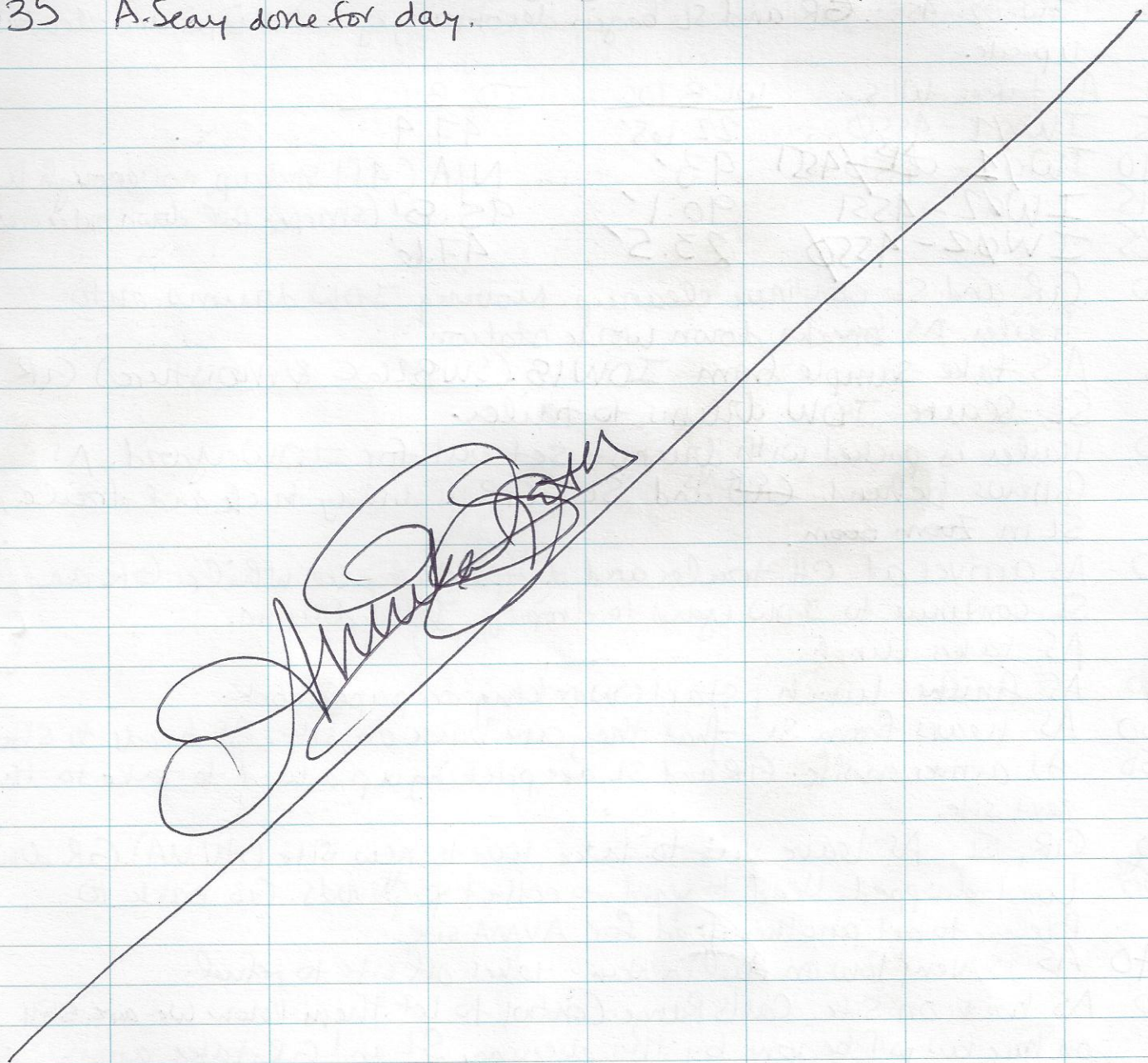
1500 LATE ENTRY AS places call to Rich Horn. Rich informed AS he will most likely be out of service area this weekend. This was a non-emergency call - wanted to inform of very squeaky breaks on van after work at Pdelene Road site the past 3 weeks.

1745 Finish unloading at AVMA. Go to IDW yard to dispose of decon water.

1800 Finish dropping of IDW; return to CH yard. Go over DQR with GR.

1820 GR and SL off CH site. AS completes IDW paperwork.

1835 A. Seay done for day.



JBER-R CG039 / AVMA 7.29.13

0730 (AS) Annika Seay arrives on base. Communicates about Saturday's activities with site manager Rich Horn (RH).

0745 AS arrives at site trailer. Travis Drewry (TD) and Sean Lee (SL) arrive shortly thereafter.

0800 Hold health and safety meeting. Continuing mobing today - discuss traffic on Poleline, Wildlife, heat / bugs, pinch points, loading / unloading

0830 TD and SL leave for CG039. AS calls Range control. Jeremiah Hunth at trailer. Discusses activity for the day.

0845 AS leaves for CG039.

0900 AS arrives on site. TD & SL are cleaning up. Fix fence back in original position. Pick up trash. Elliott Wilson arrives on site to pick up drum lifter.

1040 TD, SL, AS leave Poleline site with rig and first load of day for AVMA site. Rig is walked down road. AS follows behind in van, with hazards on.

1150 TD, SL, AS arrive at AVMA site. Unload rig. Staging trailer at site. Trees that were cut down have still not been cleared. AS observes new site and makes mental note of possible safety issues / precautions to ~~must~~ AS take.

1200 Mob. to throw away trash and drop off water drums at CH yard. TD & SL refuel, get fuel for rig.

1245 Lunch break. RH joins TD, SL, and AS at lunch. Discuss CG039 and AVMA. RH and AS discuss daily field call.

1320 TD, SL, head out to Poleline to complete site cleanup. AS follows shortly.

1340 AS arrives at CG039 as TD & SL are preparing to leave. All mobe to AVMA.

1350 AS stops by CH trailer, gets water for crew. RH gives AS the site WP. RH and AS mobe to AVMA. TD arrives at AVMA as AS & RH are leaving to retrieve air compressor.

1400 RH goes over site w/ crew. Walks site, discusses possible safety hazards.

1430 Hold H&S meeting regarding new site. Uneven ground, slips / trips / falls are the main concerns. Wildlife is also a possibility as the site backs up to a wooded area. Mosquitos and other flying / stinging insects also a possibility. Still waiting for trees and brush that was removed this weekend to be cleared from the site.

1500 RH leaves site. SL takes compressor to refuel.

1530 SL back on site. TD setting up at IW-01-4413. No drums - EW unavailable to answer phone.

1550 EW returns call - TD & SL mobe to Weston yard to retrieve drums.

JBER-R CC#39/AVMA

1550 (cont'd) AS heads to CH yard for RR break.
1610 TD, SL, AS back on site. TD, SL set up air compressor and cyclone.
1650 Begin at IW-01-4413

Time	Depth	Comments
~~AS 1650 1600~~	~~5~~ 5'	lead rod
1715	10'	5' added
1730	15'	5' added
1740	20'	5' added
1745	25'	5' added
1755	30'	5' added

~~AS 1750~~ Cease drilling for day at 30'. Begin cleanup
1800 AS leaves site for Poseline Rd.
1820 AS arrives at Poseline. Sketches well locations.

Fig 1

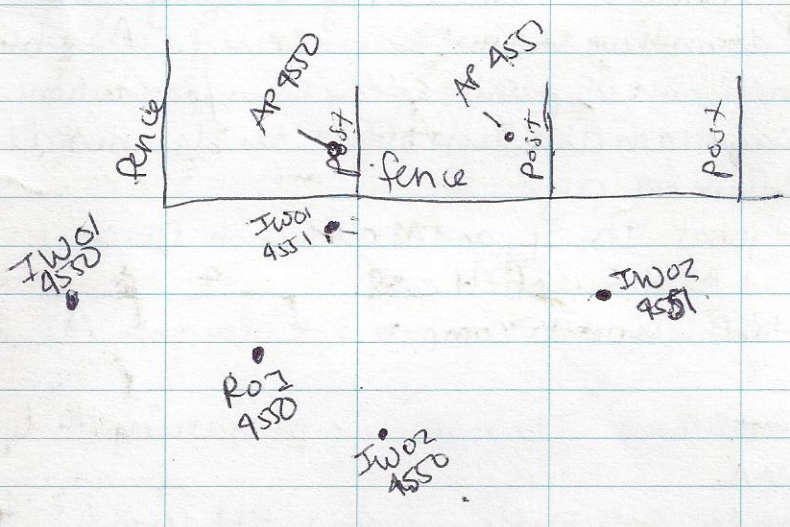
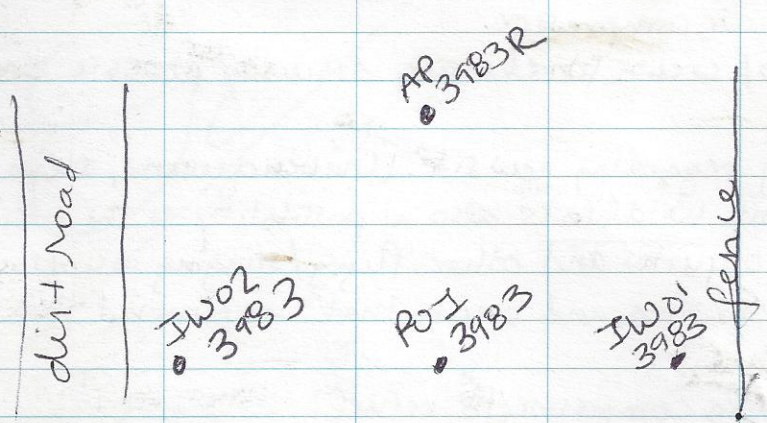


Fig 2



1835 AS finishes sketches, checks out with Range control, leaves Poseline.
1850 AS arrives at trailer site. Drops off van. Gathers paper work. Leaves base.

9/10/13 Poleline Road EVO Injections

Personnel: Corey Schwabenland
Andrew Caster
Mark Augustyn

0800: Arrive at field office. Review SPCC training presentation, EVO Injection AHA, and SPCC Plans. Gather equipment and mobilize to site...

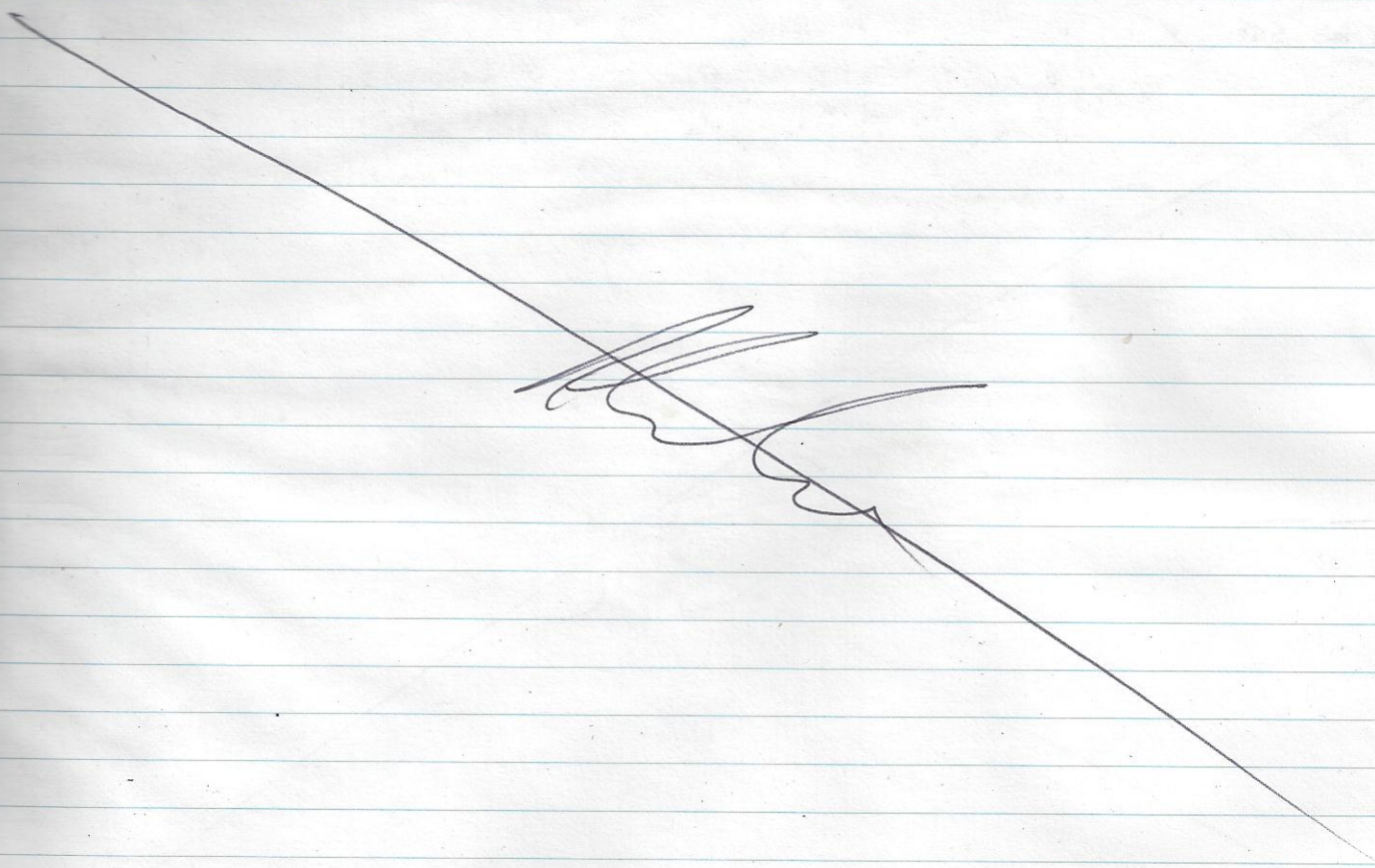
0845: Arrive at Poleline Road. Mark and Andy begin set-up. Corey begin recording water levels.

0930 COREY COLLECTS BASELINE GROUNDWATER QUALITY PARAMETERS FROM PDI-4550 AND AP-4550.

1000 RICH HOGH ARRIVES ONSITE. WORK FOR TODAY INCLUDES INJECTION AT AP-4550 INJECTION WELLS. INJECTING 6% SOLUTION OF EVO AND WATER. BECAUSE DOSATRON ONLY MIXES TO 5% SOLUTION, BATCHES WILL BE MADE TO ACCOUNT FOR ADDITIONAL 1% OF EVO. EACH BATCH WILL BE 250 GALLONS AND CONTAIN 3 GALLONS OF EVO. ANTICIPATED THAT WE WILL INJECT ONE WELL AT A TIME WITH 27 BATCHES.

1430 INJECTED UPTO BATCH 13. REALIZED A CONVERSION ERROR BETWEEN MASS AND VOLUME OF EVO WHICH RESULTED IN HAVING ~150 GALLONS LESS OF EVO THAN ANTICIPATED. AS A RESULT, WE WILL STOP ADDING THE ADDITIONAL 3 GALLONS OF EVO TO THE BATCHES AND FINISH INJECTING INTO IW01 4550 AT 5% EVO UNTIL WE REACHED TARGETED TOTAL VOLUME OF INJECTATE SOLUTION. THEN WE WILL ASSESS REMAINING EVO SUPPLY AND ADJUST ALL OTHER EVO INJECTION VOLUMES ACCORDINGLY.

1600 FINISHED INJECTION AT IW01-4550. SEE OTHER LOG BOOK FOR DETAILS. DEPART PDA FOR FIELD OFFICE.



9/10/2013 Polecine Road EVO Injection - AP-4550

WATER LEVELS

AP-4550

Time	WL
1055*	18.48
*Collected after baseline collected	
1605	18.50
9/11/13	
0916	21.75
	~~21.12~~
1504	18.58
1832	18.73

IW01-4550

Time	WL
0925	23.14
~~[illegible]~~	~~[illegible]~~
1755	21.32*
* 20 MIN AFTER STOPPING INJECTION	
0907	23.07
1500	21.12
1819	21.15

IW02-4550

Time	WL
0925	23.00
*1558	20.93
0912	22.83

RoI-4550

Time	WL
0910	25.04
1103	21.51
1557	18.70
0909	23.79
1501	9.60
1820	10.67

AP-4551

Time	WL
0956	95.66
1603	95.70
9/11/13	
0915	95.61
1505	95.70
1830	95.72

IW01-4551

Time	WL
0950	92.16
1600	92.20
0910	92.07
1502	92.23
1821	92.26

IW02-4551

Time	WL
0952	91.59
1600	91.63
0913	91.48
1503	91.64
1822	91.67

[illegible]

BASELINE SAMPLING for IW01-4550

AP-4550

TIME	TEMP	(uS/cm) COND	pH	ORP	TURBIDITY	DESCRIPTION
0935	6.52	209	6.54	-6.5	OVER RANGE	GRAY, CLOUDY
1155	5.64	209	6.70	-45.0	OVER RANGE	GRAY, CLOUDY
1356	6.66	256	7.03	-79.3	OVER RANGE	MILKY, OIL BREAKTHROUGH

RW01-4550

0940	6.30	332	6.98	-35.9	661.4	slightly cloudy
1200	6.85	349	6.75	-40.0	465	cloudy* looking like breakthrough
1350	6.62	447	7.09	-95.7	OVER RANGE	MILKY WHITE OIL BREAKTHROUGH

IW02-4550

* At ~1400 HRS, pull sample out of IW02-4550 using bailer. Water is slightly milky/cloudy indicating breakthrough laterally @ this well. Will continue to grab samples to see if water changes to look like substrate.

@ 1525 HRS, clear substrate breakthrough is evident. Water in well is not milky white.

AP-3983 & associated wells

* 1620 HRS → collect WLs & note that substrate has on pole; run bailer down and confirm that all wells in that group contain substrate at seemingly high concentrations

AP-3989

* After observing substrate @ -3983, wanted to check downgradient well to determine if substrate breakthrough has occurred there. Ran bailer. It had not broken through → water was clear.

9/11/13 POLELINE ROAD TREATABILITY STUDY EVO INJECTIONS WEATHER: 48°, MODERATE RAIN

PERSONNEL: ANDREW CASTOR, MARK AUGUSTYN

0800 ARRIVE AT FIELD TRAILER. CONDUCT H&S TAILGATE MEETING. DISCUSS ELECTRICAL SAFETY.

0830 ARRIVE AT POLELINE ROAD DISPOSAL AREA. ASSIGNMENT FOR TODAY IS TO INJECT EVO INTO IW02-4550 AND COMPLETE INJECTIONS AT AP-4550 TARGET TREATMENT ZONE. BEGIN COLLECTING WATER LEVELS AND VISUAL WATER SAMPLES AT SURROUNDING WELLS.

1000 FINISH WATER LEVEL MEASUREMENTS. BEGIN SETTING UP INJECTION SYSTEM. TRANSFER REMAINING EVO FROM TOTE BY DRAINING FROM BOTTOM VALVE. INJECTION INTO IW02-4550 REQUIRES AN ADDITIONAL 60 GALLONS OF EVO ABOVE THE 5% PROVIDED BY DOSATRON. THOSE WILL BE ADDED IN 2 BATCHES MADE WITH 30 GALLONS/TOTE (275 GALLONS). ADDED POWER STRIP TO INJECTION SYSTEM TO CONTROL PUMP AT THE INJECTION SYSTEM.

1105 BEGIN INJECTING INTO IW02-4550.

1320 COREY SCHWABENLANDER, LEAH WALLER, JEREMY BLEI, AND RICH HORN ONSITE.

1420 C. SCHWABENLANDER, L. WALLER, J. BLEI, AND DEPART SITE.

1430 RICH HORN DEPARTS SITE TO CLEAN 15 GAL BARRELS.

1545 AFTER REVIEW OF GALLONS OF OIL USED COMPARED TO ANTICIPATED GALLONS OF EVO USED IT WAS DISCOVERED THAT THE DOSATRON IS ACTUALLY ONLY MIXING AT 4.5% SOLUTION WHEN SET AT 5%. THIS IS LIKELY DUE TO THE VISCOSITY OF THE EVO REGARDING ITS INCORPORATION INTO THE DOSATRON AT THE PROPER RATE.

1650 TRANSFERRED ~ 80 GALLONS OF EVO FROM CONNEX AT AP-3983 TO CONNEX AT AP-4550

1830 FINISH INJECTION. INJECTED 375 GAL EVO, 6750 GALLONS OF INJECTATE TOTAL.

1900 FLUSHED WELL WITH 250 GALLONS OF WATER

1915 DEPART SITE

BASELINE SAMPLING for IW01-4550

AP-4550

TIME	TEMP	(uS/cm) COND	pH	ORP	TURBIDITY	DESCRIPTION
0935	6.52	209	6.54	-6.5	OVER RANGE	GRAY, CLOUDY
1155	5.64	209	6.70	-45.0	OVER RANGE	GRAY, CLOUDY
1356	6.66	256	7.03	-79.3	OVER RANGE	MILKY, OIL BREAKTHROUGH

RW01-4550

0940	6.30	332	6.98	-35.9	661.4	slightly cloudy
1200	6.85	349	6.75	-40.0	465	cloudy* looking like breakthrough
1350	6.62	447	7.09	-95.7	OVER RANGE	MILKY WHITE OIL BREAKTHROUGH

IW02-4550

* At ~1400 HRS, pull sample out of IW02-4550 using bailer. Water is slightly milky/cloudy indicating breakthrough laterally @ this well. Will continue to grab samples to see if water changes to look like substrate.

@ 1525 HRS, clear substrate breakthrough is evident. Water in well is not milky white.

AP-3983 & associated wells

* 1620 HRS → collect WLs & note that substrate has on pole; run bailer down and confirm that all wells in that group contain substrate at seemingly high concentrations

AP-3989

* After observing substrate @ -3983, wanted to check downgradient well to determine if substrate breakthrough has occurred there. Ran bailer. It had not broken through → water was clear.

BATCH COUNTS

IWOI-4550

BATCH	TOTAL GALLONS	EVO ADDED	FLOW RATE	Start time	Wellhead Pressure
1	250	3 gallons	27-28	1045	4 psi
2	250	3 gallons	25.5	1053	5 psi
3	250	3 gallons	20.5	1124	7 psi
4	250	3 gallons	21.5	1135	7 psi
5	250	3 gallons	21.0	1203	6 psi
6	250 / TOTALIZER 1551	3 gallons	20.8	1215	6 psi
7	250	3 gallons	21.7	1237	6 psi
8	250	3 gallons	21.9	1248	6 psi
9	250	3 gallons	21.3	1325	7 psi
10	250	3 gallons	20.0	1339	7 psi
11	250	3 gallons	19.2	1356	7
12	250	3 gallons	21.0	1410	7 psi
13	250	3 gallons	20.5	1425	7 psi
14	250 / totalizer 3605	3 gallons	19.5	1435	7.5 psi

☆ Stop batch processing after #14. From here on out we will stop adding extra EVO to the batches and just run from the dosatron. Using totalizer to record volume.

TIME	TOTALIZER	
1510	4075	
1710	6360	
1735	6750	→ stop dosing and begin flush
	6985	→ system flushed

TREATABILITY STUDY INJECTION MONITORING AT 1WO2-4550 9/11/13

TIME	TOTALIZER (GAL)	PRESSURE (PSI)	INSTANTANEOUS FLOWRATE (GPM)	NOTES
1104	BEGIN INJECTING			
1112	184	8	20	
1154	893	8	17	
1217	1307	8	16.6	
1241	1670	8	17	ADDED 30 GAL BATCH OF EVO
1343	2643	9	15	
1520	4090	10	15.3	ADDED 40 GAL BATCH OF EVO
1650	5382	10	14.3	
1807	6466	10	13.8	
1830	6750	10	13.5	

INJECTION OF EVO SOLUTION COMPLETE

INJECTED ~375 GALLONS OF EVO

FLUSHED WELL WITH 250 GALLONS OF WATER

WATER LEVELS

AP-3983		IW01-3983		IW02-3983		RO1-3983	
TIME	WL	TIME	WL	TIME	WL	TIME	WL
1005	22.35	1005	21.88	1005	22.15	1005	21.80
1621	21.55	1620	20.40	1620	20.44	1620	20.12
9/11/13							
0930	22.13 *	0926	21.88 *	0925	22.04 *	0925	21.70 *
1508	21.66	1507	20.89	1506	21.06	1507	20.71
1838	21.60	1836	20.95	1834	21.10	1835	19.78

AP-4519		AP-3986		~~AP-4352~~ AP-4353		AP-4354	
1025	21.04	1035	20.53	1035	31.28	1035	6.78
1611	19.95	1613	20.11	1615	31.04	1615	6.79
9/11/13							
0903	20.92			850	31.83	853	6.63
1445	20.21	1452	20.34	1445	31.46	1449	6.29
1818	20.10	1816	20.20	1810	31.04	1812	6.33

* OIL PRESENT IN WELL

WATER LEVELS

AP-3981		AP-4518		AP-3989			
TIME	WL	TIME	WL	TIME	WL	TIME	WL
1040	18.65	1100	21.64				
1615	18.25	1609	21.50				
9/11/13							
0859	18.54			0935	23.96		
1451	18.44			1509	23.90		
1814	18.32			1840	23.84		

9/12/13 POLELINE ROAD TREATABILITY STUDY EVO INJECTIONS

PERSONNEL: ANDREW CASTOR, MARK AUGUSTYN WEATHER: PARTLY CLOUDY 50°

730 ARRIVE AT FIELD OFFICE. LOAD SUPPLIES

830 ARRIVE AT POLELINE ROAD DISPOSAL AREA. WORK TODAY INCLUDES: INJECTION OF EVO AND FERROUS SULFATE SOLUTION INTO IW01-4551 AND IW02-4551. BEGIN SETTING UP INJECTION SYSTEM AND MIXING BATCHES OF FERROUS SULFATE. EACH 250 GALLON BATCH REQUIRES 30 lbs FERROUS SULFATE.

930 BEGIN MEASURING WATER LEVELS AND BASELINE SAMPLING FOR WATER QUALITY PARAMETERS AT IW02-4551 AND AP-4551

1100 BEGIN INJECTING AT IW01-4551. FORMATION IS TIGHT INJECTING AT ~5 GPM. PLAN TO INJECT 1350 GALLONS OF SOLUTION AT IW01-4551. CONTAINING 150 GALLONS OF EVO AND 326 lbs FERROUS SULFATE. WILL INJECT ONE WELL AT A TIME UNTIL WE SEE BREAKTHROUGH AT IW02-4551.

1130 BREAKTHROUGH AT IW02-4551. DECIDE TO INJECT ONE BATCH AT IW02-4551 TO TEST INJECTION RATE AND EQUALIZE BATCHES INTO EACH WELL

1150 INJECT BATCH INTO IW02-4551 AT 40 GPM WITH 0 PRESSURE. WILD DISCREPANCY BETWEEN FLOWRATE OF IW01-4551 (<3 GPM) AND IW02-4551 (40 GPM). DECIDE TO COMPLETE INJECTION AT IW02-4551 BEFORE FINISHING IW01-4551.

1230 CONTINUE INJECTING INTO IW02-4551.

1315 FINISH INJECTING INTO IW02-4551. INJECTED 1380 GALLONS SOLUTION CONTAINING ABOUT 150 GALLONS EVO AND 160 lbs FERROUS SULFATE.

1400 AIR DISPLACEMENT ISSUE (POSSIBLY) IS PREVENTING INJECTION INTO IW01-4551.

1510 RICH HORN AND DONNA BAUMLER ARRIVE AT SITE.

1700 RICH HORN AND DONNA BAUMLER DEPART SITE.

1750 FINISH BATCH 3 INJECTION INTO IW01-4551.

1800 BEGIN FLUSHING IW02-4551

1815 FINISH FLUSHING, CLEAN UP. DEPART SITE.

WATER LEVELS INJECTION OF IW01-4551 / IW02-4551 9/12/13

IW01-4551

TIME	DTW
0936	92.33
9/13/13	
0900	92.15

IW02-4551

TIME	DTW
0945	91.74
9/13/13 1638	91.15

AP-4551

TIME	DTW
0946	95.75
1336	95.25
1555	95.20
* BREAKTHROUGH	
9/13/13 0902	95.63
1646	95.50

AP-4353

TIME	DTW
1002	31.41
1600	31.23
9/13/13 0910	31.19
1656	31.20

AP-4017

TIME	DTW
COULD NOT FIND	

AP-4349

TIME	DTW
0949	75.96
1604	75.93
9/13/13 0915	75.82
1644	75.90

AP-4525

TIME	DTW
1010	799.40
TAPE ONLY GOES TO 100 FT	
1615	799.40

AP-4011

COULD NOT FIND

BASELINE GROUNDWATER QUALITY MEASUREMENTS

AP-4551

TIME	TEMP	pH	COND (µS/cm)	ORP	TURB	
1043	6.01	6.47	303	40.3	649	GRAY/CLOUDY
1555	OILY WHITE BREAKTHROUGH					

IW02-4551

TIME	TEMP	pH	COND (µS/cm)	ORP	TURB
1050	5.98	6.76	263	17.1	98.9
1145	OILY WHITE BREAKTHROUGH AFTER INJECTING 200 GALLONS				

9/12/13 / 9/13/13 TREATABILITY STUDY INJECTION POLELINE ROAD

INJECTION AT IW02-4551 BATCH INJECTION WITH 30 lbs FERROUS SULFATE AND 2.7 GALLONS OF ADDED EVO

TIME	BATCH	BATCH VOLUME	TOTALIZER (gal)	FERROUS SULFATE (lbs)	ADD. EVO (gal)	PRESSURE	GPM
1100	1	250	0	30	3	12	8.5 → 2.1
1415	2	~~250~~ 275	228*	30	3	12	1.3
1540	3	275	800	30	3	12	TOTALIZER FLOW METER NOT WORKING
9/13/13 0920	4	275	1075	30	3	12	
1210	5	275	1350	~~30~~ 40	3	12	
1530	FINISHED INJECTION						

FLUSHED WITH 100 GALLONS OF WATER

* TOTAL DIFFERENCE FROM FILLING SYSTEM HOSES

9/12/13 INJECTION AT IW02-4551 BATCH INJECTION WITH 30 lbs FERROUS SULFATE AND 2.7 GALLONS ADDED EVO

TIME	BATCH	BATCH VOLUME	TOTALIZER	FERROUS SULFATE	ADD EVO	PRESSURE	GPM
1150	1	~~250~~ 275	0	30	2.7	0	40
1226	2	~~250~~ 275	278*	30	2.7	0	34
	3	~~250~~ 275	[illegible]	30	2.7	0	32
	4	~~250~~ 275	827	30	2.7	0	30
1330	5	~~250~~ 275	[illegible]	30	2.7	1-2	28
	FINISHED INJECTION		1380				

FLUSHED WITH 230 GALLONS OF WATER

* SYSTEM WAS FILLED FROM IW02-4551

9/13/13 POLELINE ROAD TREATABILITY STUDY EVO INJECTIONS WEATHER, 48°, RAIN/CLOUDS

PERSONNEL: ANDREW CASTOR, MARK AUGUSTYN, JENN ULRICH

730 ARRIVE AT FIELD OFFICE, GATHER SUPPLIES

830 ARRIVE AT POLELINE ROAD DISPOSAL AREA BEGIN SETTING UP FOR CONTINUATION AT IWD1-4551.

900 MEASURE WATER LEVELS.

920 BEGIN INJECTING INTO IWD1-4551.

1530 FINISH INJECTING INTO IWD1-4551. INJECTED ABOUT 75 GALLONS OF EVO AND 160 lbs OF FERROUS SULFATE.

1700 MOVE EQUIPMENT TO CONNEX AT AP-3983.

1800 TEST INJECTION WELLS IWD1-3983 AND IWD2-3983 BY INJECTING 100 GALLONS OF WATER INTO EACH. BOTH WELLS WILL ACCEPT >30 GPM.

1815 DEPART SITE.

~~1845~~ (AS)

9/12/13 / 9/13/13 TREATABILITY STUDY INJECTION POLELINE ROAD

INJECTION AT IW02-4551 BATCH INJECTION WITH 30 lbs FERROUS SULFATE AND 2.7 GALLONS OF ADDED EVO

TIME	BATCH	BATCH VOLUME	TOTALIZER (gal)	FERROUS SULFATE (lbs)	ADD. EVO (gal)	PRESSURE	GPM
1100	1	250	0	30	3	12	8.5 → 2.1
1415	2	~~250~~ 275	228*	30	3	12	1.3
1540	3	275	800	30	3	12	TOTALIZER FLOW METER NOT WORKING
9/13/13 0920	4	275	1075	30	3	12	
1210	5	275	1350	~~30~~ 40	3	12	
1530	FINISHED INJECTION						

FLUSHED WITH 100 GALLONS OF WATER

* TOTAL DIFFERENCE FROM FILLING SYSTEM HOSES

9/12/13 INJECTION AT IW02-4551 BATCH INJECTION WITH 30 lbs FERROUS SULFATE AND 2.7 GALLONS ADDED EVO

TIME	BATCH	BATCH VOLUME	TOTALIZER	FERROUS SULFATE	ADD EVO	PRESSURE	GPM
1150	1	~~250~~ 275	0	30	2.7	0	40
1226	2	~~250~~ 275	278*	30	2.7	0	34
	3	~~250~~ 275	[illegible]	30	2.7	0	32
	4	~~250~~ 275	827	30	2.7	0	30
1330	5	~~250~~ 275	[illegible]	30	2.7	1-2	28
	FINISHED INJECTION		1380				

FLUSHED WITH 230 GALLONS OF WATER

* SYSTEM WAS FILLED FROM IW02-4551

9/14/13 POLELINE ROAD TREATABILITY STUDY EVO INJECTIONS

PERSONNEL: ANDREW CASTOR, MARK AUGUSTYN WEATHER: PATCHY FOG, CLEAR, 50°

800 ARRIVE AT FIELD OFFICE.

810 GO TO AVMA TO TRANSFER 30 GALLONS OF EVO FOR USE AT POLELINE ROAD

845 DEPART AVMA FOR POLELINE ROAD

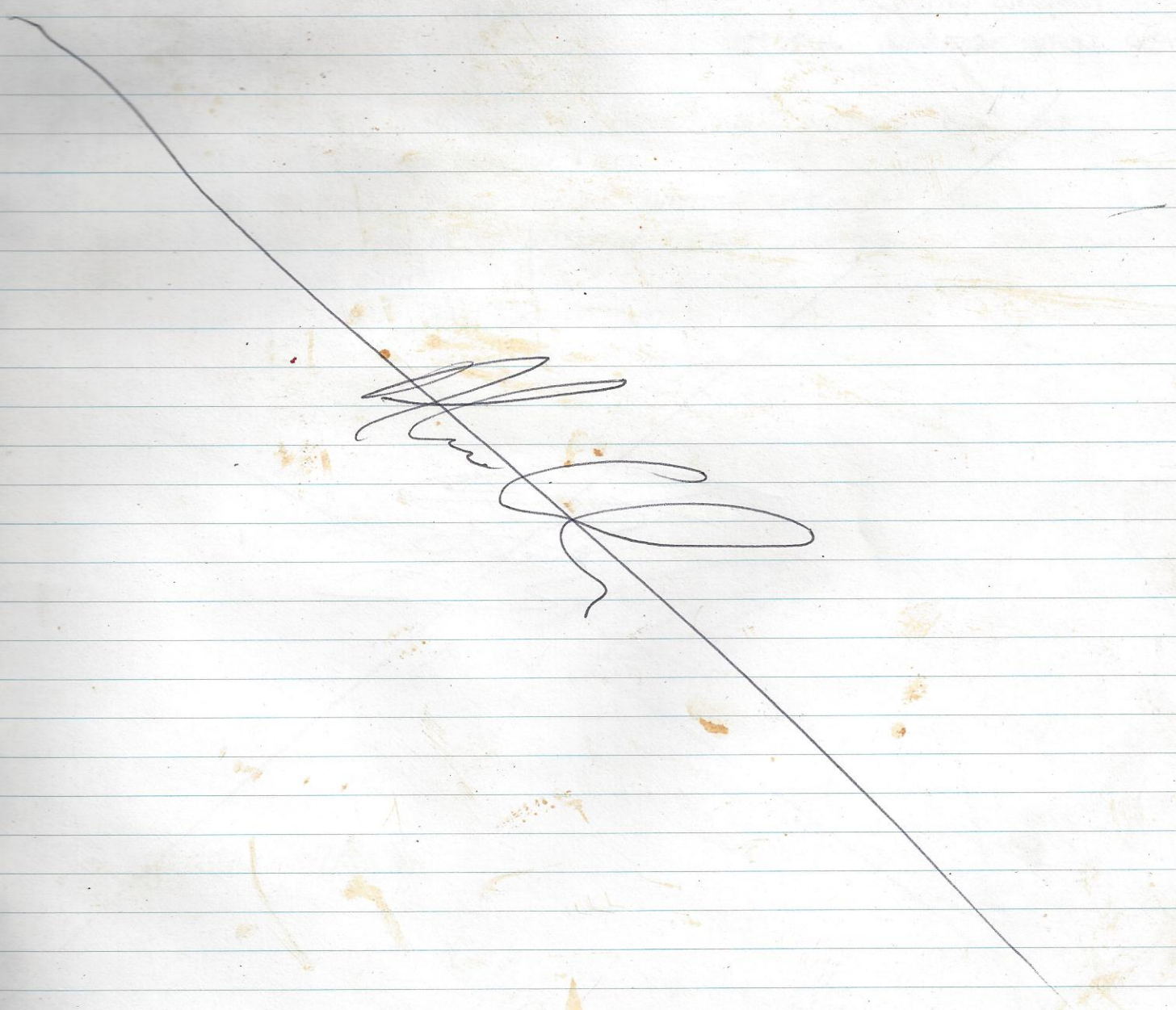
905 ARRIVE AT POLELINE ROAD DISPOSAL AREA. BEGIN SETTING UP FOR TODAYS WORK: INJECTION OF EVO AND FERROUS SULFATE AT AP-3983 TARGET TREATMENT ZONE. INJECTIONS WILL BE IN BATCHES (275 GALLON) CONTAINING 3 GALLONS OF ADDED EVO AND 33 lbs FERROUS SULFATE.

1030 MEASURE WATER LEVELS

1100 BEGIN INJECTING INTO IW01-3983 AND IW02-3983

1800 FINISH INJECTING FOR TODAY. INJECTED 4406 GALLONS INTO IW01-3983 AND 4450 GALLONS INTO IW02-3983. FLUSHED EACH WELL WITH 100 GALLONES OF WATER.

1845 DEPART SITE.



9/14/13 WATER LEVELS FOR INJECTION AT IWO1-3983 AND IWO2-3983

AP-3983

TIME	DTW
941	21.85
1803	19.03

IWO1-3983

TIME	DTW
939	21.61

IWO2-3983

TIME	DTW
937	21.90

ROI-3983

TIME	DTW
938	21.53
1805	17.70

AP-3989

TIME	DTW
1040	23.59
1816	23.10

ON BREAKTHROUGH

AP-4550

TIME	DTW
1056	21.44
1822	20.17

IWO1-4550

TIME	DTW
1045	22.95
1824	21.90

IWO2-4550

TIME	DTW
1044	22.67
1823	21.57

AP-4518

TIME	DTW
~~1040~~	~~23.59~~ (AP)
1052	21.45
1819	21.18

AP-3747

TIME	DTW
1026	19.42
1810	19.33

AP-3744

TIME	DTW
1045	23.17
1813	23.07

AP-3745

TIME	DTW
1054	17.93
1820	17.21

AP-4519

TIME	DTW
1050	20.75
1818	20.10

DID NOT TAKE WATER QUALITY READINGS AT ROI WELL (ROI-3983) OR PERFORMANCE WELL (AP-3983) AS BREAKTHROUGH OCCURRED DURING INJECTION AT AP-4550

9/14/13 INJECTION BATCH COUNT FOR IW01-3983 AND IW02-3983

BATCH	TIME	VOLUME	ADDED EVO	FERROUS	IW01 PSI	IW02 PSI	TOTALIZER IW01	TOTALIZER IW02 GPM
1	1102	275	3	33 lbs	0	0	135	144
2	1112	275	3	33	0	0	287	277
3	1130	275	3	33	0	0	513	326
4	1140	275	3	33	—	0	513	594
5	1152	275	3	33	0	—	790	594
6	1202	275	3	33	—	0	790	874
7	1212	275	3	33	0	—	1076	874
8	1222	275	3	33	—	0	1076	1151
9	1232	275	3	33	0	—	1353	1151
10	1242	275	3	33	—	0	1353	1432
11	1253	275	3	33	0	—	1638	1432
12	1303	275	3	33	—	0	1638	1703
13	1317	275	3	33	0	—	1915	1703
14	1329	275	3	33	—	0	1915	1981
15	1403	275	3	33	0	—	2191	1981
16	1413	275	3	33	—	0	2191	2252
17	1423	275	3	33	0	—	2462	2252
18	1437	275	3	33	—	0	2462	2526
19	1448	275	3	33	0	—	2738	2526
20	1457	275	3	33	—	0	2738	2795
21	1507	275	3	33	0	—	3014	2795
22	1518	275	3	33	—	0	3014	3069
23	1538	275	3	33	0	—	3292	3069
24	1553	275	3	33	—	0	3292	3346
25	1604	275	3	33	0	—	3566	3346
26	1638	275	3	33	—	0	3566	3614
27	1648	275	3	33	0	—	3845	3614
28	1658	275	3	33	—	0	3845	3890
29	1708	275	3	33	0	—	4122	3890
30	1718	275	3	33	—	0	4122	4171
31	1728	275	3	33	0	—	4406	4171
32	1738	275	3	33	—	0	4406	4450
* 33	908	275	3	33	0	—	4671	4450
34	917	275	5	33	—	0	4671	4724
35	927	275	5	33	0	—	4951	4724
36	938	275	5	33	—	0	4951	5015
37	947	275	5	33	0	—	5230	5015
38	959	275	5	33	—	0	5230	5282
39	1008	275	5	33	0	0	5388	5400

* 9/15/13 FLUSH EACH WITH 250 GALLONS OF WATER

9/15/13 POLELINE ROAD TREATABILITY STUDY EVO INJECTIONS

PERSONNEL: ANDREW CASTOR MARK AUGUSTYN WEATHER: 40°, SUNNY HIGH 63°

0800 ARRIVE AT FIELD OFFICE. LOAD SUPPLIES IN FIELD TRUCK.

0830 ARRIVE AT POLELINE ROAD DISPOSAL AREA TO CONTINUE INJECTIONS AT AP-3983 TARGET TREATMENT ZONE. WILL CONTINUE ALTERNATING INJECTIONS AT IW01-3983 AND IW02-3983.

900 BEGIN INJECTING STARTING AT IW01-3983

1030 FINISH INJECTING. INJECTED 610 GALLONS EVO AND 1300 lbs FERROUS SULFATE

TOTAL INJECTION VOLUME 10,800 GALLONS

OIL BREAKTHROUGH AT AP-3989

1130 BEGIN TRANSPORTING EQUIPMENT TO AVMA.

1530 FINISH TRANSPORTING EQUIPMENT TO AVMA. BEGIN SETTING UP AT AVMA.

1600 MEASURE WATER LEVELS

1700 TEST INJECTION WELLS WITH WATER. ALL WELLS FREELY ACCEPT INJECTION AT 0 PSI AND >30 GPM EXCEPT IW03 WHICH HAD 10 PSI AND 30 GPM. WE WILL INJECT TOMORROW WITH EVO.

1800 DEPART SITE.

9/15/13 AVMA TREATABILITY STUDY GROUNDWATER LEVELS AND BASELINE

AP-4413		IW01-4413		IW02-4413		IW03-4413		IW04-4413	
TIME	DTW	TIME	DTW	TIME	DTW	TIME	DTW	TIME	DTW
1558	71.62	1557	71.00	1555	71.40	1554	71.95	1553	72.46
1024	71.46	~~1024~~	~~70.85~~	1009	70.99	1005	71.48	1406	71.88
1153	71.46	1411	70.75	1505	70.93	1408	69.92		
1412	71.39								

~~AP-4411~~		AP-4341		AP-4342		~~AP-3534~~		~~AP-3468~~	
TIME	DTW	TIME	DTW	TIME	DTW	~~TIME~~	~~DTW~~	~~TIME~~	~~DTW~~
1556	71.20	1404	63.87	1610	96.56				
1008	70.99	1512	63.85	1518	96.49				
~~1104~~	70.75								
1409	70.95								

AP-4412		~~AP-3469~~	
TIME	DTW	~~TIME~~	~~DTW~~
1559	>100		

AP-4413 BASELINE GROUNDWATER QUALITY MEASUREMENTS

TEMP	PH	COND	ORP	TURBIDITY	
7.20	7.82	289	-209.3	34.1	CLEAR

ROI-4413

TEMP	PH	COND	ORP	TURBIDITY	~~COLOR~~
7.08	7.41	309	-202.3	OVER RANGE	CORAY, CLOUDY

BREAKTHROUGH AT IW03, ROI AFTER INJECTING IW04
NO BREAKTHROUGH AT IW02 OR 4413 AFTER INJECTING IW01
BREAKTHROUGH AT AP-4413 AFTER INJECTING IW02
DID NOT TAKE GW QUALITY READINGS AT AP-4413 AND ROI-4413 FOLLOWING OIL BREAKTHROUGH

9/4/13 AVMA TREATABILITY STUDY EVO INJECTIONS

PERSONNEL: ANDREW CASTER, MARK AUGUSTYN, JENN FRAME

WEATHER: CLEAR, 38°

0730 ARRIVE AT FIELD OFFICE, GATHER SUPPLIES

0745 CONDUCT SPCC PLAN TRAINING.

0925 MOB TO AVMA AND BEGIN SETTING UP FOR EVO INJECTIONS. PLAN TO INJECT 4000 GALLONS OF EVO SOLUTION CONTAINING 225 GALLONS OF EVO. ADD AN ADDITIONAL 3 GALLONS OF EVO PER 275 GALLON BATCH TO MAKE UP REMAINING.

0940 BEGIN INJECTING IW04-4413

1013 FINISH INJECTING IW04-4413

1130 BEGIN INJECTING IW03-4413 WELL ONLY INJECTING AT 1-2 GPM. WILL SWITCH TO IW01-4413.

1026 BEGIN INJECTING IW01-4413

1120 FINISH INJECTING IW01-4413

1125 BEGIN INJECTING IW02-4413

1155 FINISH INJECTING IW02-4413.

1150 BEGIN INJECTING IW03-4413. INJECTING VERY SLOWLY AT 15 PSI. UNREGADABLE BY FLOW METER

1250 STOP INJECTING IW03-4413. INJECTING AT < 1 GPM. WILL DISTRIBUTE REMAINING INJECTATE INTO THE OTHER THREE INJECTION WELLS

1345 FINISH INJECTING AT AVMA. BEGIN FLUSHING INJECTION SYSTEM AND WELLS

1400 MEASURE WATER LEVELS AND BEGIN INJECTION SYSTEM CLEANUP AND TEAR DOWN.

1415 DONNA BAUMGER ARRIVES ONSITE.

1550 FINISH CLEANUP AT AVMA AND DEPART SITE.

9/16/13 AVMA EVO INJECTION BATCH CONT

IW04-4413

BATCH	TIME	VOLUME	ADDED EVO	PRESSURE	TOTALIZER
1	941	275	3	0	276
2	950	275	3	0	555
3	1000	275	3	0	835
4	1008	275	3	0	1002
11 CONT	1301	275	3	0	1047
12	1310	275	5	0	+ 272
					1319

IW03-4413

BATCH	TIME	VOLUME	ADDED EVO	PRESSURE	TOTALIZER	
4 CONT	1020	275	3	14	18 *	
11 CONT	1158	275	2	15	53 *	TOTALIZER NOT WORKING

STOP INJECTING AT IW03-4413 WILL DISTRIBUTE REMAINING INJECTATE TO THE OTHER THREE WELLS

IW01-4413

BATCH	TIME	VOLUME	ADDED EVO	PRESSURE	TOTALIZER
4 CONT	1036	275	3	0	90
5	1040	275	3	0	385
6	1050	275	3	5	664
7	1100	275	3	0	956
8	1113	275	3	0	1001
14	1333	275	9	0	1269

IW02-4413

BATCH	TIME	VOLUME	ADDED EVO	PRESSURE	TOTALIZER
8 CONT	1122	275	3	0	242
9	1130	275	3	0	532
10	1138	275	3	0	814
11	1145	275	3	0	1000
13	1320	275	9	0	1290

TOTAL VOLUME OF INJECTATE = 3931 GALLONS CONSISTING OF 228 GALLONS EVO

Appendix B
Spill Prevention, Control, and Countermeasure Plan

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Tier I Qualified Facility SPCC Plan

This SPCC Plan was developed for Joint Base Elemendorf-Richardson for the Poleline Road Disposal TCE Contamination remediation project. When completed and signed by the owner or operator of the facility meets the applicability criteria in §112.3(g)(1). This template addresses the requirements of 40 CFR part 112. Maintain a complete copy of the Plan at the facility if the facility is normally attended at least four hours per day, or for a facility attended fewer than four hours per day, at the nearest field office. When making operational changes at a facility that are necessary to comply with the rule requirements, the owner/operator should follow state and local requirements (such as for permitting, design and construction) and obtain professional assistance, as appropriate.

Facility Description

Facility Name: Joint Base Elmendorf-Richardson - CG039 - Poleline Road Disposal Area

Facility Address: Poleline Road and Barrs Boulevard

City: Anchorage State: Alaska ZIP: 99506

County: Anchorage Tel. Number: (801) 558 - 6032

Owner or Operator Name: CH2M HILL

Owner or Operator Address: 160 W. 68th Avenue

City: Anchorage State: Alaska ZIP: 99518

County: Anchorage Borough Tel. Number: (907) 267-2600

I. Self-Certification Statement (§112.6(a)(1))

The owner or operator of a facility certifies that each of the following is true in order to utilize this template to comply with the SPCC requirements:

I Corey Schwabenlander certify that the following is accurate:

1. I am familiar with the applicable requirements of 40 CFR part 112;
2. I have visited and examined the facility;
3. This Plan was prepared in accordance with accepted and sound industry practices and standards;
4. Procedures for required inspections and testing have been established in accordance with industry inspection and testing standards or recommended practices;
5. I will fully implement the Plan;
6. This facility meets the following qualification criteria (under §112.3(g)(1)):
    a. The aggregate aboveground oil storage capacity of the facility is 10,000 U.S. gallons or less; and
    b. The facility has had no single discharge as described in §112.1(b) exceeding 1,000 U.S. gallons and no two discharges as described in §112.1(b) each exceeding 42 U.S. gallons within any twelve month period in the three years prior to the SPCC Plan self-certification date, or since becoming subject to 40 CFR part 112 if the facility has been in operation for less than three years (not including oil discharges as described in §112.1(b) that are the result of natural disasters, acts of war, or terrorism); and
    c. There is no individual oil storage container at the facility with an aboveground capacity greater than 5,000 U.S. gallons.
7. This Plan does not deviate from any requirement of 40 CFR part 112 as allowed by §112.7(a)(2) (environmental equivalence) and §112.7(d) (impracticability of secondary containment) or include any measures pursuant to §112.9(c)(6) for produced water containers and any associated piping;
8. This Plan and individual(s) responsible for implementing this Plan have the full approval of management and I have committed the necessary resources to fully implement this Plan.

I also understand my other obligations relating to the storage of oil at this facility, including, among others:

1. To report any oil discharge to navigable waters or adjoining shorelines to the appropriate authorities. Notification information is included in this Plan.
2. To review and amend this Plan whenever there is a material change at the facility that affects the potential for an oil discharge, and at least once every five years. Reviews and amendments are recorded in an attached log [See Five Year Review Log and Technical Amendment Log in Attachments 1.1 and 1.2.]
3. Optional use of a contingency plan. A contingency plan:
    a. May be used in lieu of secondary containment for qualified oil-filled operational equipment, in accordance with the requirements under §112.7(k), and;
    b. Must be prepared for flowlines and/or intra-facility gathering lines which do not have secondary containment at an oil production facility, and;
    c. Must include an established and documented inspection or monitoring program; must follow the provisions of 40 CFR part 109; and must include a written commitment of manpower, equipment and materials to expeditiously remove any quantity of oil discharged that may be harmful. If applicable, a copy of the contingency plan and any additional documentation will be attached to this Plan as Attachment 2.

I certify that I have satisfied the requirement to prepare and implement a Plan under §112.3 and all of the requirements under §112.6(a). I certify that the information contained in this Plan is true.

Signature _____ Title: Project Manager

Name Corey Schwabenlander Date: 9/9/2013

II. Record of Plan Review and Amendments

Five Year Review (§112.5(b)):

Complete a review and evaluation of this SPCC Plan at least once every five years. As a result of the review, amend this Plan within six months to include more effective prevention and control measures for the facility, if applicable. Implement any SPCC Plan amendment as soon as possible, but no later than six months following Plan amendment. Document completion of the review and evaluation, and complete the Five Year Review Log in Attachment 1.1. If the facility no longer meets Tier I qualified facility eligibility, the owner or operator must revise the Plan to meet Tier II qualified facility requirements, or complete a full PE certified Plan.

Table G-1 Technical Amendments (§§112.5(a), (c) and 112.6(a)(2))	
This SPCC Plan will be amended when there is a change in the facility design, construction, operation, or maintenance that materially affects the potential for a discharge to navigable waters or adjoining shorelines. Examples include adding or removing containers, reconstruction, replacement, or installation of piping systems, changes to secondary containment systems, changes in product stored at this facility, or revisions to standard operating procedures.	☒
Any technical amendments to this Plan will be re-certified in accordance with Section I of this Plan template. *[§112.6(a)(2)]* **[See Technical Amendment Log in Attachment 1.2]**	☒

III. Plan Requirements

1. Oil Storage Containers (§112.7(a)(3)(i)):

Table G-2 Oil Storage Containers and Capacities			
This table includes a complete list of all oil storage containers (aboveground containers[a] and completely buried tanks[b]) with capacity of 55 U.S. gallons or more, unless otherwise exempt from the rule. For mobile/portable containers, an estimated number of containers, types of oil, and anticipated capacities are provided.			☒
Oil Storage Container *(indicate whether aboveground (A) or completely buried (B))*	**Type of Oil**	**Shell Capacity (gallons)**	
A – Totes stored in Conex Container (3 totes per Conex)	Emulsified vegetable oil (EVO)	275 (6)	

See attached Figure 1 for oil storage location.

A small spill kit will be located adjacent to the oil storage location area.

Total Aboveground Storage Capacity [c]	1,650	gallons
Total Completely Buried Storage Capacity	0	gallons
Facility Total Oil Storage Capacity	1,650	gallons

[a] Aboveground storage containers that must be included when calculating total facility oil storage capacity include: tanks and mobile or portable containers; oil-filled operational equipment (e.g. transformers); other oil-filled equipment, such as flow-through process equipment. Exempt containers that are not included in the capacity calculation include: any container with a storage capacity of less than 55 gallons of oil; containers used exclusively for wastewater treatment; permanently closed containers; motive power containers; hot-mix asphalt containers; heating oil containers used solely at a single-family residence; and pesticide application equipment or related mix containers.

[b] Although the criteria to determine eligibility for qualified facilities focuses on the aboveground oil storage containers at the facility, the completely buried tanks at a qualified facility are still subject to the rule requirements and must be addressed in the template; however, they are not counted toward the qualified facility applicability threshold.

[c] Counts toward qualified facility applicability threshold.

2. Secondary Containment and Oil Spill Control (§§112.6(a)(3)(i) and (ii), 112.7(c) and 112.9(c)(2)):

Table G-3 Secondary Containment and Oil Spill Control	
Appropriate secondary containment and/or diversionary structures or equipment[a] is provided for all oil handling containers, equipment, and transfer areas to prevent a discharge to navigable waters or adjoining shorelines. The entire secondary containment system, including walls and floor, is capable of containing oil and is constructed so that any discharge from a primary containment system, such as a tank or pipe, will not escape the containment system before cleanup occurs.	☒

[a] Use one of the following methods of secondary containment or its equivalent: (1) Dikes, berms, or retaining walls sufficiently impervious to contain oil; (2) Curbing; (3) Culverting, gutters, or other drainage systems; (4) Weirs, booms, or other barriers; (5) Spill diversion ponds; (6) Retention ponds; or (7) Sorbent materials.

Table G-4 below identifies the tanks and containers at the facility with the potential for an oil discharge; the mode of failure; the flow direction and potential quantity of the discharge; and the secondary containment method and containment capacity that is provided.

Table G-4 Containers with Potential for an Oil Discharge

Area	Type of failure (discharge scenario)	Potential discharge volume (gallons)	Direction of flow for uncontained discharge	Secondary containment method[a]	Secondary containment capacity (gallons)
Bulk Storage Containers and Mobile/Portable Containers[b]					
6 - 275-Gallon Totes of EVO (3 totes per Conex)	Puncture, improper storage, improper handling	275	Localized	20ml. poly lined 10'x8'x1' Conex container, covered when in use.	80 ft^3 or ~598 gallons in each Conex Container
Tote Unloading Operations	Incidental releases during transfer operations, puncture of tote during unloading	1	Localized	Absorbent, Absorbent Booms, and Pads (active), Stored in Conex	4 gallons
Tote Dispensing Operations	Incidental releases during dispensing operations, release valve operational error	1	Localized	Absorbent, Absorbent Booms, and Pads (active), Stored in Conex	4 gallons

[a] Use one of the following methods of secondary containment or its equivalent: (1) Dikes, berms, or retaining walls sufficiently impervious to contain oil; (2) Curbing; (3) Culverting, gutters, or other drainage systems; (4) Weirs, booms, or other barriers; (5) Spill diversion ponds; (6) Retention ponds; or (7) Sorbent materials.
[b] For storage tanks and bulk storage containers, the secondary containment capacity must be at least the capacity of the largest container plus additional capacity to contain rainfall or other precipitation.

3. Inspections, Testing, Recordkeeping and Personnel Training (§§112.7(e) and (f), 112.8(c)(6) and (d)(4), 112.9(c)(3), 112.12(c)(6) and (d)(4)):

Table G-5 Inspections, Testing, Recordkeeping and Personnel Training	
An inspection and/or testing program is implemented for all aboveground bulk storage containers and piping at this facility. *[§§112.8(c)(6) and (d)(4), 112.9(c)(3), 112.12(c)(6) and (d)(4)]*	☒

The following is a description of the inspection and/or testing program (e.g. reference to industry standard utilized, scope, frequency, method of inspection or test, and person conducting the inspection) for all aboveground bulk storage containers and piping at this facility:

Monthly visual inspections are conducted on the following equipment:

- Aboveground Portable Containers (STI SP001 Portable Container – see Monthly Inspection checklist, Attachment 5)

Integrity testing can be performed through visual examination of portable containers. Service life for portable container is provided below. If container is to be used past that time, the portable container must be U.S. Department of Transportation (DOT) tested and recertified.

- Plastic portable container - every 7 years
- Steel portable container - every 12 years
- Stainless Steel portable container - every 17 years

Inspection, testing, and maintenance records are maintained with the SPCC Plan for a period of three years. The monthly inspection form can be found in this document as Attachment 5:

Inspections, tests, and records are conducted in accordance with written procedures developed for the facility. Records of inspections and tests kept under usual and customary business practices will suffice for purposes of this paragraph. *[§112.7(e)]*	☒
A record of the inspections and tests are kept at the facility or with the SPCC Plan for a period of three years. *[§112.7(e)]* **[See Inspection Log and Schedule in Attachment 3.1]**	☒
Inspections and tests are signed by the appropriate supervisor or inspector. *[§112.7(e)]*	☒

Personnel, training, and discharge prevention procedures [§112.7(f)]

Personnel responsible for oil-handling operations at the facility are trained on the following topics:

- Applicable pollution control laws, rules, and regulations;
- Operation and maintenance of equipment to prevent oil discharges;
- Purpose and overview of SPCC Plan;
- Review of potential spill areas and drainage routes;
- Review of emergency response procedures;
- Review of spill cleanup equipment locations and the proper use of the equipment;
- Recent spill events (if any), subsequent response and corrective action.

Personnel responsible for inspections are trained on proper inspection procedures, frequency of inspections, record-keeping requirements, and procedures for reporting and correcting detected problems. The EVO Injection project is not expected to exceed one year in duration; however, if the project and oil storage containers are onsite for more than one

year, annual refresher training and exercises/drills are completed in association with this SPCC Plan.	
Oil-handling personnel are trained in the operation and maintenance of equipment to prevent discharges; discharge procedure protocols; applicable pollution control laws, rules, and regulations; general facility operations; and, the contents of the facility SPCC Plan. *[§112.7(f)]*	☒
A person who reports to facility management is designated and accountable for discharge prevention. *[§112.7(f)]* Name/Title: Corey Schwabenlander / Project Manager	☒
Discharge prevention briefings are conducted for oil-handling personnel annually to assure adequate understanding of the SPCC Plan for that facility. Such briefings highlight and describe past reportable discharges or failures, malfunctioning components, and any recently developed precautionary measures. *[§112.7(f)]* **[See Oil-handling Personnel Training and Briefing Log in Attachment 3.4]**	☒

4. Security (excluding oil production facilities) §112.7(g):

Table G-6 Implementation and Description of Security Measures	
Security measures are implemented at this facility to prevent unauthorized access to oil handling, processing, and storage area.	☒

Access to the facility must be gained through the Joint Base Elmendorf-Richardson security station, which is manned 24 hours per day. Additionally, fencing is in place on all sides of the facility.

Sufficient lighting is provided to allow for detection of spills at night and to prevent vandalism. Joint Base Richardson-Elmendorf has sufficient lighting at the facility to assist in the discovery of discharge during hours of darkness and to prevent discharges through acts of vandalism.

5. Emergency Procedures and Notifications (§112.7(a)(3)(iv) and 112.7(a)(5)):

Table G-7 Description of Emergency Procedures and Notifications

The following is a description of the immediate actions to be taken by facility personnel in the event of a discharge to navigable waters or adjoining shorelines *[§112.7(a)(3)(iv) and 112.7(a)(5)]*:

Initial Spill Response

In the event of a spill, the person who first discovers the spill or release shall immediately contact the Project Manager at (801) 558-6032. In the event of a spill after business hours or for emergency response, 911 will be contacted. Note the size of the spill, the location, the material, if hazards are present (i.e. fire, explosions) and whether the spill is contained or still releasing.

Do the following only if you have adequate training to do so without risk to your own personal safety:

- Evacuate personnel to a safe distance.
- Stop the material from spilling (shut off valves, turn drum upright, etc.).
- Shut off ignition sources such as motors, electrical power, etc.
- Contain the spill with available equipment (dirt berms, absorbent socks, sand bags, etc.)
- Divert spill to an area where it will cause less harm using dikes or berms.
- Clean up the spill, if within capabilities
- Stand by to direct emergency response personnel when they arrive.

If the spill is small has not contaminated any open water, reached a drain, or contaminated significant quantities of soil and you are fully aware of how to protect yourself from all hazards associated with the material, then proceed as follows:

1. DO NOT FLUSH INTO STORM SEWER OR DRAINAGE DITCH.
2. DO NOT ADD WATER TO FLUSH OUT THE STORM SEWER OR STRUCTURE.
3. Collect all spilled material in a properly labeled, approved hazardous waste container.
4. Clean all surfaces or objects that have been contaminated by the spilled material.
5. Collect all disposable, contaminated objects and cleanup materials and place in a properly labeled, approved hazardous waste container.

If you are uncertain what to do, treat the situation as a worst-case emergency

Notification Procedures

1. Base PM will be notified of spill by CH2MHILL PM/EM.

2. Alaska Department of Environmental Conservation (ADEC) will be notified by the Base PM (via telephone and written notice) of any spills in the following circumstances:
   - Any amount spilled to water will be reported immediately.
   - Spills to land greater than 55 gallons will be reported immediately.
   - Spills to land greater than 10 gallons, but less than 55 gallons, will be reported within 48 hours of identifying the spill.
   - Spills to land of 1 to 10 gallons will be recorded in a spill reporting log and submitted to ADEC monthly.
   - Spills to impermeable secondary containment greater than 55 gallons will be reported within 48 hours.

3. Base PM will notify NRC

Disposal

Any contaminated materials, including absorbents, cloth, soil, wood, etc. that cannot be decontaminated should be placed in an approved United Nations specification drum for storage and final offsite disposal as hazardous waste. Offsite disposal shall be overseen and managed by Project Manager.

6. Contact List (§112.7(a)(3)(vi)):

Table G-8 Contact List	
Contact Organization / Person	**Telephone Number**
National Response Center (NRC)	1-800-424-8802
EPA Regional Administrator (RA) Dennis McLerran 1200 6th Ave. Suite 900 Seattle, WA. 98101	(206)-553-0479
Key Facility Personnel	
Designated Person Accountable for Discharge Prevention: Project Manager - Primary (Corey Schwabenlander)	Cell: (801) 558 - 6032
Project Manager - Secondary (Leah Waller)	Cell: (916) 402 - 1467
Environmental Manager (Nancy Ballantyne)	Cell: (303) 885 - 9954
Alaska Department of Environmental Conservation (ADEC) Central Alaska Response Team	Normal Business Hours (907) 269 - 3063
	Outside Business Hours 1 - 800 - 478 - 9300
Local Fire Department	(907) 384 – 6230
Local Police Department	(907) 384 – 6230
State of Alaska Emergency Operations Center (EOC)	(907) 428-7100
Hospital	(907) 276 - 1131
Other Contact References: Base Project Manager Donna Baumler JBER RPM, 673D CES/CEANR	(907) 384-2318

7. NRC Notification Procedure (§112.7(a)(4) and (a)(5)):

Table G-9 NRC Notification Procedure	
In the event of a discharge of oil to navigable waters or adjoining shorelines, the following information identified in Attachment 4 will be provided to the National Response Center immediately following identification of a discharge to navigable waters or adjoining shorelines **[See Discharge Notification Form in Attachment 4]**: *[§112.7(a)(4)]*	☒

- The exact address or location and phone number of the facility;
- Date and time of the discharge;
- Type of material discharged;
- Estimate of the total quantity discharged;
- Estimate of the quantity discharged to navigable waters;
- Source of the discharge;
- Description of all affected media;
- Cause of the discharge;
- Any damages or injuries caused by the discharge;
- Actions being used to stop, remove, and mitigate the effects of the discharge;
- Whether an evacuation may be needed; and
- Names of individuals and/or organizations who have also been contacted.

8. SPCC Spill Reporting Requirements (Report within 60 days) (§112.4):

Joint Base Elmendorf-Richardson - CG039 - Poleline Road Disposal Area will submit information to the EPA Regional Administrator (RA), Dennis McLerran, located at 1200 6th Ave. Suite 900 Seattle, WA. 98101 and the appropriate agency or agencies in charge of oil pollution control activities in the State in which the facility is located within 60 days from one of the following discharge events:

A single discharge of more than 1,000 U.S. gallons of oil to navigable waters or adjoining shorelines or
Two discharges to navigable waters or adjoining shorelines each more than 42 U.S. gallons of oil occurring within any twelve month period

You must submit the following information to the RA:

(1) Name of the facility;
(2) Your name;
(3) Location of the facility;
(4) Maximum storage or handling capacity of the facility and normal daily throughput;
(5) Corrective action and countermeasures you have taken, including a description of equipment repairs and replacements;
(6) An adequate description of the facility, including maps, flow diagrams, and topographical maps, as necessary;
(7) The cause of the reportable discharge, including a failure analysis of the system or subsystem in which the failure occurred; and
(8) Additional preventive measures you have taken or contemplated to minimize the possibility of recurrence
(9) Such other information as the Regional Administrator may reasonably require pertinent to the Plan or discharge

* * * * *

Alaska Department of Environmental Conservation (ADEC) will be notified via written forms provided as Attachment 6 and 7 of this SPCC Plan.

A. Onshore Facilities (excluding production) (§§112.8(b) through (d), 112.12(b) through (d)):

The owner or operator must meet the general rule requirements as well as requirements under this section. Note that not all provisions may be applicable to all owners/operators. For example, a facility may not maintain completely buried metallic storage tanks installed after January 10, 1974, and thus would not have to abide by requirements in §§112.8(c)(4) and 112.12(c)(4), listed below. **In cases where a provision is not applicable, write "N/A".**

Table G-10 General Rule Requirements for Onshore Facilities		N/A
Drainage from diked storage areas is restrained by valves to prevent a discharge into the drainage system or facility effluent treatment system, except where facility systems are designed to control such discharge. Diked areas may be emptied by pumps or ejectors that must be manually activated after inspecting the condition of the accumulation to ensure no oil will be discharged. *[§§112.8(b)(1) and 112.12(b)(1)]*	☐	☒
Valves of manual, open-and-closed design are used for the drainage of diked areas. *[§§112.8(b)(2) and 112.12(b)(2)]*	☐	☒
The containers at the facility are compatible with materials stored and conditions of storage such as pressure and temperature. *[§§112.8(c)(1) and 112.12(c)(1)]*	☒	☐
Secondary containment for the bulk storage containers (including mobile/portable oil storage containers) holds the capacity of the largest container plus additional capacity to contain precipitation. Mobile or portable oil storage containers are positioned to prevent a discharge as described in §112.1(b). *[§112.6(a)(3)(ii)]*	☒	☐
If uncontaminated rainwater from diked areas drains into a storm drain or open watercourse the following procedures will be implemented at the facility: *[§§112.8(c)(3) and 112.12(c)(3)]*		
• Bypass valve is normally sealed closed	☐	☒
• Retained rainwater is inspected to ensure that its presence will not cause a discharge to navigable waters or adjoining shorelines	☐	☒
• Bypass valve is opened and resealed under responsible supervision	☐	☒
• Adequate records of drainage are kept **[See Dike Drainage Log in Attachment 3.3]**	☐	☒
For completely buried metallic tanks installed on or after January 10, 1974 at this facility *[§§112.8(c)(4) and 112.12(c)(4)]*:		
• Tanks have corrosion protection with coatings or cathodic protection compatible with local soil conditions.	☐	☒
• Regular leak testing is conducted.	☐	☒
For partially buried or bunkered metallic tanks *[§112.8(c)(5) and §112.12(c)(5)]*:		
• Tanks have corrosion protection with coatings or cathodic protection compatible with local soil conditions.	☐	☒
Each aboveground bulk container is tested or inspected for integrity on a regular schedule and whenever material repairs are made. Scope and frequency of the inspections and inspector qualifications are in accordance with industry standards. Container supports and foundations are regularly inspected. **[See Inspection Log and Schedule and Bulk Storage Container Inspection Schedule in Attachments 3.1 and 3.2]** *[§112.8(c)(6) and §112.12(c)(6)(i)]*	☒	☐
Outsides of bulk storage containers are frequently inspected for signs of deterioration, discharges, or accumulation of oil inside diked areas. **[See Inspection Log and Schedule in Attachment 3.1]** *[§§112.8(c)(6) and 112.12(c)(6)]*	☒	☐
For bulk storage containers that are subject to 21 CFR part 110 which are shop-fabricated, constructed of austenitic stainless steel, elevated and have no external insulation, formal visual inspection is conducted on a regular schedule. Appropriate qualifications for personnel performing tests and inspections are documented. **[See Inspection Log and Schedule and Bulk Storage Container Inspection Schedule in Attachments 3.1 and 3.2]** *[§112.12(c)(6)(ii)]*	☐	☒

Table G-10 General Rule Requirements for Onshore Facilities		N/A
Each container is provided with a system or documented procedure to prevent overfills for the container. Describe: Totes are not filled on site.	☒	☐
Liquid level sensing devices are regularly tested to ensure proper operation **[See Inspection Log and Schedule in Attachment 3.1]**. *[§112.6(a)(3)(iii)]*	☐	☒
Visible discharges which result in a loss of oil from the container, including but not limited to seams, gaskets, piping, pumps, valves, rivets, and bolts are promptly corrected and oil in diked areas is promptly removed. *[§§112.8(c)(10) and 112.12(c)(10)]*	☒	☐
Aboveground valves, piping, and appurtenances such as flange joints, expansion joints, valve glands and bodies, catch pans, pipeline supports, locking of valves, and metal surfaces are inspected regularly. **[See Inspection Log and Schedule in Attachment 3.1]** *[§§112.8(d)(4) and 112.12(d)(4)]*	☒	☐
Integrity and leak testing are conducted on buried piping at the time of installation, modification, construction, relocation, or replacement. **[See Inspection Log and Schedule in Attachment 3.1]** *[§§112.8(d)(4) and 112.12(d)(4)]*	☐	☒

ATTACHMENT 1 – Five Year Review and Technical Amendment Logs

ATTACHMENT 1.1 – Five Year Review Log

I have completed a review and evaluation of the SPCC Plan for this facility, and will/will not amend this Plan as a result.

Table G-13 Review and Evaluation of SPCC Plan for Facility			
Review Date	Plan Amendment		Name and signature of person authorized to review this Plan
	Will Amend	Will Not Amend	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	

ATTACHMENT 1.2 – Technical Amendment Log

Any technical amendments to this Plan will be re-certified in accordance with Section I of this Plan template.

Table G-15 Description and Certification of Technical Amendments

Review Date	Description of Technical Amendment	Name and signature of person certifying this technical amendment

ATTACHMENT 2 – Oil Spill Contingency Plan and Checklist

THERE IS NO QUALIFIED OIL-FILLED OPERATIONAL EQUIPMENT AT THIS FACILITY. THEREFORE, THE FACILITY IS NOT REQUIRED TO MEET 40 CFR 109.

An oil spill contingency plan and written commitment of resources is required for:

- Flowlines and intra-facility gathering lines at oil production facilities and
- Qualified oil-filled operational equipment which has no secondary containment.

An oil spill contingency plan meeting the provisions of 40 CFR part 109, as described below, and a written commitment of manpower, equipment and materials required to expeditiously control and remove any quantity of oil discharged that may be harmful is attached to this Plan.	☐

Complete the checklist below to verify that the necessary operations outlined in 40 CFR part 109 - Criteria for State, Local and Regional Oil Removal Contingency Plans - have been included.

Table G-15 Checklist of Development and Implementation Criteria for State, Local and Regional Oil Removal Contingency Plans (§109.5)[a]	
(a) Definition of the authorities, responsibilities and duties of all persons, organizations or agencies which are to be involved in planning or directing oil removal operations.	☐
(b) Establishment of notification procedures for the purpose of early detection and timely notification of an oil discharge including:	
(1) The identification of critical water use areas to facilitate the reporting of and response to oil discharges.	☐
(2) A current list of names, telephone numbers and addresses of the responsible persons (with alternates) and organizations to be notified when an oil discharge is discovered.	☐
(3) Provisions for access to a reliable communications system for timely notification of an oil discharge, and the capability of interconnection with the communications systems established under related oil removal contingency plans, particularly State and National plans (e.g., NCP).	☐
(4) An established, prearranged procedure for requesting assistance during a major disaster or when the situation exceeds the response capability of the State, local or regional authority.	☐
(c) Provisions to assure that full resource capability is known and can be committed during an oil discharge situation including:	
(1) The identification and inventory of applicable equipment, materials and supplies which are available locally and regionally.	☐
(2) An estimate of the equipment, materials and supplies which would be required to remove the maximum oil discharge to be anticipated.	☐
(3) Development of agreements and arrangements in advance of an oil discharge for the acquisition of equipment, materials and supplies to be used in responding to such a discharge.	☐
(d) Provisions for well defined and specific actions to be taken after discovery and notification of an oil discharge including:	
(1) Specification of an oil discharge response operating team consisting of trained, prepared and available operating personnel.	☐
(2) Predesignation of a properly qualified oil discharge response coordinator who is charged with the responsibility and delegated commensurate authority for directing and coordinating response operations and who knows how to request assistance from Federal authorities operating under existing national and regional contingency plans.	☐
(3) A preplanned location for an oil discharge response operations center and a reliable communications system for directing the coordinated overall response operations.	☐
(4) Provisions for varying degrees of response effort depending on the severity of the oil discharge.	☐
(5) Specification of the order of priority in which the various water uses are to be protected where more than one water use may be adversely affected as a result of an oil discharge and where response operations may not be adequate to protect all uses.	☐
(6) Specific and well defined procedures to facilitate recovery of damages and enforcement measures as provided for by State and local statutes and ordinances.	☐

[a] The contingency plan must be consistent with all applicable state and local plans, Area Contingency Plans, and the National Contingency Plan (NCP)

ATTACHMENT 3 – Inspections, Dike Drainage and Personnel Training Logs

ATTACHMENT 3.1 – Inspection Log and Schedule

Table G-16 Inspection Log and Schedule

This log is intended to document compliance with §§112.6(a)(3)(iii), 112.8(c)(6), 112.8(d)(4), 112.9(b)(2), 112.9(c)(3), 112.9(d)(1), 112.9(d)(4), 112.12.(c)(6), and 112.12(d)(4), as applicable.

Date of Inspection	Container / Piping / Equipment	Describe Scope (or cite Industry Standard)	Observations	Name/ Signature of Inspector	Records maintained separately [a]
9/13/17	Tote Storage Areas (Conex Container)	Monthly Visual Inspections (Attachment 5)	TOTES IN GOOD CONDITION SECONDARY CONTAINMENT IN GOOD CONDITION	ANDREW CASTOR	☒
9/13/17	Small spill kit	Monthly Visual Inspections (Documented on Attachment 5)	GOOD CONDITION	ANDREW CASTOR	☐
					☐
					☐
					☐

[a] Indicate in the table above if records of facility inspections are maintained separately at this facility.

ATTACHMENT 3.2 – Bulk Storage Container Inspection Schedule – onshore facilities (excluding production):

To comply with integrity inspection requirement for bulk storage containers, inspect/test each shop-built aboveground bulk storage container on a regular schedule in accordance with a recognized container inspection standard based on the minimum requirements in the following table.

Table G-17 Bulk Storage Container Inspection Schedule

Container Size and Design Specification	Inspection requirement
Portable containers (including drums, totes, and intermodal bulk containers (IBC)) - 275 gallon totes	Visually inspect monthly for signs of deterioration, discharges or accumulation of oil inside diked areas
55 to 1,100 gallons with sized secondary containment - N/A	Visually inspect monthly for signs of deterioration, discharges or accumulation of oil inside diked areas plus any annual inspection elements per industry inspection standards
1,101 to 5,000 gallons with sized secondary containment and a means of leak detection[a j] - N/A	
1,101 to 5,000 gallons with sized secondary containment and no method of leak detection[a] - N/A	Visually inspect monthly for signs of deterioration, discharges or accumulation of oil inside diked areas, plus any annual inspection elements and other specific integrity tests that may be required per industry inspection standards

[a] Examples of leak detection include, but are not limited to, double-walled tanks and elevated containers where a leak can be visually identified.

ATTACHMENT 3.3 – Dike Drainage Log

Table G-18 Dike Drainage Log

Date	Bypass valve sealed closed	Rainwater inspected to be sure no oil (or sheen) is visible	Open bypass valve and reseal it following drainage	Drainage activity supervised	Observations	Signature of Inspector
*** Currently there are no diked areas at the facility, therefore this log is not applicable and does not need to be completed*						

ATTACHMENT 3.4 – Oil-handling Personnel Training and Briefing Log

Table G-19 Oil-Handling Personnel Training and Briefing Log

Date	Description / Scope	Attendees
9/10/13	Reviewed training presentation	Mark Argyrstyre Corey Schwabenlander Andrew Castor

ATTACHMENT 4 - Discharge Notification Form

In the event of a discharge of oil to navigable waters or adjoining shorelines, the following information will be provided to the National Response Center **[also see the notification information provided in Section 7 of the Plan]**:

Table G-20 Information provided to the National Response Center in the Event of a Discharge			
Discharge/Discovery Date		Time	
Facility Name			
Facility Location (Address/Lat-Long/Section Township Range)			
Name of reporting individual		Telephone #	
Type of material discharged		Estimated total quantity discharged	Gallons/Barrels
Source of the discharge		Media affected	☐ Soil ☐ Water (specify) ☐ Other (specify)
Actions taken			
Damage or injuries	☐ No ☐ Yes (specify)	Evacuation needed?	☐ No ☐ Yes (specify)
Organizations and individuals contacted	☐ National Response Center 800-424-8802 Time ☐ Cleanup contractor (Specify) Time ☐ Facility personnel (Specify) Time ☐ State Agency (Specify) Time ☐ Other (Specify) Time		

ATTACHMENT 5 – Portable Containers Inspection – Monthly

STI SP001 Portable Container Monthly Inspection Checklist

General Inspection Information:

Inspection Date: 9/13/13 Retain Until Date: 9/13/16 (36 months from inspection date)

Prior Inspection Date: NA Inspector Name: ANDREW CASTOR

Containers Inspected (ID #'s): NA

Inspection Guidance:

- For equipment not included in this Standard, follow the manufacturer recommended inspection/testing schedules and procedures.
- The periodic AST Inspection is intended for monitoring the external AST condition and its containment structure. This visual inspection does not require a Certified Inspector. It shall be performed by an owner's inspector who is familiar with the site and can identify changes and developing problems.
- (*) designates an item in a non-conformance status. This indicates that action is required to address a problem.
- Non-conforming items important to tank or containment integrity require evaluation by an engineer experienced in AST design, a Certified Inspector, or a tank manufacturer who will determine the corrective action. Note the non-conformance and corresponding corrective action in the comment section.
- Retain the completed checklists for 36 months.

Item	Area: PPDA		Area:		Area:		Area:	
1.0 AST Containment/Storage Area								
1.1 ASTs within designated storage area?	☒Yes	☐No*	☐Yes	☐No*	☐Yes	☐No*	☐Yes	☐No*
1.2 Debris, spills, or other fire hazards in containment or storage area?	☒Yes*	☒No	☐Yes*	☐No	☐Yes*	☐No	☐Yes*	☐No
1.3 Water in outdoor secondary containment?	☐Yes*	☒No	☐Yes*	☐No	☐Yes*	☐No	☐Yes*	☐No
1.4 Drain valves operable and in a closed position?	☒Yes	☐No*	☐Yes*	☐No	☐Yes*	☐No	☐Yes*	☐No
1.5 Egress pathways clear and gates/doors operable?	☒Yes	☐No*	☐Yes*	☐No	☐Yes*	☐No	☐Yes*	☐No

ATTACHMENT 5 – Portable Containers Inspection – Monthly (Continued)

Item	Area: PLOK	Area:	Area:	Area:
2.0 Leak Detection				
2.1 Visible signs of leakage around the container or storage area?	☐Yes* X☐No	☐Yes* ☐No	☐Yes* ☐No	☐Yes* ☐No
3.0 Container				
3.0 Noticeable container distortions, buckling, denting or bulging?	☐Yes* X☐No	☐Yes* ☐No	☐Yes* ☐No	☐Yes* ☐No

Comments: TOTES IN GOOD CONDITION.
SECONDARY CONTAINMENT IN GOOD CONDITION
NO LEAKS

ATTACHMENT 6 - ADEC Oil & Hazardous Substances Spill Notification Form

ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION

OIL & HAZARDOUS SUBSTANCES SPILL NOTIFICATION FORM

ADEC USE ONLY

ADEC SPILL #:	ADEC FILE #:	ADEC LC:

PERSON REPORTING:	PHONE NUMBER:	REPORTED HOW? (ADEC USE ONLY) ☐ Phone ☐ Fax ☐ Troopers
DATE/TIME OF SPILL:	DATE/TIME DISCOVERED:	DATE/TIME REPORTED:
INCIDENT LOCATION/ADDRESS:	DATUM: ☐ NAD27 ☐ NAD83 ☐ WGS84 ☐ Other LAT. LONG.	PRODUCT SPILLED:
QUANTITY SPILLED: ☐ gallons ☐ pounds	QUANTITY CONTAINED: ☐ gallons ☐ pounds	QUANTITY RECOVERED: ☐ gallons ☐ pounds
QUANTITY DISPOSED: ☐ gallons ☐ pounds		

	POTENTIAL RESPONSIBLE PARTY:	OTHER PRP, IF ANY:	VESSEL NAME:
Name/Business:			
Mailing Address:			VESSEL NUMBER:
Contact Name:			> 400 GROSS TON VESSEL: ☐ Yes ☐ No
Contact Number:			

SOURCE OF SPILL:	CAUSE CLASSIFICATION:
CAUSE OF SPILL: ☐ Under Investigation	☐ Accident ☐ Human Factors ☐ Structural/Mechanical ☐ Other

CLEANUP ACTIONS:
DISPOSAL METHODS AND LOCATION:

AFFECTED AREA SIZE:	SURFACE TYPE: *(gravel, asphalt, name of river etc.)*	RESOURCES AFFECTED/THREATENED: *(Water sources, wildlife, wells, etc.)*
COMMENTS:		

ADEC USE ONLY

SPILL NAME:	NAME OF DEC STAFF RESPONDING:	C-PLAN MGR NOTIFIED? ☐ Yes ☐ No

DEC RESPONSE: ☐ Phone follow-up ☐ Field visit ☐ Took Report	CASELOAD CODE: ☐ First and Final ☐ Open/No LC ☐ LC Assigned	CLEANUP CLOSURE ACTION: ☐ NFA ☐ Monitoring ☐ Transferred to CS or STP
COMMENTS:	Status of Case: ☐ Open ☐ Closed	DATE CASE CLOSED:
REPORT PREPARED BY:	DATE:	

Revised 2/5/2008

ATTACHMENT 7 - ADEC Monthly Oil Spill Reporting Log

ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
MONTHLY OIL SPILL REPORTING LOG

FACILITY NAME AND ADDRESS:
REPORT MONTH/YEAR:
REPORTED BY:

Only for minor spills, solely to land, not to creeks, sewers or storm drains.
(see Discharge Reporting requirements, 18 AAC 75.300)

LARGE SPILLS, HAZARDOUS SUBSTANCE SPILLS OR SPILLS AFFECTING WATERWAYS MUST BE REPORTED IMMEDIATELY.

Call the nearest ADEC office for more information:
Anchorage: 269-3063 **Fairbanks**: 451-2121 **Juneau**: 465-5340 **After Hours:** 1-800-478-9300

DATE / TIME OF SPILL	LOCATION	PRODUCT SPILLED	QTY SPILLED (GALLONS)	CAUSE OF SPILL & AREA AFFECTED	WHO RESPONDED	CLEANUP & METHOD / PLACE OF DISPOSAL

Appendix C
Soil Boring Logs and Well Construction Diagrams

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CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
457958.09.JD.02	CG039-AP-3983R	SHEET 1 OF 2

SOIL BORING LOG

PROJECT : JBER LOCATION : CG039

NORTHING (NAD83 SPZN4 feet):2668400.78 EASTING (NAD83 SPZN4 feet):1708835.23 DRILLING CONTRACTOR : GeoTek Alaska, Inc.

ELEVATION: 304.82 feet NAVD88 DRILLING METHOD AND EQUIPMENT : Geoprobe 8040DT, Direct Push

WATER LEVEL: --- START : 7/15/13 09:30 END : 7/15/13 15:10 LOGGER : Seay/Horn

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	SAMPLE RECOVERY (feet)	PID (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SAMPLE ID	DRILLING AND LITHOLOGY NOTES
	0.0				**SILT (OL)**, gray, low plasticity; fine, dry, very soft, very loose.		
5							
10							
	13.0				**SILTY GRAVEL (GM)**, gray, low plasticity; fine, dry, very soft, angular, loose.		Began with fines, ended with angular gravel
15							
	18.0				**SILTY GRAVEL (GM)**, grayish brown, low plasticity; cobbles, dry, very soft, angular, loose.		
20							
	23.0				**SILTY GRAVEL (GM)**, gray, low plasticity; cobbles, dry, very soft, angular, loose.		
25							groundwater encountered at 25 feet bgs
	28.0				**GRAVEL (GP)**, gray, cobbles, wet, angular, loose.		In water
30							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
457958.09.JD.02	CG039-AP-3983R	SHEET 2 OF 2

SOIL BORING LOG

PROJECT : JBER LOCATION : CG039

NORTHING (NAD83 SPZN4 feet):2668400.78 EASTING (NAD83 SPZN4 feet):1708835.23 DRILLING CONTRACTOR : GeoTek Alaska, Inc.

ELEVATION: 304.82 feet NAVD88 DRILLING METHOD AND EQUIPMENT : Geoprobe 8040DT, Direct Push

WATER LEVEL: --- START : 7/15/13 09:30 END : 7/15/13 15:10 LOGGER : Seay/Horn

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	SAMPLE RECOVERY (feet)	PID (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SAMPLE ID	DRILLING AND LITHOLOGY NOTES
					GRAVEL (GP), gray, cobbles, wet, angular, loose.(Soil Description Repeated)		
	33.0				**GRAVEL (GP)**, grayish brown, cobbles, dry, angular, loose.		fractured, some fines
35							
	38.0				**GRAVEL (GP)**, grayish brown, cobbles, dry, angular, loose.		
40							
	41.0						Boring terminated at 41 feet
45							
50							
55							
60							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
457958.09.JD.02	CG039-IW-01-3983R SHEET 1 OF 2

SOIL BORING LOG

PROJECT : JBER LOCATION : CG039

NORTHING (NAD83 SPZN4 feet):2668458.72 EASTING (NAD83 SPZN4 feet):1708849.70 DRILLING CONTRACTOR : GeoTek Alaska, Inc.

ELEVATION: 304.17 feet NAVD88 DRILLING METHOD AND EQUIPMENT : Geoprobe 8040DT, Direct Push

WATER LEVEL: --- START : 7/16/13 16:08 END : 7/17/13 18:00 LOGGER : Seay

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	SAMPLE RECOVERY (feet)	PID (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SAMPLE ID	DRILLING AND LITHOLOGY NOTES
	0.0				**GRAVELLY SAND (SP)**, grayish brown, coarse, dry, angular, loose.		rock fragments
5							
10	10.0				**GRAVELLY SAND (SP)**, grayish brown, coarse, dry, angular, loose.		rock fragments
15	15.0				**GRAVELLY SAND (SP)**, grayish brown, coarse, moist, angular, medium dense.		rock fragments
20	20.0				**GRAVELLY SAND (SP)**, grayish brown, low plasticity; coarse, moist, stiff, angular, very dense.		rock fragments, some clay, groundwater encountered at 20 feet bgs
25	25.0				**GRAVELLY SAND (SP)**, gray, low plasticity; coarse, wet, soft, angular, very dense.	13Q2CG039-IW01398301-SO-0	rock fragments, silt lenses at 23 and 25 feet bgs
30							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
457958.09.JD.02	CG039-IW-01-3983R SHEET 2 OF 2

SOIL BORING LOG

PROJECT : JBER LOCATION : CG039

NORTHING (NAD83 SPZN4 feet):2668458.72 EASTING (NAD83 SPZN4 feet):1708849.70 DRILLING CONTRACTOR : GeoTek Alaska, Inc.

ELEVATION: 304.17 feet NAVD88 DRILLING METHOD AND EQUIPMENT : Geoprobe 8040DT, Direct Push

WATER LEVEL: --- START : 7/16/13 16:08 END : 7/17/13 18:00 LOGGER : Seay

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	SAMPLE RECOVERY (feet)	PID (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SAMPLE ID	DRILLING AND LITHOLOGY NOTES
	30.0				**GRAVELLY SAND (SP)**, gray, coarse, wet, angular, very dense.		rock fragments, organic matter
						13Q2CG039-IW01398302-SO-0	
35	35.0				**GRAVELLY SAND (SP)**, gray, coarse, wet, angular, very dense.		weathered bedrock, rock fragments, organic matter
						13Q2CG039-IW01398303-SO-0	
40	40.0						Boring terminated at 41 feet
45							
50							
55							
60							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
457958.09.JD.02	CG039-IW-01-4550	SHEET 1 OF 2

SOIL BORING LOG

PROJECT : JBER LOCATION : CG039

NORTHING (NAD83 SPZN4 feet):2668396.00 EASTING (NAD83 SPZN4 feet):1708820.74 DRILLING CONTRACTOR : GeoTek Alaska, Inc.

ELEVATION: 305.69 feet NAVD88 DRILLING METHOD AND EQUIPMENT : Geoprobe 8040DT, Direct Push

WATER LEVEL: --- START : 7/19/13 13:16 END : 7/20/13 13:45 LOGGER : Seay/Frame

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	SAMPLE RECOVERY (feet)	PID (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SAMPLE ID	DRILLING AND LITHOLOGY NOTES
	0.0				**SANDY GRAVEL (GP)**, grayish brown, dry, loose.		Lead rod
5	5.0				**SANDY GRAVEL (GP)**, grayish brown, low plasticity; cobbles, dry, soft, angular, loose.		Lots of fines, compact silt
10	10.0				**SILTY SAND (SM)**, grayish brown, low plasticity; fine, dry, soft, rounded, loose.		
15	15.0				**GRAVELLY SILT (OL)**, grayish brown, low plasticity; cobbles, dry, soft, angular, loose.		rock fragments
20	20.0				**GRAVEL (GP)**, grayish brown, cobbles, wet, angular, loose.		rock fragments
25	25.0				**GRAVEL (GP)**, grayish brown, cobbles, wet, angular, loose.		rock fragments, groundwater encountered at 25 feet bgs
30							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
457958.09.JD.02	CG039-IW-01-4550 SHEET 2 OF 2

SOIL BORING LOG

PROJECT : JBER LOCATION : CG039

NORTHING (NAD83 SPZN4 feet):2668396.00 EASTING (NAD83 SPZN4 feet):1708820.74 DRILLING CONTRACTOR : GeoTek Alaska, Inc.

ELEVATION: 305.69 feet NAVD88 DRILLING METHOD AND EQUIPMENT : Geoprobe 8040DT, Direct Push

WATER LEVEL: --- START : 7/19/13 13:16 END : 7/20/13 13:45 LOGGER : Seay/Frame

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	SAMPLE RECOVERY (feet)	PID (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SAMPLE ID	DRILLING AND LITHOLOGY NOTES
	30.0				**SANDY GRAVEL (GP)**, grayish brown, low plasticity, moist, stiff, angular, dense.		rock fragments, some oxidation, clays throughout interval
35	35.0				**SANDY GRAVEL (GP)**, grayish brown, low plasticity; cobbles, moist, stiff, angular, dense.	13Q2CG039-IW01398303-SO-0	rock fragments, silty clay lenses throughout interval, oxidation throughout
40	40.0				**SANDY GRAVEL (GP)**, grayish brown, moist, angular, dense.	13Q2CG039-IW01455003-SO-1	rock fragments, oxidation throughout
45	45.0						Boring terminated at 45 feet
50							
55							
60							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
457958.09.JD.02	CG039-IW-01-4551	SHEET 1 OF 4

SOIL BORING LOG

PROJECT : JBER LOCATION : CG039

NORTHING (NAD83 SPZN4 feet):2668393.37 EASTING (NAD83 SPZN4 feet):1708830.55 DRILLING CONTRACTOR : GeoTek Alaska, Inc.

ELEVATION: 305.66 feet NAVD88 DRILLING METHOD AND EQUIPMENT : Geoprobe 8040DT, Direct Push

WATER LEVEL: --- START : 7/22/13 10:00 END : 7/24/13 10:00 LOGGER : Seay/Frame

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	SAMPLE RECOVERY (feet)	PID (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SAMPLE ID	DRILLING AND LITHOLOGY NOTES
	0.0				**GRAVELLY SILT (OL)**, grayish brown, low plasticity; fine, dry, stiff, rounded, loose.		Lead rod
5	5.0				**SILT (OL)**, grayish brown, low plasticity; fine, dry, stiff, rounded, loose.		rock fragments
10	10.0				**SILT (OL)**, grayish brown, low plasticity; fine, dry, stiff, rounded, loose.		rock fragments
15	15.0				**GRAVELLY SILT (OL)**, grayish brown, low plasticity; fine, dry, stiff, rounded, loose.		rock fragments
20	20.0				**GRAVELLY SILT (OL)**, grayish brown, low plasticity; fine, dry, stiff, rounded, loose.		rock fragments
25	25.0				**GRAVELLY SILT (OL)**, grayish brown, low plasticity; fine, dry, stiff, rounded, loose.		rock fragments
30							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
457958.09.JD.02	CG039-IW-01-4551	SHEET 2 OF 4

SOIL BORING LOG

PROJECT : JBER LOCATION : CG039

NORTHING (NAD83 SPZN4 feet):2668393.37 EASTING (NAD83 SPZN4 feet):1708830.55 DRILLING CONTRACTOR : GeoTek Alaska, Inc.

ELEVATION: 305.66 feet NAVD88 DRILLING METHOD AND EQUIPMENT : Geoprobe 8040DT, Direct Push

WATER LEVEL: --- START : 7/22/13 10:00 END : 7/24/13 10:00 LOGGER : Seay/Frame

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	SAMPLE RECOVERY (feet)	PID (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SAMPLE ID	DRILLING AND LITHOLOGY NOTES
	30.0				**GRAVEL (GP)**, gray, cobbles, wet, angular, loose.		rock fragments
35	35.0				**GRAVEL (GP)**, gray, cobbles, wet, angular, loose.		rock fragments
40	40.0				**GRAVEL (GP)**, grayish brown, cobbles, wet, angular, loose.		rock fragments, some fines
45	45.0				**GRAVELLY SAND (SP)**, grayish brown, cobbles, dry, angular, loose.		rock fragments
50	50.0				**SANDY GRAVEL (GP)**, grayish brown, cobbles, dry, angular, loose.		rock fragments
55	55.0				**SANDY GRAVEL (GP)**, grayish brown, cobbles, dry, angular, loose.		rock fragments
60							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
457958.09.JD.02	CG039-IW-01-4551	SHEET 3 OF 4

SOIL BORING LOG

PROJECT : JBER LOCATION : CG039

NORTHING (NAD83 SPZN4 feet):2668393.37 EASTING (NAD83 SPZN4 feet):1708830.55 DRILLING CONTRACTOR : GeoTek Alaska, Inc.

ELEVATION: 305.66 feet NAVD88 DRILLING METHOD AND EQUIPMENT : Geoprobe 8040DT, Direct Push

WATER LEVEL: --- START : 7/22/13 10:00 END : 7/24/13 10:00 LOGGER : Seay/Frame

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	SAMPLE RECOVERY (feet)	PID (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SAMPLE ID	DRILLING AND LITHOLOGY NOTES
	60.0				**SANDY GRAVEL (GP)**, grayish brown, cobbles, dry, angular, loose.		rock fragments
65	65.0				**SANDY GRAVEL (GP)**, grayish brown, cobbles, dry, angular, loose.		rock fragments
70	70.0				**SANDY GRAVEL (GP)**, grayish brown, cobbles, dry, angular, loose.		rock fragments
75	75.0				**SANDY GRAVEL (GP)**, grayish brown, cobbles, dry, angular, loose.		rock fragments
80	80.0				**SANDY GRAVEL (GP)**, grayish brown, cobbles, dry, angular, loose.		rock fragments
85	85.0				**SANDY GRAVEL (GP)**, grayish brown, cobbles, dry, angular, loose.		rock fragments
90							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
457958.09.JD.02	CG039-IW-01-4551	SHEET 4 OF 4

SOIL BORING LOG

PROJECT : JBER LOCATION : CG039

NORTHING (NAD83 SPZN4 feet):2668393.37 EASTING (NAD83 SPZN4 feet):1708830.55 DRILLING CONTRACTOR : GeoTek Alaska, Inc.

ELEVATION: 305.66 feet NAVD88 DRILLING METHOD AND EQUIPMENT : Geoprobe 8040DT, Direct Push

WATER LEVEL: --- START : 7/22/13 10:00 END : 7/24/13 10:00 LOGGER : Seay/Frame

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	SAMPLE RECOVERY (feet)	PID (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SAMPLE ID	DRILLING AND LITHOLOGY NOTES
	90.0				**SANDY GRAVEL (GP)**, grayish brown, cobbles, dry, angular, loose.		rock fragments, sand lense bottom interval, moisture at 93 feet bgs
95	96.0						Boring terminated at 96 feet
100							
105							
110							
115							
120							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
457958.09.JD.02	CG039-IW-02-3983R	SHEET 1 OF 2

SOIL BORING LOG

PROJECT : JBER LOCATION : CG039

NORTHING (NAD83 SPZN4 feet):2668464.46 EASTING (NAD83 SPZN4 feet):1708836.71 DRILLING CONTRACTOR : GeoTek Alaska, Inc.

ELEVATION: 304.30 feet NAVD88 DRILLING METHOD AND EQUIPMENT : Geoprobe 8040DT, Direct Push

WATER LEVEL: --- START : 7/18/13 13:12 END : 7/19/13 09:50 LOGGER : Seay

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	SAMPLE RECOVERY (feet)	PID (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SAMPLE ID	DRILLING AND LITHOLOGY NOTES
	0.0				**SILT (OL)**, grayish brown, low plasticity; fine, dry, stiff, rounded, dense.		
5	5.0				**SILT (OL)**, grayish brown, low plasticity; fine, dry, stiff, rounded, dense.		
10	10.0				**SILT (OL)**, grayish brown, low plasticity; fine, dry, stiff, rounded, dense.		
15	15.0				**GRAVEL (GP)**, grayish brown, coarse, moist, angular, loose.		rock fragments
20	20.0				**SANDY GRAVEL (GP)**, gray, cobbles, wet, rounded, loose.		rock fragments, groundwater encountered at 20 feet bgs
25	25.0				**SANDY GRAVEL (GP)**, gray, cobbles, wet, rounded, loose.		rock fragments
30							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
457958.09.JD.02	CG039-IW-02-3983R SHEET 2 OF 2

SOIL BORING LOG

PROJECT : JBER LOCATION : CG039

NORTHING (NAD83 SPZN4 feet):2668464.46 EASTING (NAD83 SPZN4 feet):1708836.71 DRILLING CONTRACTOR : GeoTek Alaska, Inc.

ELEVATION: 304.30 feet NAVD88 DRILLING METHOD AND EQUIPMENT : Geoprobe 8040DT, Direct Push

WATER LEVEL: --- START : 7/18/13 13:12 END : 7/19/13 09:50 LOGGER : Seay

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	SAMPLE RECOVERY (feet)	PID (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SAMPLE ID	DRILLING AND LITHOLOGY NOTES
	30.0				**SANDY GRAVEL (GP)**, gray, cobbles, wet, rounded, loose.		
35	35.0				**SANDY GRAVEL (GP)**, grayish brown, cobbles, dry, rounded, loose.		
40	40.0						Boring terminated at 40 feet
45							
50							
55							
60							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
457958.09.JD.02	CG039-IW-02-4550	SHEET 1 OF 2

SOIL BORING LOG

PROJECT : JBER LOCATION : CG039

NORTHING (NAD83 SPZN4 feet):2668386.41 EASTING (NAD83 SPZN4 feet):1708831.85 DRILLING CONTRACTOR : GeoTek Alaska, Inc.

ELEVATION: 305.44 feet NAVD88 DRILLING METHOD AND EQUIPMENT : Geoprobe 8040DT, Direct Push

WATER LEVEL: --- START : 7/26/13 14:00 END : 7/27/13 09:00 LOGGER : Seay

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	SAMPLE RECOVERY (feet)	PID (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SAMPLE ID	DRILLING AND LITHOLOGY NOTES
	0.0				**SILT (OL)**, gray, low plasticity; fine, dry, soft, rounded, loose.		
5	5.0				**GRAVELLY SILT (OL)**, gray, low plasticity; fine, dry, soft, angular, loose.		rock fragments
10	10.0				**GRAVELLY SILT (OL)**, gray, low plasticity; fine, dry, soft, angular, loose.		rock fragments
15	15.0				**GRAVELLY SILT (OL)**, gray, low plasticity; fine, dry, soft, angular, loose.		rock fragments
20	20.0				**SILTY SAND (SM)**, orangeish brown, low plasticity; fine, moist, soft, rounded, loose.		groundwater encountered at 23 feet bgs
25	25.0				**GRAVEL (GP)**, gray, cobbles, wet, angular, loose.		rock fragments, some fines
30							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:
457958.09.JD.02	CG039-IW-02-4550 SHEET 2 OF 2

SOIL BORING LOG

PROJECT : JBER LOCATION : CG039

NORTHING (NAD83 SPZN4 feet):2668386.41 EASTING (NAD83 SPZN4 feet):1708831.85 DRILLING CONTRACTOR : GeoTek Alaska, Inc.

ELEVATION: 305.44 feet NAVD88 DRILLING METHOD AND EQUIPMENT : Geoprobe 8040DT, Direct Push

WATER LEVEL: --- START : 7/26/13 14:00 END : 7/27/13 09:00 LOGGER : Seay

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	SAMPLE RECOVERY (feet)	PID (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SAMPLE ID	DRILLING AND LITHOLOGY NOTES
	30.0				**GRAVELLY SILT (OL)**, gray, low plasticity; fine, wet, soft, rounded, medium dense.		rock fragments
35	35.0				**SILTY GRAVEL (GM)**, grayish brown, low plasticity; cobbles, moist, hard, angular, loose.	13Q2CG039-IW02-455101-SC-0	rock fragments
40	40.0				**SILTY GRAVEL (GM)**, grayish brown, low plasticity; cobbles, dry, hard, angular, loose.		rock fragments
45	45.0						Boring terminated at 45 feet
50							
55							
60							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
457958.09.JD.02	CG039-IW-02-4551	SHEET 1 OF 4

SOIL BORING LOG

PROJECT : JBER LOCATION : CG039

NORTHING (NAD83 SPZN4 feet):2668385.33 EASTING (NAD83 SPZN4 feet):1708842.58 DRILLING CONTRACTOR : GeoTek Alaska, Inc.

ELEVATION: 304.64 feet NAVD88 DRILLING METHOD AND EQUIPMENT : Geoprobe 8040DT, Direct Push

WATER LEVEL: --- START : 7/24/13 14:29 END : 7/26/13 09:10 LOGGER : Seay

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	SAMPLE RECOVERY (feet)	PID (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SAMPLE ID	DRILLING AND LITHOLOGY NOTES
	0.0				**GRAVELLY SILT (OL)**, grayish brown, low plasticity; cobbles, dry, soft, angular, loose.		rock fragments, lead rod
5	5.0				**SILTY GRAVEL (GM)**, grayish brown, low plasticity; cobbles, dry, soft, angular, loose.		rock fragments
10	10.0				**SILTY GRAVEL (GM)**, grayish brown, low plasticity; cobbles, dry, soft, angular, loose.		rock fragments
15	15.0				**GRAVELLY SILT (OL)**, gray, low plasticity; cobbles, dry, soft, angular, loose.		rock fragments
20	20.0				**SILTY GRAVEL (GM)**, grayish black, low plasticity; cobbles, moist, soft, angular, loose.		rock fragments
25	25.0				**SILTY GRAVEL (GM)**, grayish black, low plasticity; cobbles, wet, soft, angular, loose.		rock fragments
30							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
457958.09.JD.02	CG039-IW-02-4551	SHEET 2 OF 4

SOIL BORING LOG

PROJECT : JBER LOCATION : CG039

NORTHING (NAD83 SPZN4 feet):2668385.33 EASTING (NAD83 SPZN4 feet):1708842.58 DRILLING CONTRACTOR : GeoTek Alaska, Inc.

ELEVATION: 304.64 feet NAVD88 DRILLING METHOD AND EQUIPMENT : Geoprobe 8040DT, Direct Push

WATER LEVEL: --- START : 7/24/13 14:29 END : 7/26/13 09:10 LOGGER : Seay

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	SAMPLE RECOVERY (feet)	PID (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SAMPLE ID	DRILLING AND LITHOLOGY NOTES
	30.0				**SILTY GRAVEL (GM)**, gray, low plasticity; cobbles, moist, soft, angular, loose.		rock fragments
35	35.0				**GRAVELLY SILT (OL)**, grayish brown, low plasticity; cobbles, moist, soft, angular, loose.		rock fragments
40	40.0				**GRAVELLY SILT (OL)**, grayish brown, low plasticity; cobbles, dry, soft, angular, loose.		rock fragments
45	45.0				**GRAVELLY SILT (OL)**, grayish brown, low plasticity; cobbles, dry, soft, angular, loose.		rock fragments
50	50.0				**GRAVEL (GP)**, grayish brown, cobbles, dry, angular, loose.		rock fragments
55	55.0				**GRAVEL (GP)**, grayish brown, cobbles, dry, angular, loose.		rock fragments
60							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
457958.09.JD.02	CG039-IW-02-4551	SHEET 3 OF 4

SOIL BORING LOG

PROJECT : JBER LOCATION : CG039

NORTHING (NAD83 SPZN4 feet):2668385.33 EASTING (NAD83 SPZN4 feet):1708842.58 DRILLING CONTRACTOR : GeoTek Alaska, Inc.

ELEVATION: 304.64 feet NAVD88 DRILLING METHOD AND EQUIPMENT : Geoprobe 8040DT, Direct Push

WATER LEVEL: --- START : 7/24/13 14:29 END : 7/26/13 09:10 LOGGER : Seay

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	SAMPLE RECOVERY (feet)	PID (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SAMPLE ID	DRILLING AND LITHOLOGY NOTES
	60.0				**SILTY GRAVEL (GM)**, grayish brown, low plasticity; cobbles, dry, hard, angular, loose.		rock fragments
65	65.0						
	66.0				**SILTY GRAVEL (GM)**, grayish brown, low plasticity; cobbles, dry, hard, angular, loose.		rock fragments
70	70.0				**SILTY GRAVEL (GM)**, grayish brown, low plasticity; fine, dry, hard, angular, loose.		rock fragments
75	75.0				**SANDY GRAVEL (GP)**, grayish brown, coarse, dry, angular, loose.		rock fragments
80	80.0				**SANDY GRAVEL (GP)**, grayish brown, coarse, dry, angular, loose.		rock fragments
85	85.0				**SANDY GRAVEL (GP)**, grayish brown, fine, dry, angular, loose.		rock fragments
90							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
457958.09.JD.02	CG039-IW-02-4551	SHEET 4 OF 4

SOIL BORING LOG

PROJECT : JBER LOCATION : CG039

NORTHING (NAD83 SPZN4 feet):2668385.33 EASTING (NAD83 SPZN4 feet):1708842.58 DRILLING CONTRACTOR : GeoTek Alaska, Inc.

ELEVATION: 304.64 feet NAVD88 DRILLING METHOD AND EQUIPMENT : Geoprobe 8040DT, Direct Push

WATER LEVEL: --- START : 7/24/13 14:29 END : 7/26/13 09:10 LOGGER : Seay

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	SAMPLE RECOVERY (feet)	PID (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SAMPLE ID	DRILLING AND LITHOLOGY NOTES
	90.0				**SANDY GRAVEL (GP)**, grayish brown, fine, moist, angular, loose.		weathered bedrock
	92.5						Boring terminated at 92.5 feet
95							
100							
105							
110							
115							
120							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
457958.09.JD.02	CG039-ROI-3983R	SHEET 1 OF 2

SOIL BORING LOG

PROJECT : JBER LOCATION : CG039

NORTHING (NAD83 SPZN4 feet):2668461.31 EASTING (NAD83 SPZN4 feet):1708843.09 DRILLING CONTRACTOR : GeoTek Alaska, Inc.

ELEVATION: 304.25 feet NAVD88 DRILLING METHOD AND EQUIPMENT : Geoprobe 8040DT, Direct Push

WATER LEVEL: --- START : 7/15/13 16:42 END : 7/16/13 15:00 LOGGER : Seay

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	SAMPLE RECOVERY (feet)	PID (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SAMPLE ID	DRILLING AND LITHOLOGY NOTES
	0.0				**SILT (OL)**, grayish black, low plasticity; fine, moist, soft, rounded, loose.		Some small rock gravel (less than 1 mm)
5							
	8.0				**SILTY GRAVEL (GM)**, grayish brown, low plasticity; fine, dry, soft, rounded, loose.		Angular rock fragments, some moisture
10							
	13.0				**SANDY GRAVEL (GP)**, grayish brown, fine, dry, rounded, loose.		Some moisture, angular rock fragments
15							
	18.0				**SANDY GRAVEL (GP)**, grayish brown, fine, dry, rounded, loose.		Some moisture and angular cobbles
20							
	23.0				**SANDY GRAVEL (GP)**, grayish brown, fine, dry, rounded, loose.		
25							
30							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
457958.09.JD.02	CG039-ROI-3983R	SHEET 2 OF 2

SOIL BORING LOG

PROJECT : JBER LOCATION : CG039

NORTHING (NAD83 SPZN4 feet):2668461.31 EASTING (NAD83 SPZN4 feet):1708843.09 DRILLING CONTRACTOR : GeoTek Alaska, Inc.

ELEVATION: 304.25 feet NAVD88 DRILLING METHOD AND EQUIPMENT : Geoprobe 8040DT, Direct Push

WATER LEVEL: --- START : 7/15/13 16:42 END : 7/16/13 15:00 LOGGER : Seay

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	SAMPLE RECOVERY (feet)	PID (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SAMPLE ID	DRILLING AND LITHOLOGY NOTES
	30.0				**SANDY GRAVEL (GC)**, grayish brown, low plasticity; coarse, wet, stiff, angular, dense.		rock fragments, some clay, angular rock fragments
35	35.0						Boring terminated at 35 feet
40							
45							
50							
55							
60							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
457958.09.JD.02	CG039-ROI-4550	SHEET 1 OF 2

SOIL BORING LOG

PROJECT : JBER LOCATION : CG039

NORTHING (NAD83 SPZN4 feet):2668461.31 EASTING (NAD83 SPZN4 feet):1708843.09 DRILLING CONTRACTOR : GeoTek Alaska, Inc.

ELEVATION: 304.25 feet NAVD88 DRILLING METHOD AND EQUIPMENT : Geoprobe 8040DT, Direct Push

WATER LEVEL: --- START : 7/11/13 16:45 END : 7/13/13 15:45 LOGGER : Seay/Frame/Horn

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	SAMPLE RECOVERY (feet)	PID (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SAMPLE ID	DRILLING AND LITHOLOGY NOTES
	0.0				**SILT (OL)**, gray, low plasticity, very soft.		
5							
	8.0				**SILTY GRAVEL (GM)**, gray, low plasticity; cobbles, very soft, angular.		
10							
15							
	18.0				**GRAVELLY SILT (OL)**, gray, low plasticity; cobbles, dry, very soft, angular.		Lots of fines, some brown gravels
20							
	23.0				**SANDY GRAVEL (GP)**, grayish black, cobbles, moist, angular.		groundwater encountered at 23 feet bgs
25							
	28.0				**SANDY GRAVEL (GP)**, grayish black, cobbles, moist, angular.		
30							

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
457958.09.JD.02	CG039-ROI-4550	SHEET 2 OF 2

SOIL BORING LOG

PROJECT : JBER LOCATION : CG039

NORTHING (NAD83 SPZN4 feet):2668461.31 EASTING (NAD83 SPZN4 feet):1708843.09 DRILLING CONTRACTOR : GeoTek Alaska, Inc.

ELEVATION: 304.25 feet NAVD88 DRILLING METHOD AND EQUIPMENT : Geoprobe 8040DT, Direct Push

WATER LEVEL: --- START : 7/11/13 16:45 END : 7/13/13 15:45 LOGGER : Seay/Frame/Horn

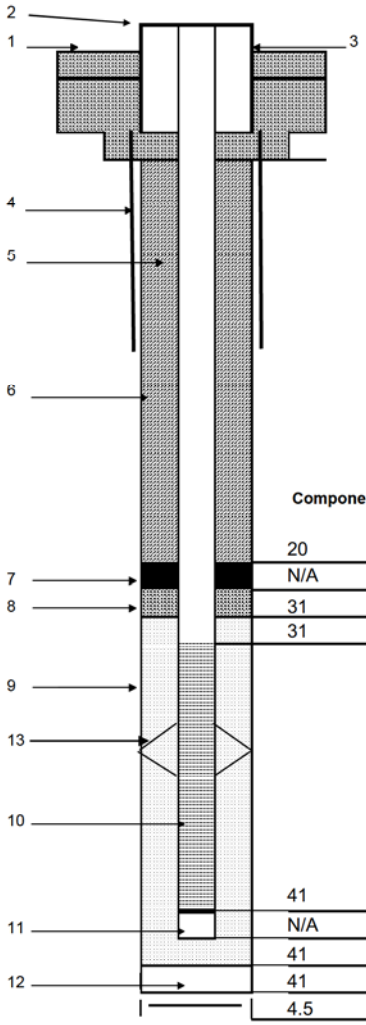
DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	SAMPLE RECOVERY (feet)	PID (ppm)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SAMPLE ID	DRILLING AND LITHOLOGY NOTES
					SANDY GRAVEL (GP), grayish black, cobbles, moist, angular.(Soil Description Repeated)		
	33.0				**SILTY GRAVEL (GM)**, gray, low plasticity; cobbles, moist, very soft, angular.		Ending dry
35							
	38.0				**SILTY GRAVEL (GM)**, gray, low plasticity; cobbles, dry, very soft, angular.		
40							
	43.0						Boring terminated at 43 feet
45							
50							
55							
60							

CH2MHILL

PROJECT NUMBER	WELL NUMBER
457958	CG039_AP-3983R

WELL COMPLETION DIAGRAM

PROJECT NAME :	JBER-R			LOCATION NAME:	CG039
NORTHING:	6799362.751	EASTING:	360168.230	DRILLING CONTRACTOR:	Geotek
START DATE:	07/15/2013	END DATE:	07/15/2013	DRILLING METHOD:	Air rotary
BOREHOLE DIAMETER:	4.5 inches			DRILLING EQUIPMENT:	Geoprobe
TOTAL BOREHOLE DEPTH:	41 feet bgs			LOGGED BY:	A. Seay



Component Depths BGS

20	Top of transition seal (feet bgs)	
N/A	Top of transition sand (feet bgs)	
31	Top of filter pack (feet bgs)	
31	Top of screen (feet bgs)	
41	Bottom of screen (feet bgs)	
N/A	Bottom of sump (feet bgs)	
41	Bottom of filter pack (feet bgs)	
41	Bottom of borehole (feet bgs)	
4.5	Borehole Diameter (inches)	

NOTE: DRAWING NOT TO SCALE

1- Ground elevation at well	304.20		feet NAVD 88
2- Top of casing elevation	307.40		feet NAVD 88
3- Surface completion type	Above Ground Momument		
a) Diameter	6		inches
b) Concrete pad dimensions	12		inches
c) Bollards	N/A		
4- Conductor casing type	N/A		
a) Diameter	N/A		inches
b) Length	N/A		feet
5- Well casing type	Schedule 40 PVC		
a) Diameter	2		inches
b) Length	31		feet
6- Sanitary seal type	Cement Grout (2% bentonite)		
a) Method of placement	Tremie pipe		
b) Volume used	25		gallons
c) Calculated volume	N/A	$feet^3$	gallons
7- Transition seal type	Bentonite pellets		
a) Quantity used	1		50 lb bags
b) Calculated quantity	N/A	$feet^3$	50 lb bags
8- Transition filter pack type	N/A		
a) Quantity used	N/A		100 lb bags
b) Calculated quantity	N/A	$feet^3$	100 lb bags
9- Filter pack type	Pre-pack filter 20/40 (2x5 ft sections)		
a) Quantity used	N/A		100 lb bags
b) Calculated quantity	N/A	$feet^3$	100 lb bags
10- Screen type / slot size	Mill-slot		
a) Diameter	2		inches
b) Length	10		feet
c) Slot size	0.010		inches
11- Sump / end cap type	PVC Slip-cap		
a) Diameter	2		inches
b) Length	0.00		feet
12- Backfill type	N/A		
a) Quantity used	N/A		
b) Calculated quantity	N/A		
13- Centralizer type	N/A		
a) Depths	N/A		feet bgs

Well Development

Start Date/Time:	7/24/2013 10:23 am	
End Date/Time:	7/24/2013 3:05 pm	
Measured Depth to Water	17.90	feet bgs
Development Method:	Surge & Pump	
Duration:	N/A	hours
Purgevolume:	153	gallons
Volume of water injected:	N/A	gallons
Calculated well volume:	37	gallons

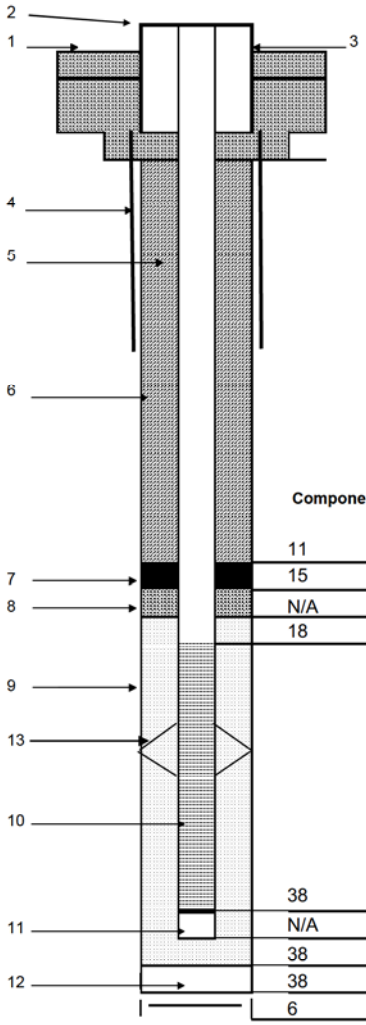
Comments:

CH2MHILL

PROJECT NUMBER	WELL NUMBER
457958	CG039-IW-01-3983

WELL COMPLETION DIAGRAM

PROJECT NAME :	JBER-R			LOCATION NAME:	CG039
NORTHING:	6799358.304	EASTING:	360168.424	DRILLING CONTRACTOR:	Geotek
START DATE:	07/16/2013	END DATE:	07/18/2013	DRILLING METHOD:	Air rotary
BOREHOLE DIAMETER:	6.0 inches			DRILLING EQUIPMENT:	Geoprobe
TOTAL BOREHOLE DEPTH:	38 feet bgs			LOGGED BY:	A. Seay



Component Depths BGS

11	Top of transition seal (feet bgs)
15	Top of transition sand (feet bgs)
N/A	Top of filter pack (feet bgs)
18	Top of screen (feet bgs)
38	Bottom of screen (feet bgs)
N/A	Bottom of sump (feet bgs)
38	Bottom of filter pack (feet bgs)
38	Bottom of borehole (feet bgs)
6	Borehole Diameter (inches)

NOTE: DRAWING NOT TO SCALE

1- Ground elevation at well	304.17		feet NAVD 88
2- Top of casing elevation	307.50		feet NAVD 88
3- Surface completion type	Above Ground Momument		
a) Diameter	6		inches
b) Concrete pad dimensions	12		inches
c) Bollards	Enviroblocks		
4- Conductor casing type	N/A		
a) Diameter	N/A		inches
b) Length	N/A		feet
5- Well casing type	Schedule 80 PVC		
a) Diameter	2		inches
b) Length	18		feet
6- Sanitary seal type	Cement Grout (2% bentonite)		
a) Method of placement	Tremie pipe		
b) Volume used	30		gallons
c) Calculated volume	N/A	$feet^3$	gallons
7- Transition seal type	Bentonite pellets		
a) Quantity used	1		50 lb bags
b) Calculated quantity	N/A	$feet^3$	50 lb bags
8- Transition filter pack type	N/A		
a) Quantity used	N/A		100 lb bags
b) Calculated quantity	N/A	$feet^3$	100 lb bags
9- Filter pack type	8/12 Silica Sand		
a) Quantity used	3.5		100 lb bags
b) Calculated quantity	N/A	$feet^3$	100 lb bags
10- Screen type / slot size	Continuous wire wrap PVC		
a) Diameter	2		inches
b) Length	20		feet
c) Slot size	0.065		inches
11- Sump / end cap type	PVC Slip-cap		
a) Diameter	2		inches
b) Length	0.00		feet
12- Backfill type	N/A		
a) Quantity used	N/A		
b) Calculated quantity	N/A		
13- Centralizer type	N/A		
a) Depths	N/A		feet bgs

Well Development

Start Date/Time:	7/31/2013 3:10 pm	
End Date/Time:	7/31/2013 4:40 pm	
Measured Depth to Water	21.40	feet bgs
Development Method:	Surge & Pump	
Duration:	N/A	hours
Purgevolume:	210	gallons
Volume of water injected:	N/A	gallons
Calculated well volume:	32	gallons

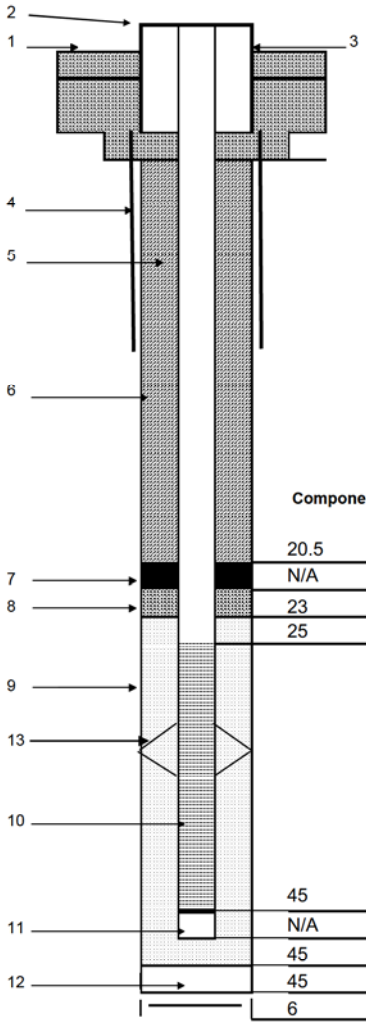
Comments:

CH2MHILL

PROJECT NUMBER	WELL NUMBER
457958	CG039-IW-01-4550

WELL COMPLETION DIAGRAM

PROJECT NAME :	JBER-R			LOCATION NAME:	CG039
NORTHING:	6799339.522	EASTING:	360158.697	DRILLING CONTRACTOR:	Geotek
START DATE:	07/19/2013	END DATE:	07/20/2013	DRILLING METHOD:	Air rotary
BOREHOLE DIAMETER:	6.0 inches			DRILLING EQUIPMENT:	Geoprobe
TOTAL BOREHOLE DEPTH:	45 feet bgs			LOGGED BY:	J. Frame



Component Depths BGS

20.5	Top of transition seal (feet bgs)
N/A	Top of transition sand (feet bgs)
23	Top of filter pack (feet bgs)
25	Top of screen (feet bgs)
45	Bottom of screen (feet bgs)
N/A	Bottom of sump (feet bgs)
45	Bottom of filter pack (feet bgs)
45	Bottom of borehole (feet bgs)
6	Borehole Diameter (inches)

NOTE: DRAWING NOT TO SCALE

1- Ground elevation at well	305.69	feet NAVD 88
2- Top of casing elevation	309.08	feet NAVD 88
3- Surface completion type	Above Ground Momument	
a) Diameter	6	inches
b) Concrete pad dimensions	12	inches
c) Bollards	N/A	
4- Conductor casing type	N/A	
a) Diameter	N/A	inches
b) Length	N/A	feet
5- Well casing type	Schedule 80 PVC	
a) Diameter	2	inches
b) Length	25	feet
6- Sanitary seal type	Cement Grout (2% bentonite)	
a) Method of placement	Tremie pipe	
b) Volume used	20	gallons
c) Calculated volume	N/A $feet^3$	gallons
7- Transition seal type	Bentonite pellets	
a) Quantity used	1	50 lb bags
b) Calculated quantity	N/A $feet^3$	50 lb bags
8- Transition filter pack type	N/A	
a) Quantity used	N/A	100 lb bags
b) Calculated quantity	N/A $feet^3$	100 lb bags
9- Filter pack type	8/12 silica sand	
a) Quantity used	N/A	100 lb bags
b) Calculated quantity	N/A $feet^3$	100 lb bags
10- Screen type / slot size	Continuous wire wrap PVC	
a) Diameter	2	inches
b) Length	20	feet
c) Slot size	0.065	inches
11- Sump / end cap type	PVC Slip-cap	
a) Diameter	2	inches
b) Length	0.00	feet
12- Backfill type	N/A	
a) Quantity used	N/A	
b) Calculated quantity	N/A	
13- Centralizer type	N/A	
a) Depths	N/A	feet bgs

Well Development

Start Date/Time:	8/8/2013 11:46 am	
End Date/Time:	8/8/2013 2:50 pm	
Measured Depth to Water	23.00	feet bgs
Development Method:	Surge & Pump	
Duration:	N/A	hours
Purgevolume:	155	gallons
Volume of water injected:	N/A	gallons
Calculated well volume:	342	gallons

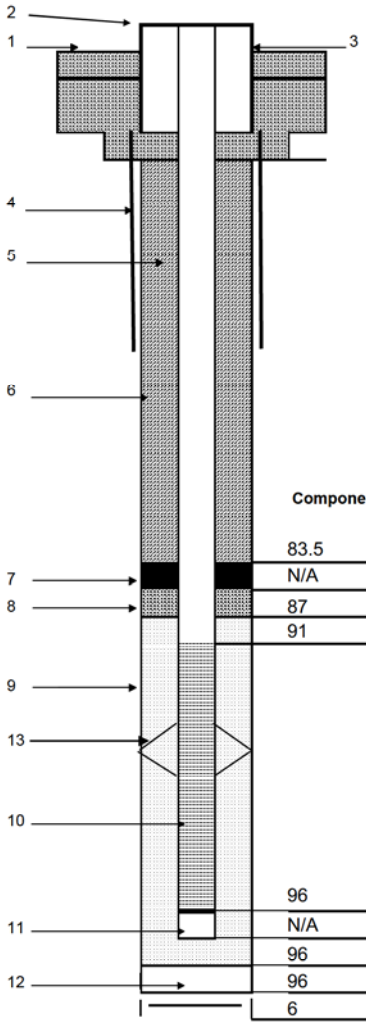
Comments:

CH2MHILL

PROJECT NUMBER	WELL NUMBER
457958	CG039-IW-01-4551

WELL COMPLETION DIAGRAM

PROJECT NAME :	JBER-R	LOCATION NAME:	CG039
NORTHING:	6799338.593	EASTING:	360161.650
START DATE:	07/22/2013	END DATE:	07/24/2013
BOREHOLE DIAMETER:	6.0 inches	DRILLING EQUIPMENT:	Geoprobe
TOTAL BOREHOLE DEPTH:	96 feet bgs	LOGGED BY:	A. Seay



Component Depths BGS

83.5	Top of transition seal (feet bgs)
N/A	Top of transition sand (feet bgs)
87	Top of filter pack (feet bgs)
91	Top of screen (feet bgs)
96	Bottom of screen (feet bgs)
N/A	Bottom of sump (feet bgs)
96	Bottom of filter pack (feet bgs)
96	Bottom of borehole (feet bgs)
6	Borehole Diameter (inches)

NOTE: DRAWING NOT TO SCALE

1- Ground elevation at well	305.66	feet NAVD 88	
2- Top of casing elevation	309.33	feet NAVD 88	
3- Surface completion type	Above Ground Momument		
a) Diameter	6	inches	
b) Concrete pad dimensions	12	inches	
c) Bollards	N/A		
4- Conductor casing type	N/A		
a) Diameter	N/A	inches	
b) Length	N/A	feet	
5- Well casing type	Schedule 80 PVC		
a) Diameter	2	inches	
b) Length	91	feet	
6- Sanitary seal type	Cement Grout (2% bentonite)		
a) Method of placement	Tremie pipe		
b) Volume used	75	gallons	
c) Calculated volume	N/A feet^3	gallons	
7- Transition seal type	Bentonite pellets		
a) Quantity used	1	50 lb bags	
b) Calculated quantity	N/A feet^3	50 lb bags	
8- Transition filter pack type	N/A		
a) Quantity used	N/A	100 lb bags	
b) Calculated quantity	N/A feet^3	100 lb bags	
9- Filter pack type	8/12 silica sand		
a) Quantity used	1.5	100 lb bags	
b) Calculated quantity	N/A feet^3	100 lb bags	
10- Screen type / slot size	Continuous wire wrap PVC		
a) Diameter	2	inches	
b) Length	5	feet	
c) Slot size	0.065	inches	
11- Sump / end cap type	PVC Slip-cap		
a) Diameter	2	inches	
b) Length	0.00	feet	
12- Backfill type	N/A		
a) Quantity used	N/A		
b) Calculated quantity	N/A		
13- Centralizer type	N/A		
a) Depths	N/A	feet bgs	

Well Development

Start Date/Time:	8/5/2013 9:55 am	
End Date/Time:	8/5/2013 5:00 pm	
Measured Depth to Water	92.11	feet bgs
Development Method:	Surge & Pump	
Duration:	N/A	hours
Purgevolume:	134	gallons
Volume of water injected:	N/A	gallons
Calculated well volume:	134	gallons

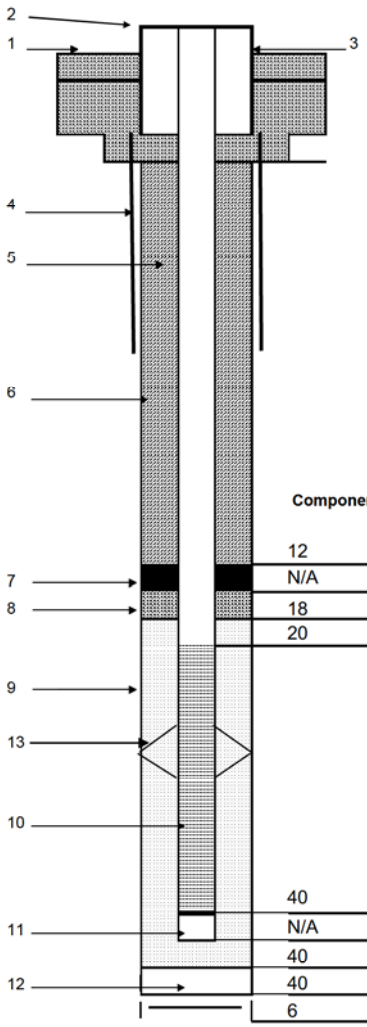
Comments:

CH2MHILL

PROJECT NUMBER	WELL NUMBER
457958	CG039-IW-02-3983

WELL COMPLETION DIAGRAM

PROJECT NAME :	JBER-R	LOCATION NAME:	CG039
NORTHING:	6799360.168	EASTING: 360164.432	DRILLING CONTRACTOR: Geotek
START DATE:	07/18/2013	END DATE: 07/19/2013	DRILLING METHOD: Air rotary
BOREHOLE DIAMETER:	6.0 inches		DRILLING EQUIPMENT: Geoprobe
TOTAL BOREHOLE DEPTH:	40 feet bgs		LOGGED BY: J. Frame



Component Depths BGS

12	Top of transition seal (feet bgs)
N/A	Top of transition sand (feet bgs)
18	Top of filter pack (feet bgs)
20	Top of screen (feet bgs)
40	Bottom of screen (feet bgs)
N/A	Bottom of sump (feet bgs)
40	Bottom of filter pack (feet bgs)
40	Bottom of borehole (feet bgs)
6	Borehole Diameter (inches)

NOTE: DRAWING NOT TO SCALE

1- Ground elevation at well	304.30	feet NAVD 88
2- Top of casing elevation	307.75	feet NAVD 88
3- Surface completion type	Above Ground Momument	
a) Diameter	6	inches
b) Concrete pad dimensions	12	inches
c) Bollards	N/A	
4- Conductor casing type	N/A	
a) Diameter	N/A	inches
b) Length	N/A	feet
5- Well casing type	Schedule 80 PVC	
a) Diameter	2	inches
b) Length	20	feet
6- Sanitary seal type	Cement Grout (2% bentonite)	
a) Method of placement	Tremie pipe	
b) Volume used	15	gallons
c) Calculated volume	N/A $feet^3$	gallons
7- Transition seal type	Bentonite pellets	
a) Quantity used	1	50 lb bags
b) Calculated quantity	N/A $feet^3$	50 lb bags
8- Transition filter pack type	N/A	
a) Quantity used	N/A	100 lb bags
b) Calculated quantity	N/A $feet^3$	100 lb bags
9- Filter pack type	8/12 Silica Sand	
a) Quantity used	3.5	100 lb bags
b) Calculated quantity	N/A $feet^3$	100 lb bags
10- Screen type / slot size	Continuous wire wrap PVC	
a) Diameter	2	inches
b) Length	20	feet
c) Slot size	0.065	inches
11- Sump / end cap type	PVC Slip-cap	
a) Diameter	2	inches
b) Length	0.00	feet
12- Backfill type	N/A	
a) Quantity used	N/A	
b) Calculated quantity	N/A	
13- Centralizer type	N/A	
a) Depths	N/A	feet bgs

Well Development

Start Date/Time:	7/30/2013 9:30 am	
End Date/Time:	7/31/2013 12:42 pm	
Measured Depth to Water	21.54	feet bgs
Development Method:	Surge & Pump	
Duration:	N/A	hours
Purgevolume:	308	gallons
Volume of water injected:	N/A	gallons
Calculated well volume:	308	gallons

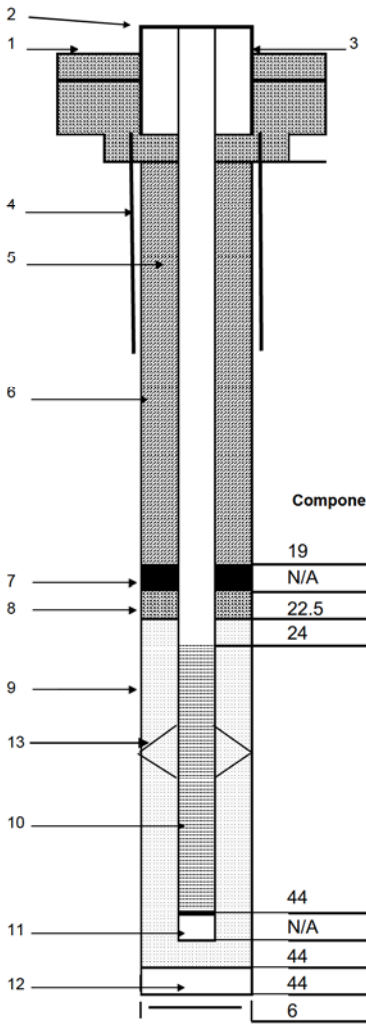
Comments:

CH2MHILL

PROJECT NUMBER	WELL NUMBER
457958	CG039-IW-02-4550

WELL COMPLETION DIAGRAM

PROJECT NAME :	JBER-R	LOCATION NAME:	CG039
NORTHING:	6799336.461	EASTING: 360161.918	DRILLING CONTRACTOR: Geotek
START DATE:	07/26/2013	END DATE: 07/26/2013	DRILLING METHOD: Air rotary
BOREHOLE DIAMETER:	6.0 inches		DRILLING EQUIPMENT: Geoprobe
TOTAL BOREHOLE DEPTH:	44 feet bgs		LOGGED BY: A. Seay



Component Depths BGS

19	Top of transition seal (feet bgs)
N/A	Top of transition sand (feet bgs)
22.5	Top of filter pack (feet bgs)
24	Top of screen (feet bgs)
44	Bottom of screen (feet bgs)
N/A	Bottom of sump (feet bgs)
44	Bottom of filter pack (feet bgs)
44	Bottom of borehole (feet bgs)
6	Borehole Diameter (inches)

NOTE: DRAWING NOT TO SCALE

1- Ground elevation at well	305.44	feet NAVD 88
2- Top of casing elevation	308.77	feet NAVD 88
3- Surface completion type	Above Ground Momument	
a) Diameter	6	inches
b) Concrete pad dimensions	12	inches
c) Bollards	N/A	
4- Conductor casing type	N/A	
a) Diameter	N/A	inches
b) Length	N/A	feet
5- Well casing type	Schedule 80 PVC	
a) Diameter	2	inches
b) Length	24	feet
6- Sanitary seal type	Cement Grout (2% bentonite)	
a) Method of placement	Tremie pipe	
b) Volume used	20	gallons
c) Calculated volume	N/A $feet^3$	gallons
7- Transition seal type	Bentonite pellets	
a) Quantity used	1	50 lb bags
b) Calculated quantity	N/A $feet^3$	50 lb bags
8- Transition filter pack type	N/A	
a) Quantity used	N/A	100 lb bags
b) Calculated quantity	N/A $feet^3$	100 lb bags
9- Filter pack type	8/12 silica sand	
a) Quantity used	N/A	100 lb bags
b) Calculated quantity	N/A $feet^3$	100 lb bags
10- Screen type / slot size	Continuous wire wrap PVC	
a) Diameter	2	inches
b) Length	20	feet
c) Slot size	0.065	inches
11- Sump / end cap type	PVC Slip-cap	
a) Diameter	2	inches
b) Length	0.00	feet
12- Backfill type	N/A	
a) Quantity used	N/A	
b) Calculated quantity	N/A	
13- Centralizer type	N/A	
a) Depths	N/A	feet bgs

Well Development

Start Date/Time:	8/7/2013 10:00 am	
End Date/Time:	8/7/2013 10:40 am	
Measured Depth to Water	22.63	feet bgs
Development Method:	Surge & Pump	
Duration:	N/A	hours
Purgevolume:	220	gallons
Volume of water injected:	N/A	gallons
Calculated well volume:	350	gallons

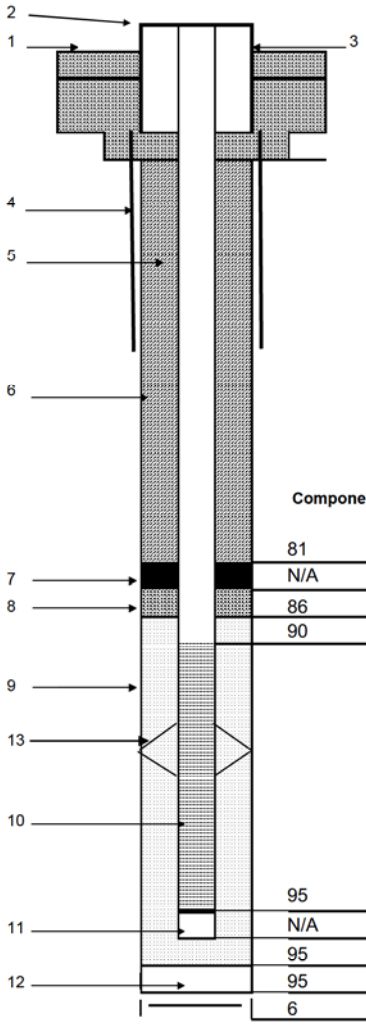
Comments:

CH2MHILL

PROJECT NUMBER	WELL NUMBER
457958	CG039-IW-02-4551

WELL COMPLETION DIAGRAM

PROJECT NAME :	JBER-R	LOCATION NAME:	CG039
NORTHING:	6799336.022	EASTING: 360165.223	DRILLING CONTRACTOR: Geotek
START DATE:	07/24/2013	END DATE: 07/27/2013	DRILLING METHOD: Air rotary
BOREHOLE DIAMETER:	6.0 inches		DRILLING EQUIPMENT: Geoprobe
TOTAL BOREHOLE DEPTH:	95 feet bgs		LOGGED BY: A. Seay



Component Depths BGS

81	Top of transition seal (feet bgs)
N/A	Top of transition sand (feet bgs)
86	Top of filter pack (feet bgs)
90	Top of screen (feet bgs)
95	Bottom of screen (feet bgs)
N/A	Bottom of sump (feet bgs)
95	Bottom of filter pack (feet bgs)
95	Bottom of borehole (feet bgs)
6	Borehole Diameter (inches)

NOTE: DRAWING NOT TO SCALE

1- Ground elevation at well	304.64	feet NAVD 88
2- Top of casing elevation	308.26	feet NAVD 88
3- Surface completion type	Above Ground Momument	
a) Diameter	6	inches
b) Concrete pad dimensions	12	inches
c) Bollards	N/A	
4- Conductor casing type	N/A	
a) Diameter	N/A	inches
b) Length	N/A	feet
5- Well casing type	Schedule 80 PVC	
a) Diameter	2	inches
b) Length	90	feet
6- Sanitary seal type	Cement Grout (2% bentonite)	
a) Method of placement	Tremie pipe	
b) Volume used	75	gallons
c) Calculated volume	N/A $feet^3$	gallons
7- Transition seal type	Bentonite pellets	
a) Quantity used	1	50 lb bags
b) Calculated quantity	N/A $feet^3$	50 lb bags
8- Transition filter pack type	N/A	
a) Quantity used	N/A	100 lb bags
b) Calculated quantity	N/A $feet^3$	100 lb bags
9- Filter pack type	8/12 silica sand	
a) Quantity used	2.5	100 lb bags
b) Calculated quantity	N/A $feet^3$	100 lb bags
10- Screen type / slot size	Continuous wire wrap PVC	
a) Diameter	2	inches
b) Length	5	feet
c) Slot size	0.065	inches
11- Sump / end cap type	PVC Slip-cap	
a) Diameter	2	inches
b) Length	0.00	feet
12- Backfill type	N/A	
a) Quantity used	N/A	
b) Calculated quantity	N/A	
13- Centralizer type	N/A	
a) Depths	N/A	feet bgs

Well Development

Start Date/Time:	8/2/2013 9:00 am	
End Date/Time:	8/2/2013 4:25 pm	
Measured Depth to Water	91.45	feet bgs
Development Method:	Surge & Pump	
Duration:	N/A	hours
Purgevolume:	143	gallons
Volume of water injected:	N/A	gallons
Calculated well volume:	72	gallons

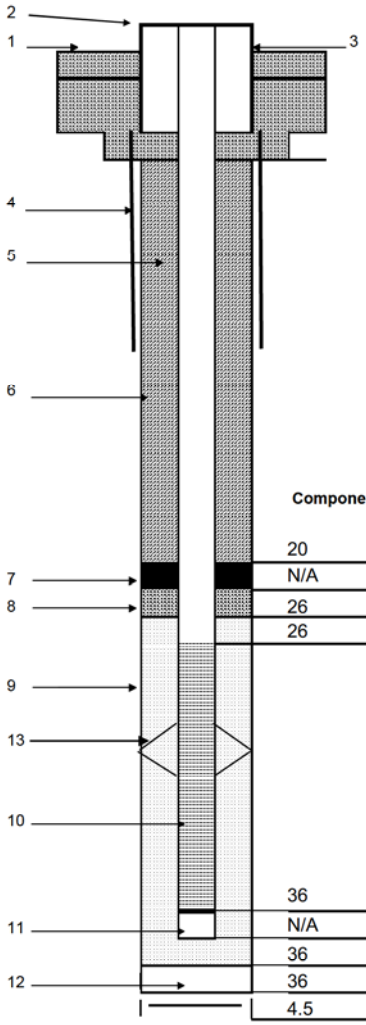
Comments:

CH2MHILL

PROJECT NUMBER	WELL NUMBER
457958	CG039-ROI-3983

WELL COMPLETION DIAGRAM

PROJECT NAME :	JBER-R			LOCATION NAME:	CG039
NORTHING:	6799359.141	EASTING:	360166.473	DRILLING CONTRACTOR:	Geotek
START DATE:	07/15/2013	END DATE:	07/16/2013	DRILLING METHOD:	Air rotary
BOREHOLE DIAMETER:	4.5 inches			DRILLING EQUIPMENT:	Geoprobe
TOTAL BOREHOLE DEPTH:	36 feet bgs			LOGGED BY:	J. Frame



Component Depths BGS

20	Top of transition seal (feet bgs)
N/A	Top of transition sand (feet bgs)
26	Top of filter pack (feet bgs)
26	Top of screen (feet bgs)
36	Bottom of screen (feet bgs)
N/A	Bottom of sump (feet bgs)
36	Bottom of filter pack (feet bgs)
36	Bottom of borehole (feet bgs)
4.5	Borehole Diameter (inches)

NOTE: DRAWING NOT TO SCALE

1- Ground elevation at well	304.25		feet NAVD 88
2- Top of casing elevation	307.35		feet NAVD 88
3- Surface completion type	Above Ground Momument		
a) Diameter	6		inches
b) Concrete pad dimensions	12		inches
c) Bollards	N/A		
4- Conductor casing type	N/A		
a) Diameter	N/A		inches
b) Length	N/A		feet
5- Well casing type	Schedule 40 PVC		
a) Diameter	2		inches
b) Length	26		feet
6- Sanitary seal type	Cement Grout (2% bentonite)		
a) Method of placement	Tremie pipe		
b) Volume used	35		gallons
c) Calculated volume	N/A	$feet^3$	gallons
7- Transition seal type	Bentonite pellets		
a) Quantity used	1		50 lb bags
b) Calculated quantity	N/A	$feet^3$	50 lb bags
8- Transition filter pack type	N/A		
a) Quantity used	N/A		100 lb bags
b) Calculated quantity	N/A	$feet^3$	100 lb bags
9- Filter pack type	Pre-pack filter 20/40 (2x5 ft sections)		
a) Quantity used	N/A		100 lb bags
b) Calculated quantity	N/A	$feet^3$	100 lb bags
10- Screen type / slot size	Mill-slot		
a) Diameter	2		inches
b) Length	10		feet
c) Slot size	0.010		inches
11- Sump / end cap type	PVC Slip-cap		
a) Diameter	2		inches
b) Length	0.00		feet
12- Backfill type	N/A		
a) Quantity used	N/A		
b) Calculated quantity	N/A		
13- Centralizer type	N/A		
a) Depths	N/A		feet bgs

Well Development

Start Date/Time:	7/24/2013 3:04 pm	
End Date/Time:	7/25/2013 11:04 pm	
Measured Depth to Water	21.12	feet bgs
Development Method:	Surge & Pump	
Duration:	N/A	hours
Purgevolume:	130	gallons
Volume of water injected:	N/A	gallons
Calculated well volume:	130	gallons

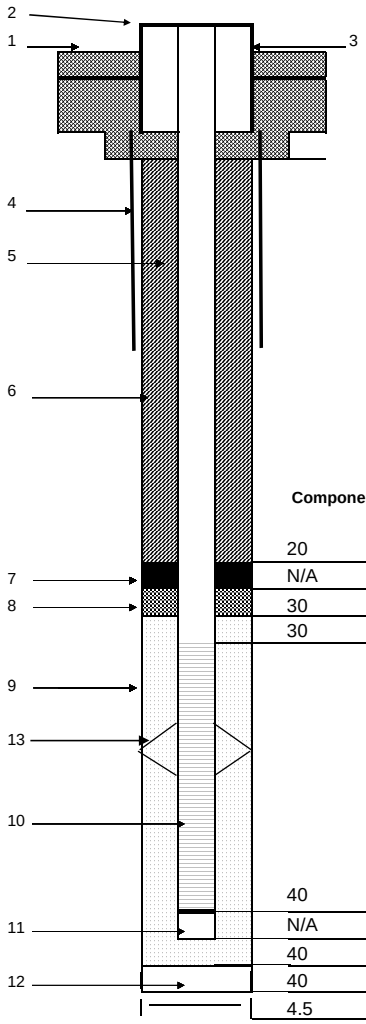
Comments:

CH2MHILL

PROJECT NUMBER	WELL NUMBER
457958	CG039-ROI-4550

WELL COMPLETION DIAGRAM

PROJECT NAME :	JBER-R			LOCATION NAME:	CG039
NORTHING:	6799338.047	EASTING:	360160.336	DRILLING CONTRACTOR:	Geotek
START DATE:	07/12/2013	END DATE:	07/13/2013	DRILLING METHOD:	Air rotary
BOREHOLE DIAMETER:	4.5 inches			DRILLING EQUIPMENT:	Geoprobe
TOTAL BOREHOLE DEPTH:	40 feet bgs			LOGGED BY:	A. Seay



Component Depths BGS

20	Top of transition seal (feet bgs)
N/A	Top of transition sand (feet bgs)
30	Top of filter pack (feet bgs)
30	Top of screen (feet bgs)
40	Bottom of screen (feet bgs)
N/A	Bottom of sump (feet bgs)
40	Bottom of filter pack (feet bgs)
40	Bottom of borehole (feet bgs)
4.5	Borehole Diameter (inches)

NOTE: DRAWING NOT TO SCALE

1- Ground elevation at well	305.77		feet NAVD 88
2- Top of casing elevation	309.35		feet NAVD 88
3- Surface completion type	Above Ground Momument		
a) Diameter	6		inches
b) Concrete pad dimensions	12		inches
c) Bollards	N/A		
4- Conductor casing type	N/A		
a) Diameter	N/A		inches
b) Length	N/A		feet
5- Well casing type	Schedule 40 PVC		
a) Diameter	2		inches
b) Length	30		feet
6- Sanitary seal type	Cement Grout (2% bentonite)		
a) Method of placement	Tremie pipe		
b) Volume used	30		gallons
c) Calculated volume	N/A	$feet^3$	gallons
7- Transition seal type	Bentonite pellets		
a) Quantity used	1		50 lb bags
b) Calculated quantity	N/A	$feet^3$	50 lb bags
8- Transition filter pack type	N/A		
a) Quantity used	N/A		100 lb bags
b) Calculated quantity	N/A	$feet^3$	100 lb bags
9- Filter pack type	Pre-pack filter 20/40 (2x5 ft sections)		
a) Quantity used	N/A		100 lb bags
b) Calculated quantity	N/A	$feet^3$	100 lb bags
10- Screen type / slot size	Mill-slot		
a) Diameter	2		inches
b) Length	10		feet
c) Slot size	0.010		inches
11- Sump / end cap type	PVC Slip-cap		
a) Diameter	2		inches
b) Length	0.00		feet
12- Backfill type	N/A		
a) Quantity used	N/A		
b) Calculated quantity	N/A		
13- Centralizer type	N/A		
a) Depths	N/A		feet bgs

Well Development

Start Date/Time:	12/10/2013 3:00 pm	
End Date/Time:	8/8/2013 4:10 pm	
Measured Depth to Water	26.70	feet bgs
Development Method:	Surge & Pump	
Duration:	N/A	hours
Purgevolume:	88	gallons
Volume of water injected:	N/A	gallons
Calculated well volume:	271	gallons

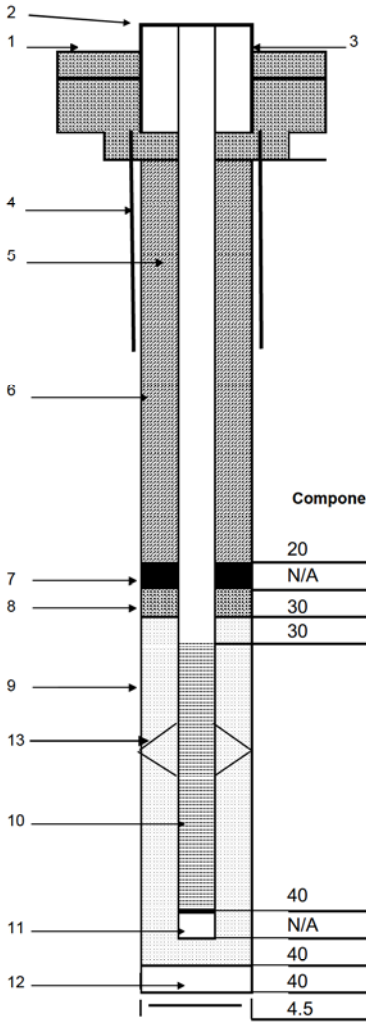
Comments:

CH2MHILL

PROJECT NUMBER	WELL NUMBER
457958	CG039-ROI-4551

WELL COMPLETION DIAGRAM

PROJECT NAME :	JBER-R			LOCATION NAME:	CG039
NORTHING:	6799338.047	EASTING:	360160.336	DRILLING CONTRACTOR:	Geotek
START DATE:	07/12/2013	END DATE:	07/13/2013	DRILLING METHOD:	Air rotary
BOREHOLE DIAMETER:	4.5 inches			DRILLING EQUIPMENT:	Geoprobe
TOTAL BOREHOLE DEPTH:	40 feet bgs			LOGGED BY:	A. Seay



Component Depths BGS

20	Top of transition seal (feet bgs)
N/A	Top of transition sand (feet bgs)
30	Top of filter pack (feet bgs)
30	Top of screen (feet bgs)
40	Bottom of screen (feet bgs)
N/A	Bottom of sump (feet bgs)
40	Bottom of filter pack (feet bgs)
40	Bottom of borehole (feet bgs)
4.5	Borehole Diameter (inches)

NOTE: DRAWING NOT TO SCALE

1- Ground elevation at well	305.77		feet NAVD 88
2- Top of casing elevation	309.35		feet NAVD 88
3- Surface completion type	Above Ground Momument		
a) Diameter	6		inches
b) Concrete pad dimensions	12		inches
c) Bollards	N/A		
4- Conductor casing type	N/A		
a) Diameter	N/A		inches
b) Length	N/A		feet
5- Well casing type	Schedule 40 PVC		
a) Diameter	2		inches
b) Length	30		feet
6- Sanitary seal type	Cement Grout (2% bentonite)		
a) Method of placement	Tremie pipe		
b) Volume used	30		gallons
c) Calculated volume	N/A	$feet^3$	gallons
7- Transition seal type	Bentonite pellets		
a) Quantity used	1		50 lb bags
b) Calculated quantity	N/A	$feet^3$	50 lb bags
8- Transition filter pack type	N/A		
a) Quantity used	N/A		100 lb bags
b) Calculated quantity	N/A	$feet^3$	100 lb bags
9- Filter pack type	Pre-pack filter 20/40 (2x5 ft sections)		
a) Quantity used	N/A		100 lb bags
b) Calculated quantity	N/A	$feet^3$	100 lb bags
10- Screen type / slot size	Mill-slot		
a) Diameter	2		inches
b) Length	10		feet
c) Slot size	0.010		inches
11- Sump / end cap type	PVC Slip-cap		
a) Diameter	2		inches
b) Length	0.00		feet
12- Backfill type	N/A		
a) Quantity used	N/A		
b) Calculated quantity	N/A		
13- Centralizer type	N/A		
a) Depths	N/A		feet bgs

Well Development

Start Date/Time:	12/10/2013 3:00 pm	
End Date/Time:	8/8/2013 4:10 pm	
Measured Depth to Water	26.70	feet bgs
Development Method:	Surge & Pump	
Duration:	N/A	hours
Purgevolume:	88	gallons
Volume of water injected:	N/A	gallons
Calculated well volume:	271	gallons

Comments:

Appendix D
Well Development Logs

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SOP-09 Attachment 1

WELL DEVELOPMENT DATASHEET

SHEET 1 OF 1

Well ID: AP-3983R

CH2MHILL

Project: ~~CG034~~ CG037 JBER PBR

Location: CG034

Project #:

Development Contractor/Geologist: J. KNUTH

Field Notebook #: WELL DEVELOPMENT BOOK

Date: 7/24/13

Start Time: 1023

End Time: ~~1505~~ 1508

Date Well Installed:

Well Information and Purge Volume Calculation

Casing ID (inch):	Unit Casing Volume (A) (gal/ft):
0.75	0.02
1	0.04
1.5	0.09
2	0.16
3	0.37
4	0.65
5	1.02
6	1.47
7	2.00
8	2.61
10	4.08
12	5.88

Total Well Depth (B) (ft btoc): 41.0'

Depth to Water (C) (ft btoc): - 17.9'

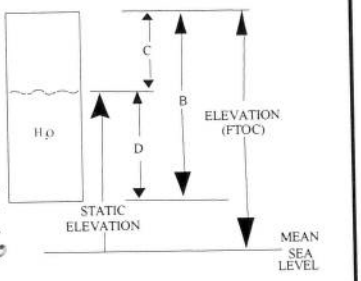
Length of Static Water Column in Well (feet): (B - C = D) = 23.1'

Unit Casing Volume (A) (gal/ft): x 0.16

Well Casing Volume (E) (gal): (D x A = E) = 3.696

x 10

Total Purge Volume (F) (gal): (E x 10 well volumes = F) = 36.96



Well Screened Interval (ft btoc): 31-41'

Approx. Sediment Depth in Well (ft):

Development Methods

Method: ☒ Surging ☒ Pumping ☐ Bailing ☐ Other Describe:

Surge time per interval (min):

Number of development intervals: 3

0.76 gpm

Pump: ☐ Perist. ☐ Bladder ☒ Subm. ☐ Other Describe:

Purge time per interval (min): ~~3~~ 10

Purge Flow Rate (gpm): ~~2.03~~ Total purge volume (gals): ~153

Total purge time (min):

Pump Intake Depth (ft btoc):

Bailer: ☐ Poly ☐ Teflon ☐ S.steel ☐ Other Describe:

Bailer Volume (gals): (0.25 / 0.33) Required Bailer Volumes: Total purge volume (gals):

Criteria for Stable Parameters

Parameter	Working Range (YSI 556MPS)	Stability Criteria	Depth to Water Stabilization	
			Time	DTW
Temperature	-5 to 45°C	± 1.0 °C		
pH	0 to 14 NTU	± 0.1		
Conductivity	0 to 200 mS/cm	± 3%		
ORP	-999 to +999 mV	± 10 mV		
Dissolved Oxygen	0 to 50 mg/L	± 10% or 0.2 mg/L		
Turbidity	0 to 1000 NTU	± 10% (≤10 NTU)		

Instrument Observations

Round	Time	Water Level (ft BTOC)	Volume Purged (gallons)	pH	Cond (mS/cm)	Turbidity (NTU)	DO (mg/L)	Temp (C)	ORP (mV)
1	~~1437~~	22.51	~135	7.53	0.354	22.9	4.64	5.26	46.5
2	1442	22.49	~139	7.45	0.350	21.8	3.43	5.02	44.1
3 (1445)	~~1445~~	22.55	~143	7.33	0.350	18.0	3.28	4.99	36.0
4 (1448)	~~1450~~	22.54	~146	7.31	0.350	17.5	3.22	5.03	36.7
5	1451	22.53	~148	7.26	0.351	14.6	3.20	5.03	43.2
6	1454	22.52	~149	7.25	0.351	14.2	3.20	4.97	39.2
7	1458	22.52	~152	7.22	0.351	12.1	3.07	4.98	43.7
8	1501	22.52	~152	7.20	0.351	11.9	3.00	5.01	40.9
9	1504	22	~153	7.17	0.351	9.66	2.99	4.95	40.1

Notes: Draw-down should ideally be less than 0.3 feet from the original depth to groundwater.
Minimal draw-down achieved and measured by: 1) pumping at a low rate (approximately 1 liter/ 3 minutes or .1 gal/min) and 2) continually measuring water levels in the well.

Sensory Observations

Color: Clear, Amber, Tan, Brown, (Grey), Milky White, Other:

Odor: None, Low, Medium, High, Very Strong, H2S, Fuel Like, Chemical ?, Unknown

Turbidity: None, Low, (Medium), High, Very Turbid, Heavy Silts

Comments:

Difficult to clear up even after purging & pumping every 3 intervals x 3 times.

SOP-09 Attachment 1

WELL DEVELOPMENT DATASHEET

SHEET 1 OF 1

Well ID: IW01-3983

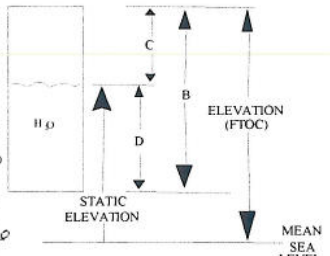
CH2MHILL

Project: JBER-R
Location: CG039
Project #: 457958
Development Contractor/Geologist: J. Knuth, J. Frame & M. Kelly (GTJA)
Field Notebook #: Well development
Date: 7.31.13
Start Time: 1510
End Time: 1640
Date Well Installed: 7.18.13

Well Information and Purge Volume Calculation

Casing ID (inch):	Unit Casing Volume (A) (gal/ft):
0.75	0.02
1	0.04
1.5	0.09
2	0.16
3	0.37
4	0.65
5	1.02
6	1.47
7	2.00
8	2.61
10	4.08
12	5.88

Total Well Depth (B) (ft btoc): 41.66'
Depth to Water (C) (ft btoc): - 21.40'
Length of Static Water Column in Well (feet): (B - C = D) = 20.26'
Unit Casing Volume (A) (gal/ft): x 0.16
Well Casing Volume (E) (gal): (D x A = E) = 3.2416
x 10
Total Purge Volume (F) (gal): (E x 10 well volumes = F) = 32.416



Well Screened Interval (ft btoc): 21-41'
Approx. Sediment Depth in Well (ft): N/A

6" calculation
41.66'
- 21.40'
20.26'
x 1.47'
29.78
x 10
total purge volume = 297.82 gal

Development Methods

Method: ☒ Surging ☒ Pumping ☐ Bailing ☐ Other Describe:
Surge time per interval (min): ____ Number of development intervals: ____
Pump: ☐ Perist. ☒ Bladder ☐ Subm. ☐ Other Describe: Geotech 1.66 Retainer Pump
Purge time per interval (min): 5 Purge Flow Rate (gpm): 0.5 Total purge volume (gals): ____
Total purge time (min): ____ Pump Intake Depth (ft btoc): ____
Bailer: ☐ Poly ☒ Teflon ☐ S.steel ☐ Other Describe:
Bailer Volume (gals): ____ (0.25 / 0.33) Required Bailer Volumes: ____ Total purge volume (gals): ____

Criteria for Stable Parameters

Parameter	*Working Range (YSI 556MPS)*	*Stability Criteria*	*Depth to Water Stabilization*	
			Time	DTW
Temperature	-5 to 45°C	± 1.0 °C		
pH	0 to 14 NTU	± 0.1		
Conductivity	0 to 200 mS/cm	± 3%		
ORP	-999 to +999 mV	± 10 mV		
Dissolved Oxygen	0 to 50 mg/L	± 10% or 0.2 mg/L		
Turbidity	0 to 1000 NTU	± 10% (≤10 NTU)		

Instrument Observations

Round	*Time*	*Water Level (ft BTOC)*	*Volume Purged (gallons)*	*pH*	*Cond (mS/cm)*	*Turbidity (NTU)*	*DO (mg/L)*	*Temp (C)*	*ORP (mV)*
1	1610	21.61	195	6.85	0.279	50.0	1.15	5.44	47.4
2	1615	21.61	197.5	6.90	0.279	49.1	1.09	5.62	49.1
3	1620	21.61	200	6.95	0.279	49.2	0.95	5.53	50.0
4	1625	21.61	202.5	6.80	0.279	42.5	0.76	5.65	57.1
5	1630	21.61	205	6.78	0.280	41.7	0.24	5.74	43.1
6	1635	21.61	207.5	6.75	0.279	39.4	0.24	5.83	40.6
7	1640	21.61	210	6.71	0.280	38.6	0.25	5.61	39.8
8									
9									

Notes: Draw-down should ideally be less than 0.3 feet from the original depth to groundwater.
Minimal draw-down achieved and measured by: 1) pumping at a low rate (approximately 1 liter/ 3 minutes or .1 gal/min) and 2) continually measuring water levels in the well.

Sensory Observations

Color: Clear, Amber, (Tan), Brown, Grey, Milky White, Other:
Odor: (None), Low, Medium, High, Very Strong, H2S, Fuel Like, Chemical ?, Unknown
Turbidity: None, Low, (Medium), High, Very Turbid, Heavy Silts

Comments: Use bailer to remove residual fines to complete development

Revised February 2010.

SOP-09 Attachment 1

WELL DEVELOPMENT DATASHEET

SHEET 1 OF 1

Well ID: JWO2-3983

CH2MHILL

Project: JBER PBR

Location: CG039

Project #:

Development Contractor/Geologist: J. KNUTH + M. KELLEY

Field Notebook #: WELL DEVELOPMENT

Date: 7/30/13 - 7/31/13

Start Time: 930

End Time:

Date Well Installed:

Well Information and Purge Volume Calculation

Casing ID (inch):	Unit Casing Volume (A) (gal/ft):
0.75	0.02
1	0.04
1.5	0.09
2	0.16
3	0.37
4	0.65
5	1.02
6	1.47
7	2.00
8	2.61
10	4.08
12	5.88

Total Well Depth (B) (ft btoc): 43.19

Depth to Water (C) (ft btoc): - 21.65

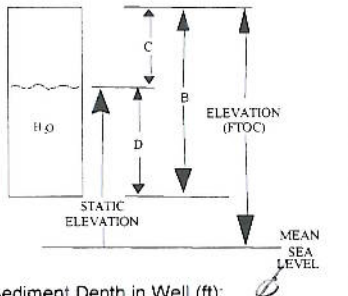
Length of Static Water Column in Well (feet): (B - C = D) = 21.54

Unit Casing Volume (A) (gal/ft): x 0.16

Well Casing Volume (E) (gal): (D x A = E) = 3.446

x 10

Total Purge Volume (F) (gal): (E x 10 well volumes = F) = 34.46



Well Screened Interval (ft btoc): 23 - 43'

Approx. Sediment Depth in Well (ft): 0

Development Methods

Method: ☐ Surging ☒ Pumping ☐ Bailing ☐ Other Describe:

Surge time per interval (min): 5 Number of development intervals:

Pump: ☐ Perist. ☒ Bladder ☐ Subm. ☐ Other Describe: Geotech 1.66 Reclaimer

Purge time per interval (min): VARIES Purge Flow Rate (gpm): 0.9 Total purge volume (gals): 308

Total purge time (min): Pump Intake Depth (ft btoc):

Bailer: ☐ Poly ☐ Teflon ☐ S.steel ☐ Other Describe: N/A

Bailer Volume (gals): (0.25 / 0.33) Required Bailer Volumes: Total purge volume (gals):

Criteria for Stable Parameters

Parameter	Working Range (YSI 556MPS)	Stability Criteria	Depth to Water Stabilization Time	DTW BTOC
Temperature	-5 to 45°C	± 1.0 °C		
pH	0 to 14 NTU	± 0.1	1138	22.00
Conductivity	0 to 200 mS/cm	± 3%	1143	22.01
ORP	-999 to +999 mV	± 10 mV	1148	22.01
Dissolved Oxygen	0 to 50 mg/L	± 10% or 0.2 mg/L		
Turbidity	0 to 1000 NTU	± 10% (≤10 NTU)		

FLOW
0.9 gpm
0.9 gpm
0.9 gpm

Instrument Observations

Round	Time	Water Level (ft BTOC)	Volume Purged (gallons)	pH	Cond (mS/cm)	Turbidity (NTU)	DO (mg/L)	Temp (C)	ORP (mV)
1	1148	22.01	260	7.10	0.281	59.7	0.65	5.14	35.4
2	1153	22.01	264.5	7.14	0.281	51.8	0.54	5.20	35.9
3	1158	22.02	269	7.19	0.280	42.6	0.51	5.25	35.4
4	1203	22.02	273	7.22	0.279	36.0	0.55	5.33	38.1
5	1208	22.02	278	7.26	0.279	33.9	0.47	5.38	38.9
6	1213	22.02	282.5	7.28	0.279	28.7	0.48	5.36	38.7
7	1218	22.01	287	7.27	0.277	26.7	0.46	5.25	38.5
8	1223	22.01	291	7.26	0.278	25.1	0.44	5.26	39.1
9	1228	22.01	295	7.26	0.278	24.1	0.46	5.19	38.7
10	1233	22.01	~~300~~ 299	7.24	0.277	22.8	0.43	5.35	38.9
11	1238	22.01	304	7.24	0.278	22.4	0.52	5.39	39.7
12	1242	22.01	308	7.10	0.277	21.5	0.50	5.35	40.0

Notes: Draw-down should ideally be less than 0.3 feet from the original depth to groundwater.
Minimal draw-down achieved and measured by: 1) pumping at a low rate (approximately 1 liter/ 3 minutes or .1 gal/min) and 2) continually measuring water levels in the well.

CONTINUED MORE

Sensory Observations

Color: Clear, Amber, Tan, Brown, Grey, Milky White, Other:

Odor: None, Low, Medium, High, Very Strong, H2S, Fuel Like, Chemical ?, Unknown

Turbidity: None, Low, Medium, High, Very Turbid, Heavy Silts

Comments:

SOP-09 Attachment 1

WELL DEVELOPMENT DATASHEET

SHEET 1 OF 1

Well ID: ROI-3983

CH2MHILL

Project: JBER PBR

Location: CG039

Project #:

Development Contractor/Geologist: J. KNUTH

Field Notebook #: Well development

Date: ~~7~~/24/13 - 7/25/13

Start Time: 1504

End Time: 1104

Date Well Installed:

Well Information and Purge Volume Calculation

Casing ID (inch):	Unit Casing Volume (A) (gal/ft):
0.75	0.02
1	0.04
1.5	0.09
2	0.16
3	0.37
4	0.65
5	1.02
6	1.47
7	2.00
8	2.61
10	4.08
12	5.88

Total Well Depth (B) (ft btoc): 38.70

Depth to Water (C) (ft btoc): - 21.12'

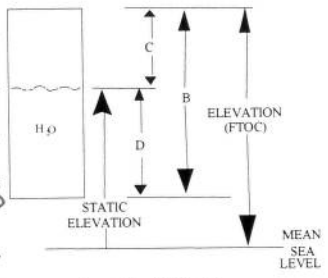
Length of Static Water Column in Well (feet): (B - C = D) = 17.58

Unit Casing Volume (A) (gal/ft): x 0.16

Well Casing Volume (E) (gal): (D x A = E) = 2,813

x 10 28.13

Total Purge Volume (F) (gal): (E x 10 well volumes = F) = 28.13



Well Screened Interval (ft btoc): 29-39'

Approx. Sediment Depth in Well (ft):

Development Methods

Method: ☒ Surging ☒ Pumping ☐ Bailing ☐ Other Describe:

Surge time per interval (min): 5

Number of development intervals: 3

Pump: ☐ Perist. ☐ Bladder ☒ Subm. ☐ Other Describe: SS HURRICANE HYDROACTIVE

Purge time per interval (min): 20

Purge Flow Rate (gpm): 0.3-1

Total purge volume (gals): 130

Total purge time (min):

Pump Intake Depth (ft btoc):

Bailer: ☐ Poly ☐ Teflon ☐ S.steel ☐ Other Describe:

Bailer Volume (gals): (0.25 / 0.33)

Required Bailer Volumes:

Total purge volume (gals):

Criteria for Stable Parameters

Parameter	Working Range (YSI 556MPS)	Stability Criteria	Depth to Water Stabilization	
			Time	DTW
Temperature	-5 to 45°C	± 1.0 °C		
pH	0 to 14 NTU	± 0.1	1016	25.06
Conductivity	0 to 200 mS/cm	± 3%	1023	24.22
ORP	-999 to +999 mV	± 10 mV		
Dissolved Oxygen	0 to 50 mg/L	± 10% or 0.2 mg/L		
Turbidity	0 to 1000 NTU	± 10% (≤10 NTU)		

Instrument Observations

Round	Time	Water Level (ft BTOC)	Volume Purged (gallons)	pH ✓	Cond (mS/cm) ✓	Turbidity (NTU) ✓	DO (mg/L) ✓	Temp (C) ✓	ORP (mV) ✓
1	1016	25.05	120	6.74	0.351	19.8	0.56	5.36	27.1
2	1049	22.65	125	6.73	0.349	12.0	0.17	6.25	23.8
3	1052	22.62	126	6.73	0.348	12.8	0.14	6.26	22.9
4	1055	22.67	127	6.72	0.347	11.7	0.17	6.22	25.3
5	1058	22.82	128	6.72	0.346	11.8	0.16	6.01	23.9
6	1101	22.59	129	6.72	0.345	12.7	0.17	6.15	23.7
7	1104	22.35	130	6.72	0.348	10.0	0.14	6.39	22.3
8									
9									

Notes: Draw-down should ideally be less than 0.3 feet from the original depth to groundwater.
Minimal draw-down achieved and measured by: 1) pumping at a low rate (approximately 1 liter/ 3 minutes or .1 gal/min) and 2) continually measuring water levels in the well.

Sensory Observations

Color: Clear, Amber, Tan, Brown, Grey, Milky White, Other:

Odor: None, Low, Medium, High, Very Strong, H2S, Fuel Like, Chemical ?, Unknown

Turbidity: None, Low, Medium, High, Very Turbid, Heavy Silts

Comments:

SOP-09 Attachment 1

WELL DEVELOPMENT DATASHEET

SHEET 1 OF 1

Well ID: IW01-4550

CH2MHILL

Project: JBER-R

Location: CG039

Project #: 457958

Date: 8.8.13

Start Time: 1146

End Time: 1450

Development Contractor/Geologist: A. Seay & M. Kelly (GTA)

Field Notebook #: Well development

Date Well Installed: 7.20.13

Well Information and Purge Volume Calculation

Casing ID (inch):	Unit Casing Volume (A) (gal/ft):
0.75	0.02
1	0.04
1.5	0.09
2	0.16
3	0.37
4	0.65
5	1.02
6	1.47
7	2.00
8	2.61
10	4.08
12	5.88

Total Well Depth (B) (ft btoc): 46.3'

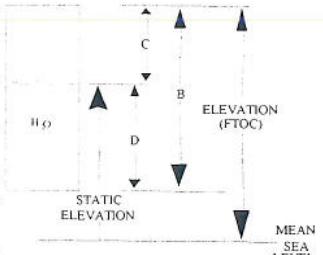
Depth to Water (C) (ft btoc): - 23'

Length of Static Water Column in Well (feet): (B - C = D) = 23.3'

Unit Casing Volume (A) (gal/ft): x 0.16

Well Casing Volume (E) (gal): (D x A = E) = 3.728 x 10

Total Purge Volume (F) (gal): (E x 10 well volumes = F) = 37.28



Well Screened Interval (ft btoc): 25-45'

Approx. Sediment Depth in Well (ft): N/A

6" calculation
46.3'
- 23'
23.3'
x 1.47
34.251
x 10
total purge volume = 342.51 gal

Development Methods

Method: ☒ Surging ☒ Pumping ☐ Bailing ☐ Other Describe:

Surge time per interval (min): Number of development intervals:

Pump: ☐ Perist. ☒ Bladder ☐ Subm. ☐ Other Describe: Geotech Level Reclaimer Pump

Purge time per interval (min): 5 Purge Flow Rate (gpm): 0.64 Total purge volume (gals): 155

Total purge time (min): Pump Intake Depth (ft btoc):

Bailer: ☐ Poly ☒ Teflon ☐ S.steel ☐ Other Describe:

Bailer Volume (gals): (0.25 / 0.33) Required Bailer Volumes: Total purge volume (gals):

Criteria for Stable Parameters

Parameter	Working Range (YSI 556MPS)	Stability Criteria	Depth to Water Stabilization	
			Time	DTW
Temperature	-5 to 45°C	± 1.0 °C		
pH	0 to 14 NTU	± 0.1		
Conductivity	0 to 200 mS/cm	± 3%		
ORP	-999 to +999 mV	± 10 mV		
Dissolved Oxygen	0 to 50 mg/L	± 10% or 0.2 mg/L		
Turbidity	0 to 1000 NTU	± 10% (≤10 NTU)		

Instrument Observations

Round	Time	Water Level (ft BTOC)	Volume Purged (gallons)	pH	Cond (mS/cm)	Turbidity (NTU)	DO (mg/L)	Temp (C)	ORP (mV)
1	1430	23.12	142.3	6.15	0.342	39.7	0.26	5.71	23.2
2	1435	23.13	145.4	6.30	0.341	40.6	1.8	6.29	8.0
3	1440	23.11	148.6	6.32	0.342	40.5	0.35	6.20	12.1
4	1445	23.10	151.8	6.34	0.342	37.9	0.34	5.80	7.4
5	1450	23.11	155	6.33	0.341	35.7	0.37	5.89	5.9
6									
7									
8									
9									

Notes: Draw-down should ideally be less than 0.3 feet from the original depth to groundwater.
Minimal draw-down achieved and measured by: 1) pumping at a low rate (approximately 1 liter/ 3 minutes or .1 gal/min) and 2) continually measuring water levels in the well.

Sensory Observations

Color: (Clear) Amber, Tan, Brown, Grey, Milky White, Other:

Odor: (None) Low, Medium, High, Very Strong, H2S, Fuel Like, Chemical ?, Unknown

Turbidity: None, (Low) Medium, High, Very Turbid, Heavy Silts

Comments:

SOP-09 Attachment 1

WELL DEVELOPMENT DATASHEET

SHEET 1 OF 1

Well ID: IW02-4550

CH2MHILL

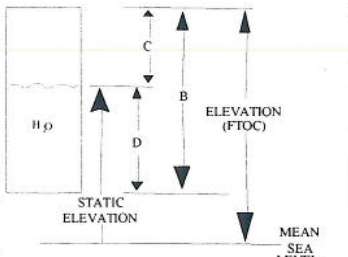
Project: JBER-R
Location: CG039
Project #: 457958
Development Contractor/Geologist: A. Seay & M. Kelly (CGTA)
Field Notebook #: Date Well Installed:

Date: 8.7.13
Start Time: 1000
End Time: 1040

Well Information and Purge Volume Calculation

Casing ID (inch):	Unit Casing Volume (A) (gal/ft):
0.75	0.02
1	0.04
1.5	0.09
2	0.16
3	0.37
4	0.65
5	1.02
6	1.47
7	2.00
8	2.61
10	4.08
12	5.88

Total Well Depth (B) (ft btoc): 46.43'
Depth to Water (C) (ft btoc): - 22.63'
Length of Static Water Column in Well (feet): (B - C = D) = 23.8'
Unit Casing Volume (A) (gal/ft): x 0.16
Well Casing Volume (E) (gal): (D x A = E) = 3.808 x 10
Total Purge Volume (F) (gal): (E x 10 well volumes = F) = 38.08



Well Screened Interval (ft btoc): 25-45' Approx. Sediment Depth in Well (ft): N/A

6" calculation
46.43'
- 22.63'
23.8'
x 1.47
34.986
x 10
total purge volume = 349.86 gal

Development Methods

Method: ☒ Surging ☒ Pumping ☐ Bailing ☐ Other Describe:
Surge time per interval (min): Number of development intervals:
Pump: ☐ Perist. ☒ Bladder ☐ Subm. ☐ Other Describe: Geotech 1.5" Reclaimer Pump 220
Purge time per interval (min): 5 Purge Flow Rate (gpm): 0.5 Total purge volume (gals):
Total purge time (min): Pump Intake Depth (ft btoc):
Bailer: ☐ Poly ☒ Teflon ☐ S.steel ☐ Other Describe:
Bailer Volume (gals): (0.25 / 0.33) Required Bailer Volumes: Total purge volume (gals):

Criteria for Stable Parameters

Parameter	Working Range (YSI 556MPS)	Stability Criteria	Depth to Water Stabilization	
			Time	DTW
Temperature	-5 to 45°C	± 1.0 °C		
pH	0 to 14 NTU	± 0.1		
Conductivity	0 to 200 mS/cm	± 3%		
ORP	-999 to +999 mV	± 10 mV		
Dissolved Oxygen	0 to 50 mg/L	± 10% or 0.2 mg/L		
Turbidity	0 to 1000 NTU	± 10% (≤10 NTU)		

Instrument Observations

Round	Time	Water Level (ft BTOC)	Volume Purged (gallons)	pH	Cond (mS/cm)	Turbidity (NTU)	DO (mg/L)	Temp (C)	ORP (mV)
1	1025	24.15	212.5	7.05	0.495	10.7	1.22	4.70	-53.2
2	1030	24.05	215	7.12	0.492	9.66	1.21	4.73	-54.8
3	1035	24.04	217.5	7.15	0.411	9.14	1.16	4.68	-54.3
4	1040	24.01	220	7.11	0.491	7.22	1.14	4.27	-53.9
5									
6									
7									
8									
9									

Notes: Draw-down should ideally be less than 0.3 feet from the original depth to groundwater.
Minimal draw-down achieved and measured by: 1) pumping at a low rate (approximately 1 liter/ 3 minutes or .1 gal/min) and 2) continually measuring water levels in the well.

Sensory Observations

Color: (Clear,) Amber, Tan, Brown, Grey, Milky White, Other:
Odor: (None) Low, Medium, High, Very Strong, H2S, Fuel Like, Chemical ?, Unknown
Turbidity: None, (Low,) Medium, High, Very Turbid, Heavy Silts

Comments:

SOP-09 Attachment 1

WELL DEVELOPMENT DATASHEET

SHEET 1 OF 1

Well ID: ROI-4550

CH2MHILL

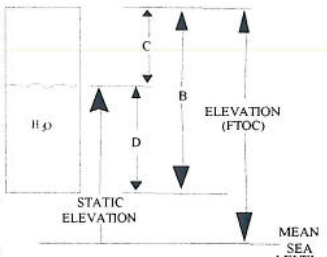
Project: JBER-R
Location: CG039
Project #: 457958
Development Contractor/Geologist: A. Seay & M. Kelly (GTA)
Field Notebook #: Well development
Date Well Installed: 7.13.13

Date: 8.8.13
Start Time: 1500
End Time: 1610

Well Information and Purge Volume Calculation

Casing ID (inch):	Unit Casing Volume (A) (gal/ft):
0.75	0.02
1	0.04
1.5	0.09
2	0.16
3	0.37
4	0.65
5	1.02
6	1.47
7	2.00
8	2.61
10	4.08
12	5.88

Total Well Depth (B) (ft btoc): 45.15'
Depth to Water (C) (ft btoc): - 26.7'
Length of Static Water Column in Well (feet): (B - C = D) = 18.45'
Unit Casing Volume (A) (gal/ft): x 0.16
Well Casing Volume (E) (gal): (D x A = E) = 2.952 x 10
Total Purge Volume (F) (gal): (E x 10 well volumes = F) = 29.52



Well Screened Interval (ft btoc): 30-40' Approx. Sediment Depth in Well (ft): N/A

6" calculation
45.15'
- 26.7'
18.45'
x 1.47
27.12
x 10
total purge volume = 271.2 gal

Development Methods

Method: ☐ Surging ☐ Pumping ☐ Bailing ☐ Other Describe:
Surge time per interval (min): Number of development intervals:
Pump: ☐ Perist. ☐ Bladder ☐ Subm. ☐ Other Describe: Geotech 1.66 Reclaimer Pump
Purge time per interval (min): Varies Purge Flow Rate (gpm): ~0.6 Total purge volume (gals):
Total purge time (min): Pump Intake Depth (ft btoc):
Bailer: ☐ Poly ☐ Teflon ☐ S.steel ☐ Other Describe:
Bailer Volume (gals): (0.25 / 0.33) Required Bailer Volumes: Total purge volume (gals):

Criteria for Stable Parameters

Parameter	Working Range (YSI 556MPS)	Stability Criteria	Depth to Water Stabilization	
			Time	DTW
Temperature	-5 to 45°C	± 1.0 °C		
pH	0 to 14 NTU	± 0.1		
Conductivity	0 to 200 mS/cm	± 3%		
ORP	-999 to +999 mV	± 10 mV		
Dissolved Oxygen	0 to 50 mg/L	± 10% or 0.2 mg/L		
Turbidity	0 to 1000 NTU	± 10% (≤10 NTU)		

Instrument Observations

Round	Time	Water Level (ft BTOC)	Volume Purged (gallons)	pH	Cond (mS/cm)	Turbidity (NTU)	DO (mg/L)	Temp (C)	ORP (mV)
1	1548	Below top of pump	74.8	6.66	0.559	947	10.0	6.88	-6.1
2	1551		76.6	7.04	0.580	N/A	14.61	7.06	-11.0
3	1553		77.8	7.37	0.590	N/A	14.48	9.13	34.9
4	1559		81.4	7.38	0.590	N/A	12.93	10.32	71.3
5	1601		82.6	7.39	0.591	N/A	12.5	7.39	75.1
6	1604		84.4	7.06	0.579	overrange	14.9	7.19	51.0
7	1607		86.2	6.79	0.556	276	13.0	8.27	16.7
8	1610	↓	88	7.18	0.557	N/A	18.8	7.71	14.0
9									

Notes: Draw-down should ideally be less than 0.3 feet from the original depth to groundwater.
Minimal draw-down achieved and measured by: 1) pumping at a low rate (approximately 1 liter/ 3 minutes or .1 gal/min) and 2) continually measuring water levels in the well.

Sensory Observations

Color: Clear, Amber, Tan, Brown, Grey, Milky White, Other:
Odor: None, Low, Medium, High, Very Strong, H2S, Fuel Like, Chemical ?, Unknown
Turbidity: None, Low, Medium, High, Very Turbid, Heavy Silts

Comments: Very slow recharge - well goes dry very quickly. Turbidity stabilization a major problem. Well got to 3005 this morning and then went dry. Starting at 1551, water stagnant in tubing and flow-thru cell. Could not retrieve turbidity sample.

SOP-09 Attachment 1

WELL DEVELOPMENT DATASHEET

SHEET 1 OF 1

Well ID: IW01-4551

CH2MHILL

Project: JBER-R PBR

Location: CG039

Project #: 457958

Development Contractor/Geologist: GeoTek (M. Kelly) / CH2M (J. Frame)

Field Notebook #: Well Development Book

Date: 8.5.13

Start Time: 0955

End Time: 1700

Date Well Installed:

Well Information and Purge Volume Calculation

Casing ID (inch):	Unit Casing Volume (A) (gal/ft):
0.75	0.02
1	0.04
1.5	0.09
2	0.16
3	0.37
4	0.65
5	1.02
6	1.47
7	2.00
8	2.61
10	4.08
12	5.88

Total Well Depth (B) (ft btoc): 101.32'

Depth to Water (C) (ft btoc): - 92.11

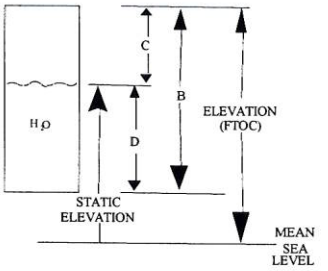
Length of Static Water Column in Well (feet): (B - C = D) = 9.21

Unit Casing Volume (A) (gal/ft): x 0.16

Well Casing Volume (E) (gal): (D x A = E) = 1.474

x 10

Total Purge Volume (F) (gal): (E x 10 well volumes = F) = 14.74



Well Screened Interval (ft btoc): 101-96

Approx. Sediment Depth in Well (ft):

Development Methods

Method: ☒ Surging ☒ Pumping ☒ Bailing ☐ Other Describe:

Surge time per interval (min): 5 mins Number of development intervals: 1 (101-96')

Pump: ☐ Perist. ☐ Bladder ☐ Subm. ☐ Other Describe:

Purge time per interval (min): 20 mins Purge Flow Rate (gpm): 0.6 Total purge volume (gals): 134

Total purge time (min): Pump Intake Depth (ft btoc): ~100'

Bailer: ☐ Poly ☐ Teflon ☐ S.steel ☐ Other Describe:

Bailer Volume (gals): (0.25 / 0.33) Required Bailer Volumes: Total purge volume (gals):

Criteria for Stable Parameters

Parameter	*Working Range (YSI 556MPS)*	*Stability Criteria*	*Depth to Water Stabilization*	
			Time	DTW
Temperature	-5 to 45°C	± 1.0 °C		
pH	0 to 14 NTU	± 0.1		
Conductivity	0 to 200 mS/cm	± 3%		
ORP	-999 to +999 mV	± 10 mV		
Dissolved Oxygen	0 to 50 mg/L	± 10% or 0.2 mg/L		
Turbidity	0 to 1000 NTU	± 10% (≤10 NTU)		

Instrument Observations

Round	*Time*	*Water Level (ft BTOC)*	*Volume Purged (gallons)*	*pH* ✓	*Cond (mS/cm)* ✓	*Turbidity (NTU)* ✓	*DO (mg/L)* ✓	*Temp (C)* ✓	*ORP (mV)* ✓
1	1635	93.15	125	7.36	.467	16.9	0.69	~~6~~ 5.89	-3.5
2	1638	93.15	128	7.40	.467	15.8	0.65	5.95	-8.1
3	1641	93.15	131	7.41	.467	16.6	0.60	6.06	-11.0
4	1644	93.15	134	7.43	.467	15.7	0.59	5.89	-14.8
5									
6									
7									
8									
9									

Notes: Draw-down should ideally be less than 0.3 feet from the original depth to groundwater.
Minimal draw-down achieved and measured by: 1) pumping at a low rate (approximately 1 liter/ 3 minutes or .1 gal/min) and 2) continually measuring water levels in the well.

Sensory Observations

Color: (Clear), Amber, Tan, Brown, Grey, Milky White, Other:

Odor: (None), Low, Medium, High, Very Strong, H2S, Fuel Like, Chemical ?, Unknown

Turbidity: None, (Low), Medium, High, Very Turbid, Heavy Silts

Comments:

SOP-09 Attachment 1

WELL DEVELOPMENT DATASHEET

SHEET 1 OF 1

Well ID: IW02-4551

CH2MHILL

Project: JBER PBR

Location: CG039 POLELINE RD DISPOSAL AREA

Project #:

Development Contractor/Geologist: J. KNUTH / M. Kelly (Geotek)

Field Notebook #: Well Development

Date: 8/2/13

Start Time: 900

End Time:

Date Well Installed:

Well Information and Purge Volume Calculation

Casing ID (inch):	Unit Casing Volume (A) (gal/ft):
0.75	0.02
1	0.04
1.5	0.09
2	0.16
3	0.37
4	0.65
5	1.02
6	1.47
7	2.00
8	2.61
10	4.08
12	5.88

Total Well Depth (B) (ft btoc): 91.45

Depth to Water (C) (ft btoc): - 96.33

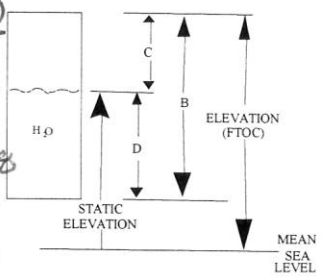
Length of Static Water Column in Well (feet): (B - C = D) = 4.88

Unit Casing Volume (A) (gal/ft): x 0.16

Well Casing Volume (E) (gal): (D x A = E) = 0.7808

x 10

Total Purge Volume (F) (gal): (E x 10 well volumes = F) = 7.81



Well Screened Interval (ft btoc): 92-97'

Approx. Sediment Depth in Well (ft):

Development Methods

Method: ☒ Surging ☒ Pumping ☐ Bailing ☐ Other Describe:

Surge time per interval (min): 5 Number of development intervals: 1

Pump: ☐ Perist. ☒ Bladder ☐ Subm. ☐ Other Describe:

Purge time per interval (min): VARIES Purge Flow Rate (gpm): 0.5 - 1 Total purge volume (gals):

Total purge time (min): Pump Intake Depth (ft btoc):

Bailer: ☐ Poly ☐ Teflon ☐ S.steel ☐ Other Describe:

Bailer Volume (gals): (0.25 / 0.33) Required Bailer Volumes: Total purge volume (gals):

Criteria for Stable Parameters

Parameter	*Working Range (YSI 556MPS)*	*Stability Criteria*	*Depth to Water Stabilization*	
			Time	DTW
Temperature	-5 to 45°C	± 1.0 °C		
pH	0 to 14 NTU	± 0.1		
Conductivity	0 to 200 mS/cm	± 3%		
ORP	-999 to +999 mV	± 10 mV		
Dissolved Oxygen	0 to 50 mg/L	± 10% or 0.2 mg/L		
Turbidity	0 to 1000 NTU	± 10% (≤10 NTU)		

Instrument Observations

Round	*Time*	*Water Level (ft BTOC)*	*Volume Purged (gallons)*	*pH*	*Cond (mS/cm)*	*Turbidity (NTU)*	*DO (mg/L)*	*Temp (C)*	*ORP (mV)*
1	1555	See	128	7.19	0.509	16.1	1.39	6.93	140.0
2	1560	notes	131	7.33	0.509	3.96	0.44	6.50	91.1
3	1565	Below	134	7.39	0.509	6.98	0.54	6.49	70.0
4	1570		137	7.43	0.509	5.32	0.56	6.54	57.1
5	1575		140	7.45	0.509	4.05	0.59	6.51	48.0
6	1580		141	7.46	0.509	3.69	0.58	6.52	42.1
7	1585	91.71	143	7.44	0.509	3.96	0.56	6.61	38.9
8									
9									

Notes: Draw-down should ideally be less than 0.3 feet from the original depth to groundwater.
Minimal draw-down achieved and measured by: 1) pumping at a low rate (approximately 1 liter/ 3 minutes or .1 gal/min) and 2) continually measuring water levels in the well.

Sensory Observations

Color: Clear, Amber, Tan, Brown, Grey, Milky White, Other:

Odor: None, Low, Medium, High, Very Strong, H2S, Fuel Like, Chemical ?, Unknown

Turbidity: None, Low, Medium, High, Very Turbid, Heavy Silts

Comments:

CANNOT MEASURE DTW WHILE PUMPING/PURGING DUE TO 4' Long bladder pump above W.L.

Revised February 2010.

96.33
9145
4.88

Appendix E
Groundwater Sampling Logs

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Groundwater Sampling Record

Project Name: JBER GW LTM
Project Location: CG039
Project Number:
Date/Time: 8/15/13

Well ID: AP-3983R
Sample No.: 13Q3CG039-AP3983R-GW-0
Sampler(s): M. Oakley & J. Brann
Weather: 60°F Overcast

Water Level Measurements and Purge Data

Time	Depth of Well (TOC)	Depth to Water (TOC)	Feet of Water in Well	Gallons per Well Volume (2" dia. = 0.163 gal/ft, 4" dia.=0.653 gal/ft)
1340	44.85 ☒ Meas. ☐ Hist.	22.27 Initial	22.58	3.68

Water Level Measurement Method: ☒ Electric Tape ☐ Other:
Well Evacuation Method: ☐ Peristaltic Pump ☒ Submersible Pump ☐ Bailer ☐ Other:
Purge Rate: 260 mL/min
Begin Purge: Time: 1340
End Purge: Time: 1450
Total Volume Purged: ~3
Well Volumes Purged: <1
Purge Water Disposed: ☒ 55-gal Drum ☐ Storage Tank ☐ Ground ☐ Liquabin ☐ Other:

Sample Collection Method & Analysis

Sample Type: ☒ Groundwater ☐ Surface Water ☐ Other:
Sample Time: 1450
Sample Collection Method: ☒ Pump Type: QED Bladder Dedicated ☐ Y ☒ N ☐ Bailer ☐ Other:
Decon Procedure: ☐ N/A ☒ Alconox Wash ☐ Tap Rinse ☐ DI Water ☐ Other:
Sample Description (color, turbidity, odor, sheen, etc.): Slightly orange/turbid, no odor, no sheen

Sample Containers

Quantity	Size	Bottle Type	Laboratory Analysis
2	500 mL poly	☐ Glass ☒ Plastic	E300M E375.4 Chloride/Sulfate
1	500 mL	☐ Glass ☒ Plastic	E310.1
1	125 mL	☐ Glass ☒ Plastic	E353.2 Nitrate/Nitrite
1	125 mL	☐ Glass ☒ Plastic	E376.1 Sulfide
3 + 3	40 mL VOA	☒ Glass ☐ Plastic	RSK-175 + 8260C
1	500 mL	☐ Glass ☒ Plastic	6020A - Diss.

Notes: 1.0 ppm in well 1 250mL Glass 9060
0.0 ppm in air space/breathing zone

Sampler Signature: M Oakley

Date: 8/15/13 Well ID: AP-3983R

Well Evacuation / Field Parameters

Time	Depth to Water (TOC)	Volume (gallons)	Temp (°C)	Cond (µS/cm)	DO (mg/L)	pH	ORP (mV)	Color/ Turbidity
1400	22.27	1	7.17	0.289	12.27	5.09	85.7	orange/rust 119
1406	22.39	1.25	6.65	0.287	10.86	4.90	87.2	87.8
1410		1.5 (230 mL/min)	6.64	0.286	14.03	5.19	86.9	
→ Pull up pump to check connections, air bubbling in YSI cell								
1425	22.39	1.75 (270 mL/min)	6.76	0.286	8.15	5.92	56.8	331
1430	22.35	2.0	6.99	0.286	6.63	5.78	55.7	554
1434	22.35	2.25	6.82	0.286	4.53	5.76	53.8	525
1438	22.35	2.5	6.81	0.286	4.89	5.78	52.0	369

Notes :

Groundwater Sampling Record

Project Name: JBER GW LTM
Project Location: CG039
Project Number:
Date/Time: 8/16/13

Well ID: AP-4550
Sample No.: 13Q3CG039-AP-4550-GW-0
Sampler(s): M. Oakley & J. Brann
Weather: 55°F Rain

Water Level Measurements and Purge Data

Time	Depth of Well (TOC)	Depth to Water (TOC)	Feet of Water in Well	Gallons per Well Volume (2" dia. = 0.163 gal/ft, 4" dia.=0.653 gal/ft)
1430	43.0 ☒ Meas. ☐ Hist.	21.65 Initial	21.37	3.48

Water Level Measurement Method: ☒ Electric Tape ☐ Other:
Well Evacuation Method: ☐ Peristaltic Pump ☒ Submersible Pump ☐ Bailer ☐ Other:
Purge Rate: 260 mL/min
Begin Purge: Time: 1500
End Purge: Time: 1600
Total Volume Purged: 2
Well Volumes Purged: <1
Purge Water Disposed: ☒ 55-gal Drum ☐ Storage Tank ☐ Ground ☐ Liquabin ☐ Other:

Sample Collection Method & Analysis

Sample Type: ☒ Groundwater ☐ Surface Water ☐ Other:
Sample Time: 1600
Sample Collection Method: ☒ Pump Type: QED Bladder Dedicated ☐ Y ☒ N ☐ Bailer ☐ Other:
Decon Procedure: ☐ N/A ☒ Alconox Wash ☐ Tap Rinse ☐ DI Water ☐ Other:
Sample Description (color, turbidity, odor, sheen, etc.): Clear, no odor, no sheen

Sample Containers

Quantity	Size	Bottle Type	Laboratory Analysis
8 + 4 + 4	500 mL	☐ Glass ☒ Plastic	E300M E375.4 + SW6020 DISS. E310.1
4 + 4	125 mL	☐ Glass ☒ Plastic	E353.2 + E376.1
12 + 12	40 mL	☒ Glass ☐ Plastic	RSK-175 + SW8260C
4	250 mL	☒ Glass ☐ Plastic	SW9060
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	

Notes: 0.5 ppm in well
00 ppm in breathing zone

Also Collected:
13Q3CG039-AP4550 GW-1 @ 1615
13Q3CG039-AP-4550-GW-0MS @ 1600
13Q3CG039-AP4550 GW-0SD @ 1600

Sampler Signature: Monica Oakley

Date: 8/16/13 Well ID: AP-4550

Well Evacuation / Field Parameters

Time	Depth to Water (TOC)	Volume (gallons)	Temp (°C)	Cond (µS/cm)	DO (mg/L)	pH	ORP (mV)	Color/ Turbidity
1517	21.90	.5	5.95	.297	.56	6.01	55.8	>1000
1522	21.88	.75	5.76	.296	.37	5.78	61.8	885
1626	21.85	1	5.67	.296	.36	5.81	57.0	315
1531	21.88	1.25	5.62	.296	.33	5.90	52.0	142
1536	21.89	1.5	5.71	.297	.41	6.01	46.3	117
1539	21.88	1.75	5.74	.298	.35	6.10	41.8	104
1544	21.88	1.5	5.71	.299	.34	6.12	41.2	93.1
1548	21.89	2	5.67	.299	.35	6.11	40.5	72.1

Notes :

Groundwater Sampling Record

Project Name: JBER GW LTM
Project Location: CG039
Project Number:
Date/Time: 8/15/13

Well ID: AP-4551
Sample No.: 13Q3CG039-AP4551-GW-D
Sampler(s): M. Oakley + J. Braun
Weather: 60°F Overcast

Water Level Measurements and Purge Data

Time	Depth of Well (TOC)	Depth to Water (TOC)	Feet of Water in Well	Gallons per Well Volume (2" dia. = 0.163 gal/ft, 4" dia.=0.653 gal/ft)
1545	98.18 ☒ Meas. ☐ Hist.	95.66 Initial	2.42	0.4

Water Level Measurement Method: ☒ Electric Tape ☐ Other:
Well Evacuation Method: ☐ Peristaltic Pump ☒ Submersible Pump ☐ Bailer ☐ Other:
Purge Rate: 140 mL/min
Begin Purge: Time: 1600
End Purge: Time: 1645
Total Volume Purged: ~0.7 gal
Well Volumes Purged: almost 2
Purge Water Disposed: ☒ 55-gal Drum ☐ Storage Tank ☐ Ground ☐ Liquabin ☐ Other:

Sample Collection Method & Analysis

Sample Type: ☒ Groundwater ☐ Surface Water ☐ Other:
Sample Time: 1645
Sample Collection Method: ☒ Pump Type: QED Bladder Dedicated ☐ Y ☒ N ☐ Bailer ☐ Other:
Decon Procedure: ☐ N/A ☒ Alconox Wash ☐ Tap Rinse ☐ DI Water ☐ Other:
Sample Description (color, turbidity, odor, sheen, etc.): Clear + no odor, no sheen

Sample Containers

Quantity	Size	Bottle Type	Laboratory Analysis
2	500 mL	☐ Glass ☒ Plastic	E300M + E375.4
1	500 mL	☐ Glass ☒ Plastic	E310.1
1	125 mL	☐ Glass ☒ Plastic	E353.2
1	125L	☐ Glass ☒ Plastic	E376.1
3 + 3	40 mL VOA	☒ Glass ☐ Plastic	RSK-175 + 8260C
1	500 mL	☐ Glass ☐ Plastic	SW 6020A - Diss
		1250 mL Glass	SW 9060

Notes: 16 ppm in well
0.0 in breathing zone

Sampler Signature: Melanie Oakley

Date: 8/15/13 Well ID: AP-455

Well Evacuation / Field Parameters

Time	Depth to Water (TOC)	Volume (gallons)	Temp (°C)	Cond (µS/cm)	DO (mg/L)	pH	ORP (mV)	Color/ Turbidity
1615	95.69	0.2	8.45	0.408	11.98	6.41	50.0	28.0
1620	95.72	.25	8.03	0.404	11.93	6.29	52.7	17.8
1625	95.72	.27	7.97	.400	12.06	6.31	52.4	11.8
1629	95.70	.35	8.25	.401	12.09	6.46	47.4	9.18
1633	95.70	0.5	8.04	.400	12.30	6.51	470	7.08
1637	95.70	0.6	8.04	.400	12.46	6.56	47.0	7.01
1641 ~~1701~~	95.70	0.7	7.94	0.400	12.73	6.58	45.1	6.91

Notes :

Groundwater Sampling Record

Project Name: IBER GW LTM
Project Location: CG039
Project Number:
Date/Time: 8/16/13

Well ID: IW-01-3983
Sample No.: 13CG039-IW013983-GW
Sampler(s): M. Oakley J. Brann
Weather: 55°F Overcas

Water Level Measurements and Purge Data

Time	Depth of Well (TOC)	Depth to Water (TOC)	Feet of Water in Well	Gallons per Well Volume (2" dia. = 0.163 gal/ft, 4" dia.=0.653 gal/ft)
	39.36 ☒ Meas. ☐ Hist.	21.81 Initial	17.55	2.86

Water Level Measurement Method: ☒ Electric Tape ☐ Other:
Well Evacuation Method: ☐ Peristaltic Pump ☒ Submersible Pump ☐ Bailer ☐ Other:
Purge Rate: 270 mL/min
Begin Purge: Time: 0915
End Purge: Time:
Total Volume Purged: 1.5
Well Volumes Purged: ~1/2
Purge Water Disposed: ☒ 55-gal Drum ☐ Storage Tank ☐ Ground ☐ Liquabin ☐ Other:

Sample Collection Method & Analysis

Sample Type: ☒ Groundwater ☐ Surface Water ☐ Other:
Sample Time: 0955
Sample Collection Method: ☐ Pump Type: ~~Bladder~~ QED Dedicated ☐ Y ☒ N ☐ Bailer ☐ Other:
Decon Procedure: ☐ N/A ☒ Alconox Wash ☐ Tap Rinse ☐ DI Water ☐ Other:
Sample Description (color, turbidity, odor, sheen, etc.): Clear, no odor, no sheen

Sample Containers

Quantity	Size	Bottle Type	Laboratory Analysis
3	40 ML	☒ Glass ☐ Plastic	8260C
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	

Notes: 0.3 ppm in well
0.0 in breathing zone

Sampler Signature: Monica Oakley

Date: 8/16/13 Well ID: IW-01-3983

Well Evacuation / Field Parameters

Time	Depth to Water (TOC)	Volume (gallons)	Temp (°C)	Cond (µS/cm)	DO (mg/L)	pH	ORP (mV)	Color/ Turbidity
0920	21.85	0.25	6.46	0.223	6.93	5.84	106.7	62.6
0924	21.85	0.4	6.40	0.220	9.16	4.85	141.2	51.7 ~~62.6~~ ②
0929	21.85	0.6	5.90	0.217	7.48	4.56	144.9	39.5
0936	21.85	0.8	5.72	0.216	6.16	4.78	127.9	8.91
0940	21.85	1.0	5.66	0.214	6.02	4.83	124.6	4.65
0946	21.86	1.2	5.60	0.214	2.84 ~~5.05~~	5.05	113.3	4.32
0950	21.86	1.5	5.55	0.214	4.10	5.08	110.5	5.14

Notes :

Groundwater Sampling Record

Project Name: JBER GW LTM
Project Location: CG039
Project Number:
Date/Time: 8/16/13

Well ID: IW-02-3983
Sample No.: CG0 1303 CG039-IW023983-GW
Sampler(s): M. Oakley / J. Braun
Weather: ~55°F Overcast

Water Level Measurements and Purge Data

Time	Depth of Well (TOC)	Depth to Water (TOC)	Feet of Water in Well	Gallons per Well Volume (2" dia. = 0.163 gal/ft, 4" dia.=0.653 gal/ft)
	42.30 ☒ Meas. ☐ Hist.	22.12 Initial	20.18	3.3

Water Level Measurement Method: ☒ Electric Tape ☐ Other:
Well Evacuation Method: ☐ Peristaltic Pump ☒ Submersible Pump ☐ Bailer ☐ Other:
Purge Rate: 265 mL/min
Begin Purge: Time: 1020
End Purge: Time: 1100
Total Volume Purged: 2 gal
Well Volumes Purged: <1
Purge Water Disposed: ☒ 55-gal Drum ☐ Storage Tank ☐ Ground ☐ Liquabin ☐ Other:

Sample Collection Method & Analysis

Sample Type: ☑ Groundwater ☐ Surface Water ☐ Other:
Sample Time: 1105
Sample Collection Method: ☑ Pump Type: QED Dedicated ☐ Y ☑ N ☐ Bailer ☐ Other:
Decon Procedure: ☐ N/A ☑ Alconox Wash ☐ Tap Rinse ☐ DI Water ☐ Other:
Sample Description (color, turbidity, odor, sheen, etc.): Clear, no sheen, no odor

Sample Containers

Quantity	Size	Bottle Type	Laboratory Analysis
3	40 mL	☑ Glass ☐ Plastic	8260c
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	

Notes:
1.0 ppm down well
0.0 ppm in breathing zone

Sampler Signature: Marion Oakley

Date: 8/16/13 Well ID: IW-02-3983

Well Evacuation / Field Parameters

Time	Depth to Water (TOC)	Volume (gallons)	Temp (°C)	Cond (µS/cm)	DO (mg/L)	pH	ORP (mV)	Color/ Turbidity
1028	22.15	.25	6.19	.229	0.72	5.76	79.9	357
1032	22.17	.5	6.12	.230	.52	5.69	80.5	327
1036	22.17	.75	6.03	.231	.55	5.76	76.6	253
1040	22.15	1	6.05	.233	.37	5.83	73.1	244
1044	22.15	1.25	6.05	.233	.40	5.96	66.3	202
1048	22.15	1.5	6.10	.233	.47	6.06	62.7	183
1052	22.15	1.75	6.03	.233	.45	6.01	63.7	161
1055	22.15	2	5.97	.233	.38	5.99	64.4	148

Notes :

Groundwater Sampling Record

Project Name: JBER GW LTM
Project Location: CG039
Project Number:
Date/Time: 8/16/13

Well ID: 1W-01-4550
Sample No.: 13Q3CG039-1W01-4550-GW-0
Sampler(s): M. Oakley / J. Brann
Weather: 55°F Overcast

Water Level Measurements and Purge Data

Time	Depth of Well (TOC)	Depth to Water (TOC)	Feet of Water in Well	Gallons per Well Volume (2" dia. = 0.163 gal/ft, 4" dia.=0.653 gal/ft)
	48.38 ☒ Meas. ☐ Hist.	23.15 Initial	25.23	4.11

Water Level Measurement Method: ☒ Electric Tape ☐ Other:
Well Evacuation Method: ☐ Peristaltic Pump ☒ Submersible Pump ☐ Bailer ☐ Other:
Purge Rate: 220 mL/min
Begin Purge: Time: 1130
End Purge: Time: 1210
Total Volume Purged: 1.2
Well Volumes Purged: <1
Purge Water Disposed: ☒ 55-gal Drum ☐ Storage Tank ☐ Ground ☐ Liquabin ☐ Other:

Sample Collection Method & Analysis

Sample Type: ☒ Groundwater ☐ Surface Water ☐ Other:
Sample Time: 1210
Sample Collection Method: ☒ Pump Type: QED Bladder Dedicated ☐ Y ☒ N ☐ Bailer ☐ Other:
Decon Procedure: ☐ N/A ☐ Alconox Wash ☐ Tap Rinse ☐ DI Water ☐ Other:
Sample Description (color, turbidity, odor, sheen, etc.): Slightly turbid/gray, water, no sheen

Sample Containers

Quantity	Size	Bottle Type	Laboratory Analysis
3	40 mL	☒ Glass ☐ Plastic	8260C
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	

Notes: 1.0 ppm in well
0.0 in breathing zone

Sampler Signature: M Oakley

Date: 8/16/13

Well ID: LW-01-4550

Well Evacuation / Field Parameters

Time	Depth to Water (TOC)	Volume (gallons)	Temp (°C)	Cond (µS/cm)	DO (mg/L)	pH	ORP (mV)	Color/ Turbidity
								Gray
1142	23.18	0.25	7.72	0.271	1.60	6.46	48.8	988
1146	23.18	0.4	7.01	0.272	0.69	6.15	56.4	936
1153	23.18	0.6	6.70	0.272	0.50	6.09	56.1	750
1157	23 18	0.75	6.96	0.272	0.53	6.09	55.2	500
1201	23.18	0.90	6.64	0.269	0.50	6.15	51.0	384
1205	23.18	1.1	6.60	0.267	0.49	6.14	51.8	234

Notes :

Groundwater Sampling Record

Project Name: JBER GW LTM
Project Location: CG039
Project Number:
Date/Time: 8/16/13

Well ID: 1W-02-4550
Sample No.: 13Q3CG039-1W02-4550-GW
Sampler(s): M. Oakley & J. Braun
Weather: 55°F Overcast

Water Level Measurements and Purge Data

Time	Depth of Well (TOC)	Depth to Water (TOC)	Feet of Water in Well	Gallons per Well Volume (2" dia. = 0.163 gal/ft, 4" dia.=0.653 gal/ft)
1330	42.56 ☒ Meas. ☐ Hist.	22.85 Initial	19.71	3.21

Water Level Measurement Method: ☒ Electric Tape ☐ Other:
Well Evacuation Method: ☐ Peristaltic Pump ☒ Submersible Pump ☐ Bailer ☐ Other:
Purge Rate: 240 mL/min
Begin Purge: Time: 1335
End Purge: Time: 1410
Total Volume Purged: 1.6
Well Volumes Purged: 1/2
Purge Water Disposed: ☐ 55-gal Drum ☐ Storage Tank ☐ Ground ☐ Liquabin ☐ Other:

Sample Collection Method & Analysis

Sample Type: ☒ Groundwater ☐ Surface Water ☐ Other:
Sample Time: 1410
Sample Collection Method: ☒ Pump Type: QED Bladder Dedicated ☐ Y ☒ N ☐ Bailer ☐ Other:
Decon Procedure: ☐ N/A ☒ Alconox Wash ☐ Tap Rinse ☐ DI Water ☐ Other:
Sample Description (color, turbidity, odor, sheen, etc.): Clear, no odor, no sheen

Sample Containers

Quantity	Size	Bottle Type	Laboratory Analysis
3	40 mL	☒ Glass ☐ Plastic	8260 C
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	

Notes: 1.7 ppm in well
0.0 in breathing zone

Sampler Signature: Monica Oakley

Date: 8/16/13 Well ID: IW-02-4550

Well Evacuation / Field Parameters

Time	Depth to Water (TOC)	Volume (gallons)	Temp (°C)	Cond (µS/cm)	DO (mg/L)	pH	ORP (mV)	Color/ Turbidity
1343	22.98	0.25	6.99	0.398	1.41	6.56	45.6	263
1347	22.94	0.75	6.45	0.393	0.63	6.15	57.6	115
1355	22.94	1	6.42	0.387	0.51	6.21	46.8	83.5
1358	22.98	1.2	6.38	0.389	0.48	6.28	42.1	65.1
1402	22.98	1.4	6.38	0.390	0.47	6.35	37.4	50.0
1405	22.98	1.6	6.47	0.390	0.44	6.39	34.4	42.2

Notes :

Groundwater Sampling Record

Project Name: JBER GW LTM
Project Location: CG039
Project Number:
Date/Time: 8/16/13

Well ID: LW-02-4551
Sample No.: 130CG039-LW02-4551-GW-0
Sampler(s): M Oakley & J Brumm
Weather: 55°F Overcast

Water Level Measurements and Purge Data

Time	Depth of Well (TOC)	Depth to Water (TOC)	Feet of Water in Well	Gallons per Well Volume (2" dia. = 0.163 gal/ft, 4" dia.=0.653 gal/ft)
1230	99.92 ☒ Meas. ☐ Hist.	92.08 Initial	7.84	1.28

Water Level Measurement Method: ☒ Electric Tape ☐ Other:
Well Evacuation Method: ☐ Peristaltic Pump ☒ Submersible Pump ☐ Bailer ☐ Other:
Purge Rate: 288mL/min
Begin Purge: Time: 1230
End Purge: Time: 1315
Total Volume Purged: 1.3
Well Volumes Purged: 1
Purge Water Disposed: ☒ 55-gal Drum ☐ Storage Tank ☐ Ground ☐ Liquabin ☐ Other:

Sample Collection Method & Analysis

Sample Type: ☒ Groundwater ☐ Surface Water ☐ Other:
Sample Time: 1315
Sample Collection Method: ☒ Pump Type: QED Bladder Dedicated ☐ Y ☒ N ☐ Bailer ☐ Other:
Decon Procedure: ☐ N/A ☒ Alconox Wash ☐ Tap Rinse ☐ DI Water ☐ Other:
Sample Description (color, turbidity, odor, sheen, etc.): Clear, no sheen, no odor

Sample Containers

Quantity	Size	Bottle Type	Laboratory Analysis
3	40 mL	☒ Glass ☐ Plastic	8260C
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	

Notes: 1.0 ppm in well
0.0 ppm in breathing zone

Sampler Signature: Mary Oakley

Date: 8/16/13

Well ID: LW-01-4551

Well Evacuation / Field Parameters

Time	Depth to Water (TOC)	Volume (gallons)	Temp (°C)	Cond (µS/cm)	DO (mg/L)	pH	ORP (mV)	Color/ Turbidity
1250	92.2	0.25	7.00	0.367	1.00	6.63	50.8	326
1254	92.2	0.40	6.71	0.368	0.84	6.46	57.4	150
1258	92.2	0.70	6.66	0.368	0.64	6.47	56.5	78.8
1302	92.2	0.90	6.68	0.367	0.52	6.54	52.6	43.6
1307	92.2	1.1	6.71	0.367	0.50	6.58	50.0	27.8
1311	92.2	1.3	6.63	0.367	0.48	6.61	49.5	22.5

Notes :

Groundwater Sampling Record

Project Name: Chemhill GW LTM
Project Location: CG039
Project Number: 20221.003
Date/Time: 8/19/13
Well ID: 1W02-4551
Sample No.: 13Q3CG039-1W02-4551-GW-0
Sampler(s): AO / SB
Weather: 82°F, Rain, 3-5 mph Wind

Water Level Measurements and Purge Data

Time	Depth of Well (TOC)	Depth to Water (TOC)	Feet of Water in Well	Gallons per Well Volume (2" dia. = 0.163 gal/ft, 4" dia.=0.653 gal/ft)
1140	98.50 ☐ Meas. ☐ Hist.	92.75 Initial	5.75	0.93

Water Level Measurement Method: ☐ Electric Tape ☐ Other:
Well Evacuation Method: ☐ Peristaltic Pump ☑ Submersible Pump ☐ Bailer ☐ Other:
Purge Rate: 300 ml/min QED bladder
Begin Purge: Time: 1200
End Purge: Time: 1300
Total Volume Purged: ~2 gal
Well Volumes Purged: ~2
Purge Water Disposed: ☒ 55-gal Drum ☐ Storage Tank ☐ Ground ☐ Liquabin ☐ Other:

Sample Collection Method & Analysis

Sample Type: ☒ Groundwater ☐ Surface Water ☐ Other:
Sample Time: 1230 / 1300 (FD)
Sample Collection Method: ☐ Pump Type: QED bladder Dedicated ☐ Y ☑ N ☐ Bailer ☐ Other:
Decon Procedure: ☐ N/A ☒ Alconox Wash ☐ Tap Rinse ☐ DI Water ☐ Other:
Sample Description (color, turbidity, odor, sheen, etc.): Clear, No turb, no sheen, no odor

Sample Containers

Quantity	Size	Bottle Type	Laboratory Analysis
12	40 ml VOA	☑ Glass ☐ Plastic	8260
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	
		☐ Glass ☐ Plastic	

Notes: Also collected field dup 13Q3CG039-1W02-4551-GW-FD @ 1300
MS = 13Q3CG039-1W02-4551-GW-OMS
MSD = 13Q3CG039-1W02-4551-GW-OSD
PID in well = 0.0 ppm
PID in breathing zone = 0.0 ppm

Sampler Signature:

Date: 8/19/13 Well ID: IW-02-4551

Well Evacuation / Field Parameters

Time	Depth to Water (TOC)	Volume (gallons)	Temp (°C) ±.2	Cond (µS/cm) 3%	DO (mg/L) 10%	pH ±.1	ORP (mV) 10%	Color/ Turbidity 10%
1212	91.88	0.2	6.21	0.370	1.14	5.55	90.5	21.8
1215	91.86	0.4	6.03	0.369	1.07	5.38	94.8	13.8
1218	91.86	0.6	5.92	0.369	0.87	5.32	95.0	7.70
1221	91.86	0.8	5.88	0.369	0.76	5.37	92.2	5.73
1224	91.80	1.0	5.90	0.369	0.72	5.46	87.3	4.56
1227	91.86	1.2	5.87	0.369	0.68	5.62	81.8	4.33

Notes :

Appendix F
Terra Systems SRS Specification Sheet and Alpha Chemical Certificate of Analysis

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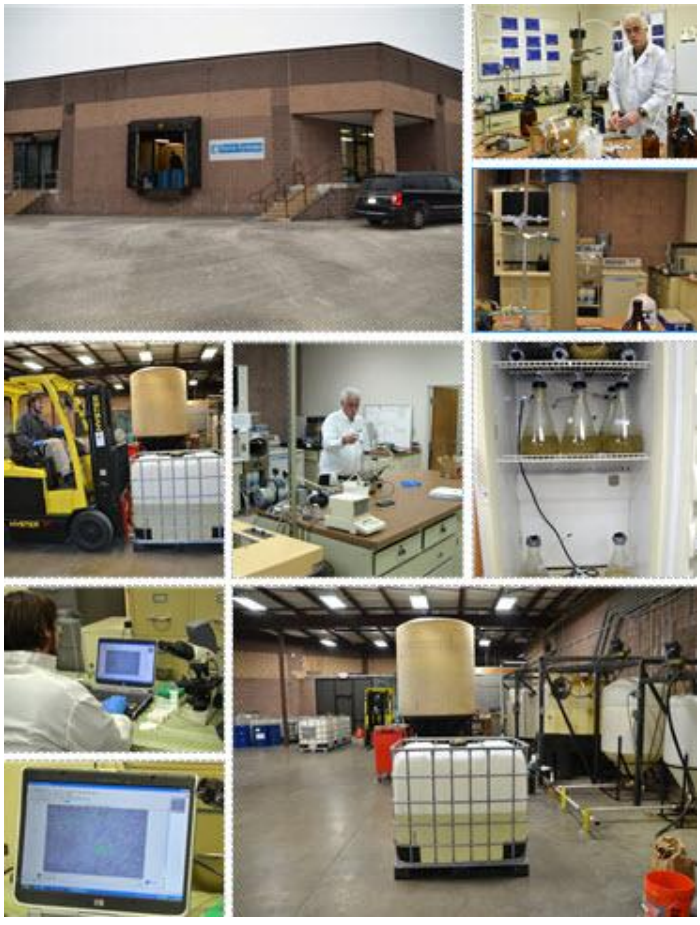
Terra Systems Capabilities Document

Research – Product Development – Manufacturing – Distribution

Core Competencies

1. Operates its own U.S. manufacturing plant with a full time U.S. production staff
2. Flexible manufacturing process that enables the company to produce five unique formulations of SRS® emulsified vegetable oil substrate packages and customer designed formulations
3. Quality control lab on the manufacturing floor
4. On-site R&D and Treatability Study Laboratory
5. Sustainable Partnership program for minimizing carbon footprint of remediation projects
6. Data management and process visualization
7. Distribution system with Just-In-Time Delivery



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Summary of In-Situ Bioremediation Products

Offering Anaerobic and Aerobic In-Situ Bioremediation Solutions

Terra Systems, Inc.'s scientists have been developing in-situ bioremediation technology since the 1980's. Our roots go back to Richard Raymond, Sr. who received the first patent for in-situ bioremediation of petroleum hydrocarbons in the 1970's. Today, Terra Systems, Inc. offers proven bioremediation products backed by a strong Research & Development program unmatched by any of our competitors, focused on the advancement of bioremediation technology and implementation cost reduction. Our emulsified products have assisted site remediation companies with green remediation alternatives for over 12 years and include a family of patented SRS® products.

Terra Systems operates its own manufacturing facilities so we can easily setup "***Just-In-Time***" manufacturing and delivery of SRS® to your site. We work closely with the on-site project managers to produce and deliver SRS® based on real-time site conditions. The benefit of this is that if you run into any injection delays, you don't have to worry about on-site storage of large amounts of material especially in hot weather. As a product supplier, we view environmental consulting companies as our customers, not our competitors and our goal is to make you successful with your clients.

Product	Description	Benefit
SRS®-SD	60% soybean oil, at least 4% potassium or sodium lactate, which are both soluble substrates that rapidly generates anaerobic conditions. Proprietary organic and inorganic nutrients such as yeast extract, nitrogen and phosphorus, which have been shown to support growth of the anaerobic microbial population. A neutral pH for optimum aquifer conditions. >250 ppb Vitamin B_{12}, which He et al. 2007 demonstrated is an important micronutrient to enhance dechlorination activity. **0.6 µm droplet size** and a **nonionic** (does not have a charge) **surfactant mixture**.	Proprietary surfactant mixture doesn't have a charge and will not adhere readily to the positively charged soil particles. This combined with a small droplet size will result in greater distribution in the aquifer. Ideal for groundwater flow rates (gwfr's) of less than **0.5 ft/day**. Nutrient package for optimal bacteria growth.
SRS®-FR	60% soybean oil, at least 4% potassium or sodium lactate, which are both soluble substrates that rapidly generates anaerobic conditions. Proprietary organic and inorganic nutrients such as yeast extract, nitrogen and phosphorus, which have been shown to support growth of the anaerobic microbial population. A neutral pH for optimum aquifer conditions. >250 ppb Vitamin B_{12}, which He et al. 2007 demonstrated is an important micronutrient to enhance dechlorination activity. **5 µm droplet size** and an **anionic** (has a negative charge) **surfactant mixture**.	Proprietary natural emulsifier has a negative charge and will adhere more readily to the positively charged soil particles than a nonionic surfactant. This increased "***stickiness***" combined with a larger droplet size (5 µm) will result in more adsorption of SRS®-FR in fractured bedrock system or other highly permeable aquifers. Ideal for gwfr's of **0.5 ft/day or more**. Nutrient package for optimal bacteria growth.
SRS®-C	SRS®-C is a defined by the client and can be a specific client recipe or special packaging requirements.	Packaging in 5 gallon buckets, 50/50 mix of SRS®-SD and SRS®-FR, or can increase lactate from 4% to 7%.

Product	Description	Benefit
SRS®-M	60% soybean oil, at least 4% potassium or sodium lactate, which are both soluble substrates that rapidly generates anaerobic conditions. Proprietary organic and inorganic nutrients such as yeast extract, nitrogen and phosphorus, which have been shown to support growth of the anaerobic microbial population. A neutral pH for optimum aquifer conditions. >250 ppb Vitamin B_{12}, which He et al. 2007 demonstrated is an important micronutrient to enhance dechlorination activity. A proprietary food grade reductant is included which will reduce hexavalent chromium (Cr^{6+}) and other metals. The concentration of the abiotic reductant can be adjusted depending on the metal concentrations.	The microbial population removes the oxygen, nitrate, sulfate and other competing electron acceptors. The redox potential is depressed, which results in the reduction and precipitation of the Cr^{6+}. The slow release characteristics of SRS®-M maintain reducing conditions for up to 24 months with a single application. The proprietary food grade reductant reduces $Cr^{6+ \text{ to }} Cr^{3+}$ Ideal for sites with both chlorinated solvents (PCE, TCE) and Cr^{6+} contamination.
SRS®-B	60% soybean oil, at least 4% potassium or sodium lactate, which are both soluble substrates that rapidly generates anaerobic conditions. Proprietary organic and inorganic nutrients such as yeast extract, nitrogen and phosphorus, which have been shown to support growth of the anaerobic microbial population. A neutral pH for optimum aquifer conditions. >250 ppb Vitamin B_{12}, which He et al. 2007 demonstrated is an important micronutrient to enhance dechlorination activity.	SRS®-$B_{uffered}$ is offered in four standard "***off the shelf***" concentrations (1%, 5%, 10% and 15%) based on the buffering capacity of the aquifer (groundwater and soil) or it can be custom blended depending upon the site's pH. It provides immediate and long-term pH optimization at your site and sustains optimal pH conditions for dechlorination to occur. Ideal for sites where the **pH is <4.**
QRS® & QRS®-Plus	60% sodium lactate substrate with the option to fortify with a proprietary nutrient package (QRS®-Plus) .	Soluble quick release sodium lactate substrate with an optional proprietary nutrient package and Vitamin B_{12} (standard).provides an immediate carbon source and arrives "injection ready", which provides short-term sustainable, in-situ anaerobic remediation.
EZVI-Mixed Micro/Nano or EZV - Nano	10% - 17% Mixed Micro/Nano Scale or 10 - 17% Nano Scale Emulsified Zero Valent Iron	A combination of zero valent iron (ZVI), biodegradable soybean oil, surfactants, and water that form a stable emulsion particle (or micelles) that contain ZVI particles in water surrounded by an oil-liquid layer. The exterior oil layer has similar hydrophobic properties as chlorinated compounds. The emulsion attracts the contaminants and pulls them into the interior reactive zone for degradation.

Microbubbler	Oxygen Generator and Oxygen Spargers	An oxygen generator concentrates oxygen from air to greater than 90%. The standard unit can produce 27 pounds of oxygen daily using 120 volt power. The Microbubbler Oxygen Spargers generate fine (<5 μm) bubbles for maximal oxygen distribution.

Summary of In-Situ Treatability Laboratory Services

Offering Anaerobic and Aerobic In-Situ Lab Treatability Studies

Introduction

Terra Systems, Incorporated's Treatability Laboratory is located at 130 Hickman Road, Suite 1, Claymont, DE. 19703. Terra Systems is one of the most experienced companies in conducting treatability studies. Our laboratory has conducted over 200 studies to evaluate enhanced anaerobic bioremediation of chlorinated solvents, in situ chemical oxidation, monitored natural attenuation of chlorinated solvents and petroleum and enhanced aerobic bioremediation of petroleum. TSI can evaluate the benefits of inorganic nutrient additions, pH control, or various oxygen sources from sparged oxygen, slow release oxygen compounds, or hydrogen peroxide. TSI has an EPA permit DER000002360 to accept and dispose of hazardous wastes from treatability studies.

In Situ Chemical Oxidation

TSI has conducted treatability studies at over 100 sites in support of in situ chemical oxidation using potassium and sodium permanganate, activated persulfate, catalyzed hydrogen peroxide, or ozone and in situ chemical reduction of volatile organics, semivolatiles organics, and metals. Targeted compounds range from aromatics like benzene, toluene, ethylbenzene, xylenes; polynuclear aromatic hydrocarbons; chlorinated solvents such as perchloroethene, trichloroethene, 1,1,1-trichloroethane, carbon tetrachloride, and others. TSI does not perform in situ chemical oxidation or in situ reduction field projects, but works with a number of environmental engineering consultants including ERM, AMEC, TRC, Moraine Environmental, URS, GZA, and others to evaluate chemical oxidant demand and effectiveness in the laboratory before the consultants go to pilot or full-scale implementation. Analytical samples can be submitted to any laboratory selected by the consultant.

In Situ Aerobic Bioremediation Treatability Studies

TSI has extensive experience in evaluating in situ aerobic biodegradation of petroleum hydrocarbons ranging from gasoline and diesel to heavier products such as No. 6 Fuel oil. TSI can evaluate the benefits of inorganic nutrient additions, pH control, or various oxygen sources from sparged oxygen, slow release oxygen compounds, or hydrogen peroxide.

In Situ Anaerobic Bioremediation

TSI has conducted more than eighty anaerobic bioremediation studies over the past 20 years investigating the fate of chlorinated solvents such perchloroethene, trichloroethene, cis-1,2-dichloroethene, vinyl chloride, 1,2-

dichloroethane, carbon tetrachloride, chloroform, methylene chloride, Dinoseb, 1,1,1-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethene, chloroethane, and petroleum. We can evaluate different substrates, amendments to adjust pH, nutrients, or the need for bioaugmentation to promote the complete dechlorination of the solvents. TSI personnel conducted a number of the microcosm studies in support of the Remediation Technology Development Forum (RTDF) project at Dover Air Force Base. TSI also operated the pilot system which was the first field demonstration of bioaugmentation to promote the complete dechlorination of trichloroethene and cis-1,2-dichloroethene to ethene. TSI was a participant in the SABRE (Source Area BioRemediation Evaluation) project in Great Britain, which conducted laboratory and field investigations of bioremediation of trichloroethene dense nonaqueous phase liquids. The treatability study which TSI participated in used over 100 microcosms to evaluate the effects of substrates, nutrient addition, bioaugmentation, and trichloroethene dosage on the dechlorination of trichloroethene. TSI's emulsified vegetable product, SRS®, was selected as the optimal electron donor and was used in subsequent column and field studies.

Monitored Natural Attenuation

TSI has done a number of assessments of monitored natural attenuation of chlorinated solvents and petroleum hydrocarbons in soils, groundwater, and sediments both in laboratory evaluations and from field monitoring data.

Other Services

TSI can determine the number of culturable total bacteria and numbers of specific degraders such as gasoline or diesel. TSI offers light hydrocarbon gas analyses to quantify biodegradation products such as methane, acetylene, ethene, and ethane.

Equipment

TSI has a gas chromatograph dedicated to the analyses of chlorinated solvents and light hydrocarbon gases. We also work closely with other analytical laboratories when other analyses are needed or when certified analyses are required. TSI possess a laboratory chemical hood to safely conduct treatability studies with volatile constituents. The TSI laboratory also has an anaerobic chamber used to set up anaerobic microcosm studies. General laboratory equipment include centrifuge, temperature controlled shaker table, ovens, pH meters, redox meters, conductivity meters, dissolved oxygen, spectrophotometer, microscope, and other miscellaneous equipment.

USDA Permit to Receive Foreign Soils

TSI has a permit from the United States Department of Agriculture allowing it to import soils from outside of the continental United States. The permit number is P330-10-00222. The labels that need to be attached to the shipping container with the soil sample, copies of the USDA permit, and shipping instructions can be provided upon request.

EPA Hazardous Waste Small Generator ID

TSI has an EPA Hazardous Waste Small Generator permit. Our EPA Permit number is DEN201200001. We report the number and quantity of treatability study samples to the Delaware Department of Natural Resources and Conservation yearly.

Treatability Sample Disposal

Upon receipt, samples are logged in. When the samples are used in the treatability study, the quantity of soil remaining is recorded. Upon the completion of the studies, the treatability samples can be returned to the client or sent for disposal at licensed disposal facilities with shipment by licensed hazardous waste transporters.

Personnel

The treatability studies will be conducted under the supervision of Michael D. Lee, Ph.D. He has over 25 years of experience in bioremediation and monitored natural attenuation. Erich Hauptmann is a technician who provides support for the treatability studies; he has worked in the treatability laboratory for more than four years.

C of A

Alpha Chemicals
802 Enterprise Street
Cape Girardeau, MO 63703
573-579-6022
alphachem08@yahoo.com

DATE: JULY 24, 2013

FOR:

Customer:
Ship Date:
Via:
Cust. PO:

PRODUCT	AMOUNT	LOT #	TYPICAL
Ferrous Sulfate Heptahydrate	50# Bags	04163	20% Fe
Date of Mfg: 4/16/13			
Best Used by Date: 4/16/14			

Lab #: CA132941

AlphaChemicals.com

Appendix G
Soil and Investigative-Derived Waste Analytical Laboratory Results and Geotechnical Results (electronic only)

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Appendix H
Groundwater Analytical Results Table, Data Quality Evaluation Report, and Laboratory Analytical Report

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Groundwater Raw Analytical Results
February 2014

Summary of Chemicals Detected in Groundwater: Site OUB Poleline Rd (FTRS-39)

Analyte	Location / Sample ID / Sample Depth (ft) / Sample Date / Screening Level	Screening Level Source	AP-3983R	AP-4550		AP-4551	IW013983	IW014550	IW014551	IW023983	IW024550	IW02-4551	
	Sample ID		13Q3CG039-AP3983R-GW-0	13Q3CG039-AP4550-GW-1	13Q3CG039-AP4550-GW-0	13Q3CG039-AP4551-GW-0	13Q3CG039-IW013983-GW-0	13Q3CG039-IW014550-GW-0	13Q3CG039-IW014551-GW-0	13Q3CG039-IW023983-GW-0	13Q3CG039-IW024550-GW-0	13Q3CG039-IW02-4551-GW-0	13Q3CG039-IW02-4551-GW-1
	Sample Depth (ft)		999 - 999	999 - 999	999 - 999	999 - 999	999 - 999	999 - 999	999 - 999	999 - 999	999 - 999	999 - 999	999 - 999
	Sample Date		8/15/2013	8/15/2013	8/16/2013	8/15/2013	8/16/2013	8/16/2013	8/16/2013	8/16/2013	8/16/2013	8/19/2013	8/19/2013
Metals (mg/L)													
Iron, dissolved	--		**3.03**	- -	**8.36**	**0.0312 J**	- -	- -	- -	- -	- -	- -	- -
Manganese, dissolved	--		**0.416**	- -	**0.775**	**0.00552 J**	- -	- -	- -	- -	- -	- -	- -
Mercury, dissolved	0.002	2012 ADEC Table C GW	0.00003 U	- -	0.00003 U	**0.0000325 J**	- -	- -	- -	- -	- -	- -	- -
VOCs (µg/L)													
1,1,1,2-Tetrachloroethane	--		0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
1,1,1-Trichloroethane	200	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
1,1,2,2-Tetrachloroethane	4.3	2012 ADEC Table C GW	**407**	**501**	**497**	**106**	**199**	**389**	**131**	**186**	**776**	**125**	**130**
1,1,2-Trichloroethane	5	2012 ADEC Table C GW	**10.5**	**11**	**10.7**	**6.91**	**5.12**	**9.22**	**7.7**	**6.06**	**22.8**	**7.03**	**7.32**
1,1,2-Trichlorotrifluoroethane	--		0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
1,1-Dichloroethane	7300	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
1,1-Dichloroethene	7	2012 ADEC Table C GW	**3.88**	**4.05**	**3.75**	**10.4**	**2.34**	**3.62**	**12.1**	**3.16**	**6.52**	**11.8**	**12.6**
1,1-Dichloropropene	--		0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
1,2,3-Trichlorobenzene	--		0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
1,2,3-Trichloropropane	0.12	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
1,2,4-Trichlorobenzene	70	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
1,2,4-Trimethylbenzene	1800	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
1,2-Dibromo-3-Chloropropane	0.2	EPA MCL	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
1,2-Dichlorobenzene	600	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
1,2-Dichloroethane	5	2012 ADEC Table C GW	**0.48 J**	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
1,2-Dichloropropane	5	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
1,3,5-Trimethylbenzene	1800	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
1,3-Butadiene	--		0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
1,3-Dichlorobenzene	3300	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
1,3-Dichloropropane	--		0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
1,4-Dichlorobenzene	75	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2,2-Dichloropropane	--		0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2-Butanone (MEK)	22000	2012 ADEC Table C GW	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Chlorotoluene	--		0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2-Hexanone	--		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4-Chlorotoluene	--		0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
4-Methyl-2-Pentanone (MIBK)	2900	2012 ADEC Table C GW	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Acetone	33000	2012 ADEC Table C GW	**0.93 B**	**0.97 B**	1 U	1 U	1 U	**2.75 B**	**0.52 B**	1 U	**1.28 B**	1 U	1 U
Benzene	5	2012 ADEC Table C GW	**1.02**	**0.73**	**0.71**	**0.37 J**	**0.4 J**	**0.61**	**0.63**	**0.78**	**0.91**	**0.61**	**0.63**
Bromobenzene	--		0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Bromochloromethane	--		0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Bromodichloromethane	14	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Bromoform	110	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Bromomethane	51	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Carbon Disulfide	3700	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Carbon Tetrachloride	5	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Chlorobenzene	100	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Chloroethane	290	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Chloroform	140	2012 ADEC Table C GW	**1.25 B**	**0.75 B**	**0.7 B**	**1.14 B**	**0.62 B**	**0.88 B**	**1.17 B**	**0.69 B**	**1.75**	**1.14 B**	**1.22 B**
Chloromethane	66	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
cis-1,2-Dichloroethene	70	2012 ADEC Table C GW	**180**	**160**	**159**	**113**	**94.5**	**147**	**105**	**107**	**335**	**113**	**118**
cis-1,3-Dichloropropene	8.5	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Cyclohexane	--		0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Dibromochloromethane	10	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Dibromomethane	--		0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Dichlorodifluoromethane	7300	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Ethane	--		0.115 U	0.109 U	**0.0926 J**	0.114 U	- -	- -	- -	- -	- -	- -	- -
Ethylbenzene	700	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Ethylene	--		**0.0682 J**	0.118 U	**0.0407 J**	0.123 U	- -	- -	- -	- -	- -	- -	- -
Ethylene Dibromide (EDB)	0.05	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Hexachlorobutadiene	7.3	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Isopropylbenzene	3700	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
m- & p-Xylene	10000	2012 ADEC Table C GW	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methane	--		**9.84**	**0.0482 B**	**53.3 J**	**0.463 J**	- -	- -	- -	- -	- -	- -	- -
Methyl tert-Butyl Ether (MTBE)	470	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Methylene Chloride	5	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
n-Butylbenzene	370	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
n-Hexane	--		0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
n-Propylbenzene	370	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Naphthalene	730	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
o-Xylene	10000	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
p-Isopropyltoluene	--		0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
sec-Butylbenzene	370	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Styrene	100	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
tert-Butylbenzene	370	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Tetrachloroethene (PCE)	5	2012 ADEC Table C GW	**30.5**	**29.3**	**26.7**	**5**	**20.3**	**23.5**	**6.19**	**21.7**	**7.99**	**5.76**	**5.93**
Toluene	1000	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Total Xylenes	10000	2012 ADEC Table C GW	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U
trans-1,2-Dichloroethene	100	2012 ADEC Table C GW	**62**	**58.4**	**56.2**	**9.59**	**30.6**	**51.7**	**25.8**	**39.3**	**124**	**26.1**	**26.6**
trans-1,3-Dichloropropene	8.5	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Trichloroethene (TCE)	5	2012 ADEC Table C GW	**1880**	**1490**	**1500**	**2300**	**987**	**1330**	**2690 J**	**1160**	**3200**	**2620 J**	**2640**
Trichlorofluoromethane	11000	2012 ADEC Table C GW	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Vinyl Acetate	--		0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl Chloride	2	2012 ADEC Table C GW	0.25 U	**0.28 J**	**0.27 J**	0.25 U	0.25 U	**0.24 J**	**0.53**	0.25 U	**0.87**	**0.46 J**	**0.56**

Groundwater Raw Analytical Results
February 2014

Summary of Chemicals Detected in Groundwater: Site OUB Poleline Rd (FTRS-39)

	Location Screening Level Source	**AP-3983R**	**AP-4550**		**AP-4551**	**IW013983**	**IW014550**	**IW014551**	**IW023983**	**IW024550**	**IW02-4551**	
	Sample ID	13Q3CG039-AP3983R-GW-0	13Q3CG039-AP4550-GW-1	13Q3CG039-AP4550-GW-0	13Q3CG039-AP4551-GW-0	13Q3CG039-IW013983-GW-0	13Q3CG039-IW014550-GW-0	13Q3CG039-IW014551-GW-0	13Q3CG039-IW023983-GW-0	13Q3CG039-IW024550-GW-0	13Q3CG039-IW02-4551-GW-0	13Q3CG039-IW02-4551-GW-1
	Sample Depth (ft)	999 - 999	999 - 999	999 - 999	999 - 999	999 - 999	999 - 999	999 - 999	999 - 999	999 - 999	999 - 999	999 - 999
	Sample Date	8/15/2013	8/15/2013	8/16/2013	8/15/2013	8/16/2013	8/16/2013	8/16/2013	8/16/2013	8/16/2013	8/19/2013	8/19/2013
Analyte	**Screening Level**											
General Chemistry (mg/L)												
Alkalinity, bicarb. (as CaCO3)	--	**150**	**158**	**158**	**251**	- -	- -	- -	- -	- -	- -	- -
Alkalinity, carb. (as CaCO3)	--	10 U	10 U	10 U	10 U	- -	- -	- -	- -	- -	- -	- -
Alkalinity, bicarb. (as CaCO3)	--	**150**	**158**	**158**	**251**	- -	- -	- -	- -	- -	- -	- -
Chloride	--	**2.4 B**	**2.93 B**	**3.47 B**	**3.54 B**	- -	- -	- -	- -	- -	- -	- -
Nitrogen, Nitrate-Nitrite	--	**0.0611**	**0.0661**	**0.062**	**0.0357**	- -	- -	- -	- -	- -	- -	- -
Sulfate	--	**25.3**	**30.3**	**27.6**	**9.53**	- -	- -	- -	- -	- -	- -	- -
Sulfide	--	**0.0647**	**0.0451**	**0.0456**	0.0142 U	- -	- -	- -	- -	- -	- -	- -
Total Alkalinity	--	**150**	**158**	**158**	**251**	- -	- -	- -	- -	- -	- -	- -
Total Organic Carbon	--	**3.47**	**3.41**	**3.53**	**4.25**	- -	- -	- -	- -	- -	- -	- -
Organic Acids by IC (µg/L)												
Acetic Acid	--	60 U	60 U	60 U	60 U	- -	- -	- -	- -	- -	- -	- -
Butyric Acid	--	120 U	120 U	120 U	120 U	- -	- -	- -	- -	- -	- -	- -
Butyric Acid	--	120 U	120 U	120 U	120 U	- -	- -	- -	- -	- -	- -	- -
Formic Acid	--	60 U	60 U	60 U	60 U	- -	- -	- -	- -	- -	- -	- -
Lactic Acid	--	60 U	60 U	60 U	60 U	- -	- -	- -	- -	- -	- -	- -
Propionic Acid	--	60 U	60 U	60 U	60 U	- -	- -	- -	- -	- -	- -	- -
Pyruvic Acid	--	120 U	120 U	120 U	120 U	- -	- -	- -	- -	- -	- -	- -

Notes:
µg/L = microgram(s) per liter
B = The analyte was detected in the associated method and/or calibration blank.
J = The analyte was positively identified: the associated numerical value is the approximate concentration of the analyte in the sample.
U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
mg/l = milligram(s) per liter
NA = Not analyzed
Bold indicates the analyte was detected
Shading indicates the result exceeded screening criteria

JOINT BASE ELMENDORF-RICHARDSON – ARMORED VEHICLE MAINTENANCE AREA, DA089 AND POLELINE ROAD DISPOSAL AREA, CG039 – LONG-TERM MONITORING AND TREATABILITY STUDY – 2013 DATA QUALITY EVALUATION REPORT

Introduction

The objective of this data quality evaluation (DQE) report is to assess the data quality of analytical results for groundwater samples collected at the Joint Base Elmendorf-Richardson (JBER) Armored Vehicle Maintenance Area (DA089) and Poleline Road Disposal Area (CG039). Samples were collected and analyzed in support of the long-term monitoring and treatability studies at these sites. The data may also be used to support future activities such as feasibility studies, risk assessments, fate and transport modeling and remedial actions. Individual method requirements and guidelines from *the United States Air Force, Joint Base Elmendorf-Richardson, Alaska, Environmental Restoration Program, Basewide Uniform Federal Policy Quality Assurance Project Plan (March 2013) (*JBER QAPP) were used in this assessment.

This report is intended as a general data quality assessment designed to summarize data issues.

Analytical Data

This DQE report covers 28 primary samples, five field duplicates (FDs), five equipment blanks (EBs) and four trip blanks (TBs). All samples were collected August 15 through September 23, 2013. A list of samples associated with this DQE is included in Attachment H-1.

The Work Plan requires a collection frequency of 10 percent for FDs and 5 percent for matrix spike / matrix spike duplicate (MS/MSD) sets and EBs; collection frequencies are outlined by method in Table H-1 below. The required frequency was met for each method with the following exceptions:

- A MS/MSD was not collected for Method E310.1; MS/MSD analysis is not typical for this method.
- A FD was not collected for Method SW7470A.

Table H-1: Percentage of FD, EB and MS/MSD Collected by Method

Method	Matrix	Count of Primary Samples	Count of FDs	Percent of FDs	Count of MS/MSDs	Percent of MS/MSDs	Count of EBs	Percent of EBs
AK101	Groundwater	1	1	100	1	100	1	100
AK102/103	Groundwater	1	1	100	1	100	1	100
E300.0	Groundwater	19	4	21	4	21	4	21
E300.0M	Groundwater	5	2	40	2	40	2	40
E310.1	Groundwater	4	2	50	NA	NA	2	50
E353.2	Groundwater	19	4	21	4	21	4	21

Table H-1: Percentage of FD, EB and MS/MSD Collected by Method

Method	Matrix	Count of Primary Samples	Count of FDs	Percent of FDs	Count of MS/MSDs	Percent of MS/MSDs	Count of EBs	Percent of EBs
E376.2	Groundwater	4	2	50	2	50	2	50
RSK-175	Groundwater	19	4	21	1	5.3	4	21
SW6010B	Groundwater	19	4	21	4	21	4	21
SW7470A	Groundwater	3	0	0	1	33	1	33
SW8260C	Groundwater	27	5	18	6	33	5	18
SW9060	Groundwater	4	2	50	2	50	2	50

The sample results were reported as five sample delivery groups (SDG) (M2526, M2594, M2615, M2646, and M2839). The analyses were performed by Applied Sciences Laboratory in Corvallis, Oregon.

Twelve methods were used to analyze the environmental samples. Samples were collected and shipped via overnight carrier to the laboratory. Selected samples were analyzed for one or more of the following analytes/methods in Table H-2.

Table H-2: Analytical Parameters

Parameter	Method
GRO	AK101
DRO/RRO	AK102/103
Chloride and sulfate	E300
Volatile fatty acids	E300.0M
Alkalinity	E310.1
Nitrate+nitrite	E353.2
Sulfide	E376.2
Dissolved gases	RSK-175
Iron and manganese	SW6010B
Mercury	SW7470A
Volatile organic compounds	SW8260C
TOC	SW9060

Notes:

DRO = diesel-range organics
GRO = gasoline-range organics
RRO = residual-range organics
TOC = total organic carbon

The assessment of data includes a review of: (1) the chain-of-custody documentation; (2) holding-time compliance; (3) the required quality control (QC) samples at the specified frequencies; (4) method blanks; (5) laboratory control sample/laboratory control sample duplicates (LCS/LCSD); (6) surrogate spike recoveries; (7) matrix spike/matrix spike duplicate (MS/MSD) samples; and (8) initial and continuing calibration information and other method-specific criteria as defined by the JBER QAPP.

Field samples were also reviewed to ascertain field compliance and data quality issues. This included a review of FDs, EBs and TBs.

Data flags were assigned according to the JBER QAPP. Multiple flags are routinely applied to specific sample method/matrix/analyte combinations, but there will be only one final flag. A final flag is applied to the data and is the most conservative of the applied validation flags. The final flag also includes matrix and blank sample impacts.

The data flags are defined below:

- **J** = The analyte was positively identified, and the quantitation is an estimation because of discrepancies in meeting certain analyte-specific quality control criteria. Or the analyte was positively identified, but the associated concentration is estimated above the method detection limit and below the limit of quantitation (LOQ).

- **R** = The data are rejected because of deficiencies in meeting QC criteria and may not be used for decision making.

- **B** = The analyte was detected in the sample at a concentration less than or equal to five times (10 times for common laboratory contaminants) the blank concentration.

- **U** = The analyte was analyzed for, but the analyte was not detected.

- **UJ** = The analyte was not detected; however, the result is estimated because of discrepancies in meeting certain analyte-specific QC criteria.

Findings

The overall summaries of the data validation findings are contained in the following sections and Table H-3.

Also included as documentation of data validation findings is the Alaska Department of Environmental Conservation Laboratory Data Review Checklist (Version 2.7, January 2010). A checklist is provided for each laboratory SDG and can be found in Attachment H-2 to this DQE.

Holding Times

All holding-time criteria were met with the following exceptions:

- Samples AP-4413-13-0830-0 and AP-4413-13-0830-1 were analyzed two days outside of holding time for Method E376.2. One associated detected result was qualified as estimated

and flagged "J"; one associated nondetected result was qualified as estimated and flagged "UJ".

- Samples 13Q3CG039-AP3747-GW-0 and 13Q3CG039-AP4353-GW-0 were analyzed one day outside of holding time for Method SW8260C. Sixteen associated detected results were qualified as estimated and flagged "J"; 126 associated nondetected results were qualified as estimated and flagged "UJ".

Calibration

All initial and continuing calibration criteria were met with one exception:

- The recovery of chloroethane was greater than JBER QAPP criteria in a continuing calibration verification for Method SW8260C, indicating associated sample results are possibly biased high. Eleven associated nondetected results were not qualified.

Method Blanks

Method blanks were analyzed at the required frequency and were free of contamination with the following exceptions:

- DRO was detected below the LOQ in a method blank for Method AK102/103. Two associated sample results detected less than five times the blank concentration were qualified as estimated and flagged "B".

- Lactic acid was detected below the LOQ in a method blank for Method E300.0M. Three associated nondetected results were not qualified.

- Alkalinity was detected below the LOQ in a method blank for Method E310.1. Four associated results detected greater than five times the blank were not qualified.

- Methane was detected below the LOQ in a method blank for Method RSK-175. One associated sample result detected less than five times the blank concentration was qualified as estimated and flagged "B".

- Dissolved manganese was detected below the LOQ in the method blanks for Method SW6010B. Four associated sample results detected less than five times the blank concentrations were qualified as estimated and flagged "B". Six associated results detected greater than five times the blank concentrations were not qualified.

- TOC was detected above the LOQ in a method blank for Method SW9060. Two associated sample results detected less than five times the blank concentration were qualified as estimated and flagged "B".

Calibration Blanks

Chloride was detected below the LOQ in a continuing calibration blank (CCB) for Method E300.0. Four associated results detected greater than five times the blank concentrations were not qualified.

Trip Blanks

Four TBs were collected and were free of contamination with the following exceptions:

- Methane was detected below the LOQ in the TBs for Method RSK-175. Fifteen associated sample results detected less than five times the blank concentration were qualified as estimated and flagged "B". Five associated sample results detected greater than five times the blank concentrations, and three associated nondetected results, were not qualified.

Equipment Blanks

Five EBs were collected and were free of contamination with the exceptions listed below:

- DRO and RRO were detected below the LOQ in an EB for Method AK102/103. Two associated sample results detected less than five times the blank concentration were qualified as estimated and flagged "B". Two associated nondetected sample results were not qualified.

- Chloride and sulfate were detected above or below the LOQ in the EBs for Method E300.0. Four associated sample results detected less than five times the blank concentration were qualified as estimated and flagged "B". Twenty-one associated sample results detected greater than five times the blank concentrations were not qualified.

- Acetic acid was detected below the LOQ in an EB for Method E300.0M. Four associated nondetected sample results were not qualified.

- Alkalinity was detected below the LOQ in an EB for Method E310.1. Eight associated sample results detected greater than five times the blank concentrations were not qualified.

- Methane was detected below the LOQ in the EBs for Method RSK-175. Sixteen associated sample results detected less than five times the blank concentration were qualified as estimated and flagged "B". Four associated sample results detected greater than five times the blank concentrations, and three associated nondetected results, were not qualified.

- Dissolved iron and dissolved manganese were detected below the LOQ in the EBs for Method SW6010B. Fourteen associated sample results detected less than five times the blank concentrations were qualified as estimated and flagged "B". Seven associated sample results detected greater than five times the blank concentrations, and eight associated nondetected results, were not qualified.

- Acetone, chloroform, trichlorothene, tetrachloroethene and toluene were detected below or above the LOQ in the EBs for Method SW8260C. Twenty-two associated sample results detected less than five times the blank concentrations were qualified as estimated and flagged

"B". Twenty-eight associated sample results detected greater than five times the blank concentrations, and 49 associated nondetected results, were not qualified.

- TOC was detected below the LOQ in an EB for Method SW9060. Two associated sample results detected less than five times the blank concentration were qualified as estimated and flagged "B". Four associated sample results detected greater than five times the blank concentrations were not qualified.

Field Duplicates

Five FD sets were collected. Precision was acceptable with the following exceptions:

- The relative percent difference (RPD) of methane was greater than JBER QAPP criteria in FD set 13Q3CG039-AP4550-GW-0/13Q3CG039-AP4550-GW-1 for Method RSK-175. Two associated detected results were qualified as estimated and flagged "J".

Matrix Spike Samples

The results of MS/MSD analyses provide information about the possible influence of the matrix on either accuracy or precision of the measurements. The field crew designated samples for MS/MSD analysis. All acceptance criteria were met with the following exception:

- The recovery of nitrate+nitrite was less than JBER QAPP criteria in the MS of sample AP-4413-13-0830-0 for Method E353.2. The associated detected result was qualified as estimated and flagged "J".

- The recovery of trichloroethene was less than JBER QAPP criteria in the MSD of sample 13Q3CG039-IW014551-GW-0 for Method SW8260C. The associated detected result was qualified as estimated and flagged "J".

- The RPD of formic acid was greater than JBER QAPP criteria in the MS/MSD set of sample 13Q3CG039-AP4550-GW-0 for Method E300.0M. The associated nondetected result was not qualified.

Surrogates

Surrogates were added to all samples for the methods requiring their use. Surrogate recoveries met criteria.

Laboratory Control Samples

LCS/LCSDs were analyzed and all accuracy and precision criteria were met.

Internal Standards

All internal standard acceptance criteria were met.

Tentatively Identified Compounds

Tentatively identified compounds were not reported.

Chain-of-Custody and Sample Receipt Discrepancies

- **SDG M2526.** Sample ID 13Q3CG039-1W02-4551-GW-01 on chain of custody is 13Q3CG039-IW02-4551-GW-1 on container labels. Sample logged in and analyzed as 13Q3CG039-IW02-4551-GW-1.

  Sample 13Q3CG039-IW02-4551-GW-1 was labeled as 13Q3CG039-IW02-4551-GW-0FD. Sample logged in and analyzed as 13Q3CG039-IW02-4551-GW-1.

  Chain of custody requested Method E375.4 for sulfate. Sampled logged in and analyzed for sulfate by E300.0.

  MS/MSD analysis requested for Method E310.1 was not logged in and analyzed; MS/MSD analysis is not typical for this method.

- **SDG M2594.** No discrepancies noted.

- **SDG M2615.** Metals bottles received for samples AP-4414-14-0830-0, AP-4414-14-0830-0MS, AP-4414-14-0830-0MSD, AP-4414-14-0830-1 are mislabeled. All sample IDs start with 13Q3DA085 on bottle. Samples logged in and analyzed per the chain of custody.

  Sulfide bottle received for sample AP-4414-14-0830-0 is mislabeled. Sample ID starts with 13Q3DA085 on bottle. Sample logged in and analyzed per the chain of custody.

- **SDG M2646.** Sample 13Q3DA085-AP3468-GW-0 for Method E376.1 was incorrectly preserved. Sample analysis was canceled.

- **SDG M2839.** No discrepancies noted.

Overall Assessment

The final activity in the data quality evaluation is an assessment of whether the data meet the data quality objectives. The goal of this assessment is to demonstrate that a sufficient number of representative samples were collected and the resulting analytical data can be used to support the decision making process. The precision, accuracy, representativeness, completeness and comparability are addressed in the JBER QAPP. The following summary highlights the data evaluation findings for the above defined events:

1. No data were rejected and completeness was 100 percent for all method/matrix/analyte combinations.

2. Approximately 50 percent of the AK102/103 data were qualified due to low-level detections in a laboratory blank and EB. The degree to which blank contamination was observed is within reasonable method expectations considering the small size of the dataset.

3. Approximately 9 percent of the E300.0 data were qualified due to low-level detections in the EBs. The degree to which blank contamination was observed suggests a contamination issue during sample collection.

4. Approximately 22 percent of the RSK-175 data were qualified due to low-level detections in the TBs and EBs. The degree to which blank contamination was observed suggests a contamination issue during sample collection and sample handling/shipping.

5. Approximately 34 percent of the SW6010B data were qualified due to low-level detections in the laboratory blanks and EBs. The degree to which blank contamination was observed suggests a contamination issue during sample collection.

6. Less than one percent of the SW8260C data were qualified due to low-level detections in the EBs. The degree to which blank contamination was observed is within reasonable method expectations.

7. Approximately 33 percent of the SW9060 data were qualified due to low-level detections in a laboratory blank and EB. The degree to which blank contamination was observed suggests a contamination issue at the laboratory; sample detections in the EB were similar to the laboratory blank concentration.

8. A FD RPD exceedance was observed for Method RSK-175; one result was qualified as estimated.

9. Two samples were analyzed outside of holding time for Method E376.2, and two samples were analyzed outside of holding time for Method SW8260C; 215 results were qualified as estimated.

10. MS and MSD recovery exceedances were observed for Methods SW8260C and E353.2; two results were qualified as estimated.

11. Although data were qualified as estimated due to QC exceedances as noted, overall precision and accuracy of the data, as measured by field and laboratory QC indicators suggest that data are usable for projects objectives.

Table H-3: Validation Flags

Native ID	Method	Analyte	Final Result	Units	Validation Flag	Validation Reason
13Q31W-01-4413-GW-0	SW8260C	Acetone	1.31	µg/L	B	EB<LOQ
13Q3CG039-AP3747-GW-0	RSK-175	Methane	0.0995	µg/L	B	EB<LOQ
		Methane	0.0995	µg/L	B	TB<LOQ
	SW6010B	Iron, dissolved	40.8	µg/L	B	EB<LOQ
	SW8260C	1,1,1,2-Tetrachloroethane	0.25	µg/L	UJ	HTa>UCL
		1,1,1-Trichloroethane	0.25	µg/L	UJ	HTa>UCL
		1,1,2,2-Tetrachloroethane	0.58	µg/L	J	HTa>UCL
		1,1,2-Trichloroethane	0.34	µg/L	J	HTa>UCL
		1,1,2-Trichloro-1,2,2-trifluoroethane	0.25	µg/L	UJ	HTa>UCL
		1,1-Dichloroethane	0.25	µg/L	UJ	HTa>UCL
		1,1-Dichloroethene	0.25	µg/L	J	HTa>UCL
		1,1-Dichloropropene	0.25	µg/L	UJ	HTa>UCL
		1,2,3-Trichlorobenzene	0.25	µg/L	UJ	HTa>UCL
		1,2,3-Trichloropropane	0.25	µg/L	UJ	HTa>UCL
		1,2,4-Trichlorobenzene	0.25	µg/L	UJ	HTa>UCL
		1,2,4-Trimethylbenzene	0.25	µg/L	UJ	HTa>UCL
		1,2-Dichloroethane	0.25	µg/L	UJ	HTa>UCL
		1,2-Dichlorobenzene	0.25	µg/L	UJ	HTa>UCL
		1,2-Dibromo-3-chloropropane	0.25	µg/L	UJ	HTa>UCL
		1,2-Dichloropropane	0.25	µg/L	UJ	HTa>UCL
		Ethylene dibromide	0.25	µg/L	UJ	HTa>UCL
		1,3,5-Trimethylbenzene	0.25	µg/L	UJ	HTa>UCL
		1,3-Butadiene	0.25	µg/L	UJ	HTa>UCL
		1,3-Dichlorobenzene	0.25	µg/L	UJ	HTa>UCL
		1,3-Dichloropropane	0.25	µg/L	UJ	HTa>UCL
		1,4-Dichlorobenzene	0.25	µg/L	UJ	HTa>UCL
		2,2-Dichloropropane	0.25	µg/L	UJ	HTa>UCL
		2-Butanone	1	µg/L	UJ	HTa>UCL
		2-Chlorotoluene	0.25	µg/L	UJ	HTa>UCL
		2-Hexanone	1	µg/L	UJ	HTa>UCL
		4-Chlorotoluene	0.25	µg/L	UJ	HTa>UCL
		4-Methyl-2-pentanone	1	µg/L	UJ	HTa>UCL
		Acetone	1	µg/L	UJ	HTa>UCL
		Benzene	0.25	µg/L	UJ	HTa>UCL
		Bromobenzene	0.25	µg/L	UJ	HTa>UCL
		Bromochloromethane	0.25	µg/L	UJ	HTa>UCL
		Bromodichloromethane	0.25	µg/L	UJ	HTa>UCL
		Bromoform	0.25	µg/L	UJ	HTa>UCL
		Bromomethane	0.25	µg/L	UJ	HTa>UCL
		Carbon disulfide	0.25	µg/L	UJ	HTa>UCL
		Carbon tetrachloride	0.57	µg/L	J	HTa>UCL

Table H-3: Validation Flags

Native ID	Method	Analyte	Final Result	Units	Validation Flag	Validation Reason
		Chlorobenzene	0.25	µg/L	UJ	HTa>UCL
		Chloroethane	0.25	µg/L	UJ	HTa>UCL
		Chloroform	0.6	µg/L	J	HTa>UCL
		Chloromethane	0.25	µg/L	UJ	HTa>UCL
		cis-1,2-Dichloroethene	3.97	µg/L	J	HTa>UCL
		cis-1,3-Dichloropropene	0.25	µg/L	UJ	HTa>UCL
		Cyclohexane	0.25	µg/L	UJ	HTa>UCL
		Dibromochloromethane	0.25	µg/L	UJ	HTa>UCL
		Dibromomethane	0.25	µg/L	UJ	HTa>UCL
		Dichlorodifluoromethane	0.25	µg/L	UJ	HTa>UCL
		Ethylbenzene	0.25	µg/L	UJ	HTa>UCL
		Hexachlorobutadiene	0.25	µg/L	UJ	HTa>UCL
		Isopropylbenzene	0.25	µg/L	UJ	HTa>UCL
		m,p-Xylene	0.5	µg/L	UJ	HTa>UCL
		Methyl tert-butyl ether	0.25	µg/L	UJ	HTa>UCL
		Methylene chloride	0.25	µg/L	UJ	HTa>UCL
		Naphthalene	0.25	µg/L	UJ	HTa>UCL
		n-Butylbenzene	0.25	µg/L	UJ	HTa>UCL
		n-Hexane	0.25	µg/L	UJ	HTa>UCL
		n-Propylbenzene	0.25	µg/L	UJ	HTa>UCL
		o-Xylene	0.25	µg/L	UJ	HTa>UCL
		p-Isopropyltoluene	0.25	µg/L	UJ	HTa>UCL
		sec-Butylbenzene	0.25	µg/L	UJ	HTa>UCL
		Styrene	0.25	µg/L	UJ	HTa>UCL
		Trichloroethene	82.1	µg/L	J	HTa>UCL
		tert-Butylbenzene	0.25	µg/L	UJ	HTa>UCL
		Tetrachloroethylene	0.78	µg/L	J	HTa>UCL
		Toluene	0.25	µg/L	UJ	HTa>UCL
		trans-1,2-Dichloroethene	1.36	µg/L	J	HTa>UCL
		trans-1,3-Dichloropropene	0.25	µg/L	UJ	HTa>UCL
		Trichlorofluoromethane	0.25	µg/L	UJ	HTa>UCL
		Vinyl acetate	0.5	µg/L	UJ	HTa>UCL
		Vinyl chloride	0.25	µg/L	UJ	HTa>UCL
		Xylenes, total	0.75	µg/L	UJ	HTa>UCL
13Q3CG039-AP3748-GW-0	RSK-175	Methane	0.0421	µg/L	B	EB<LOQ
		Methane	0.0421	µg/L	B	TB<LOQ
	SW6010B	Iron, dissolved	13.3	µg/L	B	EB<LOQ
		Manganese, dissolved	1.16	µg/L	B	EB<LOQ
13Q3CG039-AP3748-GW-1	SW6010B	Iron, dissolved	11	µg/L	B	EB<LOQ
		Manganese, dissolved	0.978	µg/L	B	EB<LOQ

Table H-3: Validation Flags

Native ID	Method	Analyte	Final Result	Units	Validation Flag	Validation Reason
13Q3CG039-AP3983R-GW-0	E300.0	Chloride	2.4	mg/L	B	EB>LOQ
	SW8260C	Acetone	0.93	µg/L	B	EB<LOQ
		Chloroform	1.25	µg/L	B	EB<LOQ
13Q3CG039-AP4344-GW-0	RSK-175	Methane	0.0218	µg/L	B	EB<LOQ
		Methane	0.0218	µg/L	B	TB<LOQ
	SW6010B	Iron, dissolved	12.3	µg/L	B	EB<LOQ
		Manganese, dissolved	0.466	µg/L	B	EB<LOQ
		Manganese, dissolved	0.466	µg/L	B	LB<LOQ
13Q3CG039-AP4353-GW-0	SW8260C	1,1,1,2-Tetrachloroethane	0.25	µg/L	UJ	HTa>UCL
		1,1,1-Trichloroethane	0.25	µg/L	UJ	HTa>UCL
		1,1,2,2-Tetrachloroethane	47	µg/L	J	HTa>UCL
		1,1,2-Trichloroethane	1.44	µg/L	J	HTa>UCL
		1,1,2-Trichloro-1,2,2-trifluoroethane	0.25	µg/L	UJ	HTa>UCL
		1,1-Dichloroethane	0.25	µg/L	UJ	HTa>UCL
		1,1-Dichloroethene	1.05	µg/L	J	HTa>UCL
		1,1-Dichloropropene	0.25	µg/L	UJ	HTa>UCL
		1,2,3-Trichlorobenzene	0.25	µg/L	UJ	HTa>UCL
		1,2,3-Trichloropropane	0.25	µg/L	UJ	HTa>UCL
		1,2,4-Trichlorobenzene	0.25	µg/L	UJ	HTa>UCL
		1,2,4-Trimethylbenzene	0.25	µg/L	UJ	HTa>UCL
		1,2-Dichloroethane	0.25	µg/L	UJ	HTa>UCL
		1,2-Dichlorobenzene	0.25	µg/L	UJ	HTa>UCL
		1,2-Dibromo-3-chloropropane	0.25	µg/L	UJ	HTa>UCL
		1,2-Dichloropropane	0.25	µg/L	UJ	HTa>UCL
		Ethylene dibromide	0.25	µg/L	UJ	HTa>UCL
		1,3,5-Trimethylbenzene	0.25	µg/L	UJ	HTa>UCL
		1,3-Butadiene	0.25	µg/L	UJ	HTa>UCL
		1,3-Dichlorobenzene	0.25	µg/L	UJ	HTa>UCL
		1,3-Dichloropropane	0.25	µg/L	UJ	HTa>UCL
		1,4-Dichlorobenzene	0.25	µg/L	UJ	HTa>UCL
		2,2-Dichloropropane	0.25	µg/L	UJ	HTa>UCL
		2-Butanone	1	µg/L	UJ	HTa>UCL
		2-Chlorotoluene	0.25	µg/L	UJ	HTa>UCL
		2-Hexanone	1	µg/L	UJ	HTa>UCL
		4-Chlorotoluene	0.25	µg/L	UJ	HTa>UCL
		4-Methyl-2-pentanone	1	µg/L	UJ	HTa>UCL
		Acetone	1	µg/L	UJ	HTa>UCL
		Benzene	0.25	µg/L	UJ	HTa>UCL
		Bromobenzene	0.25	µg/L	UJ	HTa>UCL
		Bromochloromethane	0.25	µg/L	UJ	HTa>UCL
		Bromodichloromethane	0.25	µg/L	UJ	HTa>UCL

Table H-3: Validation Flags

Native ID	Method	Analyte	Final Result	Units	Validation Flag	Validation Reason
		Bromoform	0.25	µg/L	UJ	HTa>UCL
		Bromomethane	0.25	µg/L	UJ	HTa>UCL
		Carbon disulfide	0.25	µg/L	UJ	HTa>UCL
		Carbon tetrachloride	0.25	µg/L	UJ	HTa>UCL
		Chlorobenzene	0.25	µg/L	UJ	HTa>UCL
		Chloroethane	0.25	µg/L	UJ	HTa>UCL
		Chloroform	0.25	µg/L	UJ	HTa>UCL
		Chloromethane	0.25	µg/L	UJ	HTa>UCL
		cis-1,2-Dichloroethene	38.1	µg/L	J	HTa>UCL
		cis-1,3-Dichloropropene	0.25	µg/L	UJ	HTa>UCL
		Cyclohexane	0.25	µg/L	UJ	HTa>UCL
		Dibromochloromethane	0.25	µg/L	UJ	HTa>UCL
		Dibromomethane	0.25	µg/L	UJ	HTa>UCL
		Dichlorodifluoromethane	0.25	µg/L	UJ	HTa>UCL
		Ethylbenzene	0.25	µg/L	UJ	HTa>UCL
		Hexachlorobutadiene	0.25	µg/L	UJ	HTa>UCL
		Isopropylbenzene	0.25	µg/L	UJ	HTa>UCL
		m,p-Xylene	0.5	µg/L	UJ	HTa>UCL
		Methyl tert-butyl ether	0.25	µg/L	UJ	HTa>UCL
		Methylene chloride	0.25	µg/L	UJ	HTa>UCL
		Naphthalene	0.25	µg/L	UJ	HTa>UCL
		n-Butylbenzene	0.25	µg/L	UJ	HTa>UCL
		n-Hexane	0.25	µg/L	UJ	HTa>UCL
		n-Propylbenzene	0.25	µg/L	UJ	HTa>UCL
		o-Xylene	0.25	µg/L	UJ	HTa>UCL
		p-Isopropyltoluene	0.25	µg/L	UJ	HTa>UCL
		sec-Butylbenzene	0.25	µg/L	UJ	HTa>UCL
		Styrene	0.25	µg/L	UJ	HTa>UCL
		Trichloroethene	227	µg/L	J	HTa>UCL
		tert-Butylbenzene	0.25	µg/L	UJ	HTa>UCL
		Tetrachloroethylene	3.23	µg/L	J	HTa>UCL
		Toluene	0.25	µg/L	UJ	HTa>UCL
		trans-1,2-Dichloroethene	12.4	µg/L	J	HTa>UCL
		trans-1,3-Dichloropropene	0.25	µg/L	UJ	HTa>UCL
		Trichlorofluoromethane	0.25	µg/L	UJ	HTa>UCL
		Vinyl acetate	0.5	µg/L	UJ	HTa>UCL
		Vinyl chloride	0.25	µg/L	UJ	HTa>UCL
		Xylenes, total	0.75	µg/L	UJ	HTa>UCL
13Q3CG039-AP4550-GW-0	E300.0	Chloride	3.47	mg/L	B	EB>LOQ
	RSK-175	Methane	53.3	µg/L	J	FD>RPD
	SW8260C	Chloroform	0.7	µg/L	B	EB<LOQ

Table H-3: Validation Flags

Native ID	Method	Analyte	Final Result	Units	Validation Flag	Validation Reason
13Q3CG039-AP4550-GW-1	E300.0	Chloride	2.93	mg/L	B	EB>LOQ
	RSK-175	Methane	0.0482	µg/L	B	EB<LOQ
		Methane	0.0482	µg/L	B	FD>RPD
		Methane	0.0482	µg/L	B	TB<LOQ
	SW8260C	Acetone	0.97	µg/L	B	EB<LOQ
		Chloroform	0.75	µg/L	B	EB<LOQ
13Q3CG039-AP4551-GW-0	E300.0	Chloride	3.54	mg/L	B	EB>LOQ
	SW8260C	Chloroform	1.14	µg/L	B	EB<LOQ
13Q3CG039-AP5246-GW-0	RSK-175	Methane	0.0389	µg/L	B	EB<LOQ
		Methane	0.0389	µg/L	B	TB<LOQ
	SW6010B	Iron, dissolved	27.8	µg/L	B	EB<LOQ
13Q3CG039-AP5683-GW-0	RSK-175	Methane	0.0303	µg/L	B	EB<LOQ
		Methane	0.0303	µg/L	B	TB<LOQ
	SW6010B	Manganese, dissolved	1.31	µg/L	B	EB<LOQ
13Q3CG039-IW013983-GW-0	SW8260C	Chloroform	0.62	µg/L	B	EB<LOQ
13Q3CG039-IW014550-GW-0	SW8260C	Acetone	2.75	µg/L	B	EB<LOQ
		Chloroform	0.88	µg/L	B	EB<LOQ
13Q3CG039-IW014551-GW-0	SW8260C	Acetone	0.52	µg/L	B	EB<LOQ
		Chloroform	1.17	µg/L	B	EB<LOQ
		Trichloroethene	2690	µg/L	J	SD<LCL
13Q3CG039-IW023983-GW-0	SW8260C	Chloroform	0.69	µg/L	B	EB<LOQ
13Q3CG039-IW024550-GW-0	SW8260C	Acetone	1.28	µg/L	B	EB<LOQ
13Q3CG039-IW02-4551-GW-0	SW8260C	Chloroform	1.14	µg/L	B	EB<LOQ
13Q3CG039-IW02-4551-GW-1	SW8260C	Chloroform	1.22	µg/L	B	EB<LOQ
13Q3DA085-AP3468-GW-0	RSK-175	Methane	0.0376	µg/L	B	EB<LOQ
		Methane	0.0376	µg/L	B	TB<LOQ
	SW8260C	Acetone	0.85	µg/L	B	EB>LOQ
13Q3DA085-AP3534-GW-0	RSK-175	Methane	0.0214	µg/L	B	EB<LOQ
		Methane	0.0214	µg/L	B	TB<LOQ
	SW8260C	Acetone	1.29	µg/L	B	EB>LOQ
13Q3DA085-AP3774-GW-0	RSK-175	Methane	0.042	µg/L	B	EB<LOQ
		Methane	0.042	µg/L	B	TB<LOQ
13Q3DA085-AP3870-GW-0	RSK-175	Methane	0.031	µg/L	B	EB<LOQ
		Methane	0.031	µg/L	B	TB<LOQ
13Q3DA085-AP3871-GW-0	SW8260C	Acetone	0.76	µg/L	B	EB>LOQ
13Q3DA085-AP3893-GW-0	RSK-175	Methane	0.176	µg/L	B	EB<LOQ
	SW6010B	Iron, dissolved	38	µg/L	B	EB<LOQ
13Q3DA085-AP4341-GW-0	AK102/103	TPH-diesel	39.1	µg/L	B	EB<LOQ
		TPH-diesel	39.1	µg/L	B	LB<LOQ
	RSK-175	Methane	0.0418	µg/L	B	EB<LOQ
		Methane	0.0418	µg/L	B	TB<LOQ

Table H-3: Validation Flags

Native ID	Method	Analyte	Final Result	Units	Validation Flag	Validation Reason
13Q3DA085-AP4341-GW-1	AK102/103	TPH-diesel	32.6	µg/L	B	EB<LOQ
		TPH-diesel	32.6	µg/L	B	LB<LOQ
	RSK-175	Methane	0.0356	µg/L	B	EB<LOQ
		Methane	0.0356	µg/L	B	TB<LOQ
	SW8260C	Acetone	0.54	µg/L	B	EB>LOQ
13Q3DA085-AP4342-GW-0	RSK-175	Methane	0.25	µg/L	B	EB<LOQ
		Methane	0.25	µg/L	B	LB<LOQ
		Methane	0.25	µg/L	B	TB<LOQ
	SW6010B	Manganese, dissolved	2.84	µg/L	B	EB<LOQ
		Manganese, dissolved	2.84	µg/L	B	LB<LOQ
13Q3DA085-AP4411-GW-0	SW6010B	Iron, dissolved	81.1	µg/L	B	EB<LOQ
	SW8260C	Toluene	0.81	µg/L	B	EB<LOQ
13Q3DA085-ROI-4413-0	SW8260C	Acetone	4.41	µg/L	B	EB<LOQ
AP-4413-13-0830-0	E353.2	Nitrate/nitrite-N	3.48	mg/L	J	MS<LCL
	E376.2	Sulfide	0.017	mg/L	J	HTa>UCL
	RSK-175	Methane	0.136	µg/L	B	EB<LOQ
		Methane	0.136	µg/L	B	TB<LOQ
	SW6010B	Manganese, dissolved	0.387	µg/L	B	EB<LOQ
		Manganese, dissolved	0.387	µg/L	B	LB<LOQ
	SW9060	Total organic carbon	0.478	mg/L	B	EB<LOQ
		Total organic carbon	0.478	mg/L	B	LB>LOQ
AP-4413-13-0830-1	E376.2	Sulfide	0.0142	mg/L	UJ	HTa>UCL
	RSK-175	Methane	0.184	µg/L	B	EB<LOQ
		Methane	0.184	µg/L	B	TB<LOQ
	SW6010B	Manganese, dissolved	0.601	µg/L	B	EB<LOQ
		Manganese, dissolved	0.601	µg/L	B	LB<LOQ
	SW9060	Total organic carbon	0.482	mg/L	B	EB<LOQ
		Total organic carbon	0.482	mg/L	B	LB>LOQ

Notes:

µg/L = microgram(s) per liter
mg/L = milligram(s) per liter

EB<LOQ = Equipment blank concentration less than the limit of quantitation
EB>LOQ = Equipment blank concentration greater than the limit of quantitation
FD>RPD = Field duplicate relative percent difference criterion exceeded
Hta>UCL = Analytical holding time exceeded
LB<LOQ = Laboratory blank concentration less than the limit of quantitation
LB>LOQ = Laboratory blank concentration greater than the limit of quantitation
MS<LCL = Matrix spike recovery less than the lower control limit
SD<LCL = Matrix spike duplicate recovery less than the lower control limit
TB<LOQ = Trip blank concentration less than the limit of quantitation

Attachment H-1: Samples Associated with DQE

Sample ID	Collection Date	Sample Type	Matrix
13Q3CG039-EB01-GW-0	19-Aug-13	EB	Water
13Q3CG039-GWEB01	23-Aug-13	EB	Water
13Q3CG039-IW02-4551-GW-0EB	19-Aug-13	EB	Water
13Q3DA085-EB01-GW-0	26-Aug-13	EB	Water
13Q3DA085-EB02-GW-0	30-Aug-13	EB	Water
13Q3CG039-AP3748-GW-1	23-Aug-13	FD	Groundwater
13Q3CG039-AP4550-GW-1	16-Aug-13	FD	Groundwater
13Q3CG039-IW02-4551-GW-1	19-Aug-13	FD	Groundwater
13Q3DA085-AP4341-GW-1	27-Aug-13	FD	Groundwater
AP-4413-13-0830-1	26-Aug-13	FD	Groundwater
13Q31W-01-4413-GW-0	26-Aug-13	N	Groundwater
13Q3CG039-AP3747-GW-0	20-Aug-13	N	Groundwater
13Q3CG039-AP3748-GW-0	23-Aug-13	N	Groundwater
13Q3CG039-AP3983R-GW-0	15-Aug-13	N	Groundwater
13Q3CG039-AP4344-GW-0	23-Aug-13	N	Groundwater
13Q3CG039-AP4353-GW-0	20-Aug-13	N	Groundwater
13Q3CG039-AP4550-GW-0	16-Aug-13	N	Groundwater
13Q3CG039-AP4551-GW-0	15-Aug-13	N	Groundwater
13Q3CG039-AP5246-GW-0	23-Aug-13	N	Groundwater
13Q3CG039-AP5683-GW-0	22-Aug-13	N	Groundwater
13Q3CG039-IW013983-GW-0	16-Aug-13	N	Groundwater
13Q3CG039-IW014550-GW-0	16-Aug-13	N	Groundwater
13Q3CG039-IW014551-GW-0	16-Aug-13	N	Groundwater
13Q3CG039-IW023983-GW-0	16-Aug-13	N	Groundwater
13Q3CG039-IW024550-GW-0	16-Aug-13	N	Groundwater
13Q3CG039-IW02-4551-GW-0	19-Aug-13	N	Groundwater
13Q3DA085-AP3468-GW-0	28-Aug-13	N	Groundwater
13Q3DA085-AP3468-GW-0RE	23-Sep-13	N	Groundwater
13Q3DA085-AP3534-GW-0	28-Aug-13	N	Groundwater
13Q3DA085-AP3774-GW-0	29-Aug-13	N	Groundwater
13Q3DA085-AP3870-GW-0	29-Aug-13	N	Groundwater
13Q3DA085-AP3871-GW-0	28-Aug-13	N	Groundwater
13Q3DA085-AP3893-GW-0	28-Aug-13	N	Groundwater
13Q3DA085-AP4341-GW-0	27-Aug-13	N	Groundwater
13Q3DA085-AP4342-GW-0	26-Aug-13	N	Groundwater
13Q3DA085-AP4411-GW-0	29-Aug-13	N	Groundwater

Attachment H-1: Samples Associated with DQE

Sample ID	Collection Date	Sample Type	Matrix
13Q3DA085-ROI-4413-0	26-Aug-13	N	Groundwater
AP-4413-13-0830-0	26-Aug-13	N	Groundwater
13Q3CG039-GWTB01	20-Aug-13	TB	Water
13Q3CG039-TB01-GW-0	15-Aug-13	TB	Water
13Q3DA085-TB01-GW-0	27-Aug-13	TB	Water
13Q3DA085-TB01-GW-0	26-Aug-13	TB	Water

Notes:

EB = equipment blank
FD= field duplicate
N = primary sample
TB = trip blank

Attachment H-2: Laboratory Data Review Checklists

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Attachment H-2: Laboratory Data Review Checklists

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Laboratory Data Review Checklist

CompletedBy	Berney Kidd		
Title	Project Chemist	Date	11/12/2013
CS Report Name		ReportDate	8/27/2013
Consultant Firm	CH2M Hill		
Laboratory Name	Applied Sciences Laboratory	Laboratory Report Number	M2526
ADEC File Number		ADECRecKeyNumber	

1. Laboratory

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

◉ Yes ○ No ○ NA (Please explain.) 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 ◉ NA (Please explain.) Comments:

No samples transferred.

2. Chain of Custody (COC)

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Correct analyses requested?

◉ Yes ○ No ○ NA (Please explain.) Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Samples received at 4.1C.

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

Sample ID 13Q3CG039-1W02-4551-GW-01 on chain of custody is 13Q3CG039-IW02-4551-GW-1 on container labels. Sample logged in and analyzed as 13Q3CG039-IW02-4551-GW-1.
Sample 13Q3CG039-IW02-4551-GW-1 was labeled as 13Q3CG039-IW02-4551-GW-0FD. Sample logged in and analyzed as 13Q3CG039-IW02-4551-GW-1.
Chain of custody requested Method E375.4 for sulfate. Sampled logged in and analyzed for sulfate by E300.0.
MS/MSD analysis requested for Method E310.1 was not logged in and analyzed; MS/MSD analysis is not typical for this method.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as qualified.

4. Case Narrative

a.Present and understandable?

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

E300.0:
Chloride detected in the EB and CCB.
E300.0M:
Acetic acid detected in the EB.
MS/MSD RPD exceedance.
E310.1:
Target analytes detected in the EB.
E353.2:
No items of interest.
E376.2:
No items of interest.
RSK-175:
Methane detected in the RB and TB.
FD RPD exceedance.
SW6010B:
Target analyte detected in the EB.
SW7470A:
No items of interest.
SW9060:
TOC detected in the EB.
SW8260C:
Target analytes detected in the EB.
CCV recovery exceedance.

c. Were all corrective actions documented?

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

Comments:

All data are usable as qualified.

5. Samples Results

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. All applicable holding times met?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. All soils reported on a dry weight basis?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No soil samples reported.

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

○ Yes ○ No ◉ NA (Please explain.) Comments:

For comparison to cleanup levels, see site-specific report.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as qualified.

6. QC Samples

a. Method Blank

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. All method blank results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Method Blank detects: Alkalinity for E310.1.

iii. If above PQL, what samples are affected?

Comments:

13Q3CG039-AP3983R-GW-0, 13Q3CG039-AP4550-GW-0, 13Q3CG039-AP4550-GW-1, 13Q3CG039-AP4551-GW-0

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

○ Yes ◉ No ○ NA (Please explain.) Comments:

Associated sample detects greater than five times the blank concentration and non-detects were not qualified.

v. Data quality or usability affected? (Please explain)

Comments:

No data affected, associated samples detected greater than five times the blank concentration.

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 ○ NA (Please explain.) Comments:

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

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 ○ NA (Please explain.) Comments:

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

Comments:

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

○ Yes ○ No ◉ NA (Please explain.) Comments:

vii. Data quality or usability affected? (Please explain)

Comments:

All data are usable as qualified.

c. Surrogates - Organics Only

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

◉ Yes ○ No ○ NA (Please explain.) 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 ○ NA (Please explain.) Comments:

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

○ Yes ○ No ◉ NA (Please explain.) Comments:

No surrogate exceedances.

iv. Data quality or usability affected? (Use the comment box to explain.).
Comments:

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 ○ NA (Please explain.) 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 ○ NA (Please explain.) Comments:

iii. All results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Trip Blank detects: Methane for RSK-175.

iv. If above PQL, what samples are affected?
Comments:

13Q3CG039-AP3983R-GW-0, 13Q3CG039-AP4550-GW-0, 13Q3CG039-AP4550-GW-1, 13Q3CG039-AP4551-GW-0

v. Data quality or usability affected? (Please explain.)
Comments:

Associated sample detects less than five times the blank concentration were flagged 'B'. Associated sample detects greater than five times the blank concentration and non-detects were not qualified.

e. Field Duplicate

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Submitted blind to lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

$$RPD\ (\%) = \text{Absolute Value of: } \frac{(R1 - R2) \times 100}{((R1 + R2)/2)}$$

Where R1 = Sample Concentration
R2 = Field Duplicate Concentration

○ Yes ◉ No ○ NA (Please explain.) Comments:

These samples were out of control for RSK-175: Methane (13Q3CG039-AP4550-GW-0, %RPD 199.64 vs 30), Methane (13Q3CG039-AP4550-GW-1, %RPD 199.64 vs 30), associated sample results were flagged J.

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

Data qualified as estimated; usable as qualified.

f. Decontamination or Equipment Blank (if applicable)

◉ Yes ○ No ○ NA (Please explain.) Comments:

i. All results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Equipment Blank detects: Chloride for E300.0.

These analytes had Equipment Blank detects: Acetic Acid for E300.0M.

These analytes had Equipment Blank detects: Alkalinity for E310.1.

These analytes had Equipment Blank detects: Methane for RSK-175.

These analytes had Equipment Blank detects: Dissolved Manganese for SW6010B.

These analytes had Equipment Blank detects: Acetone, Chloroform, Trichloroethene, Toluene for SW8260C.

These analytes had Equipment Blank detects: Total Organic Carbon for SW9060.

ii. If above PQL, what samples are affected?

13Q3CG039-AP3983R-GW-0, 13Q3CG039-AP4550-GW-0, 13Q3CG039-AP4550-GW-1, 13Q3CG039-AP4551-GW-0, 13Q3CG039-IW013983-GW-0, 13Q3CG039-IW014550-GW-0, 13Q3CG039-IW014551-

GW-0, 13Q3CG039-IW023983-GW-0, 13Q3CG039-IW024550-GW-0, 13Q3CG039-IW02-4551-GW-0, 13Q3CG039-IW02-4551-GW-1

iii. Data quality or usability affected? (Please explain.)

Associated sample detects less than five times (10 times for acetone) the blank concentrations were flagged 'B'. Associated sample detects greater than five times the blank concentration and non-detects were not qualified.

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

a. Defined and appropriate?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Calibration:

Chloride was detected in a continuing calibration blank for Method E300.0. Associated samples 13Q3CG039-AP3983R-GW-0, 13Q3CG039-AP4550-GW-0, 13Q3CG039-AP4550-GW-1, 13Q3CG039-AP4551-GW-0 were detected greater than five times the blank concentration and were not qualified.

The recovery of chloroethane was greater than the upper control limit in a continuing calibration verification for Method SW8260C. Associated samples 13Q3CG039-AP3983R-GW-0, 13Q3CG039-AP4550-GW-0, 13Q3CG039-AP4550-GW-1, 13Q3CG039-AP4551-GW-0, 13Q3CG039-IW013983-GW-0, 13Q3CG039-IW014550-GW-0, 13Q3CG039-IW014551-GW-0, 13Q3CG039-IW023983-GW-0, 13Q3CG039-IW024550-GW-0, 13Q3CG039-IW02-4551-GW-0, 13Q3CG039-IW02-4551-GW-1 were nondetect and no data were qualified.

Matrix:

These samples were flagged for Matrix spike duplicate recovery criteria less than the lower control limit: TCE (13Q3CG039-IW014551-GW-0, SD 69% LCL = 70 UCL = 130) for SW8260C. Associated detected result flagged "J".

The RPD of formic acid was greater than criteria in the MS/MSD set of sample 13Q3CG039-AP4550-GW-0 for Method E300.0M. The associated nondetected result was not qualified.

Laboratory Data Review Checklist

CompletedBy	Berney Kidd		
Title	Project Chemist	Date	11/12/2013
CS Report Name		ReportDate	9/24/2013
Consultant Firm	CH2M Hill		
Laboratory Name	Applied Sciences Laboratory	Laboratory Report Number	M2594
ADEC File Number		ADECRecKeyNumber	

1. Laboratory

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

◉ Yes ○ No ○ NA (Please explain.) 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 ◉ NA (Please explain.) Comments:

No samples transferred.

2. Chain of Custody (COC)

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Correct analyses requested?

◉ Yes ○ No ○ NA (Please explain.) Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Samples received at 4.2C and 4.8C.

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

No discrepancies.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as qualified.

4. Case Narrative

a.Present and understandable?

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

SW8260C:
No items of interest.
RSK-175:
No items of interest.
SW6010B:
No items of interest.
E300.0:
No items of interest.
E353.2:
No items of interest.

c. Were all corrective actions documented?

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

Comments:

All data are usable as qualified.

5. Samples Results

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. All applicable holding times met?

○ Yes ◉ No ○ NA (Please explain.) Comments:

Samples 13Q3CG039-AP3747-GW-0 and 13Q3CG039-AP4353-GW-0 were analyzed one day outside of holding time for Method SW8260C. Associated detected results were qualified as estimated and flagged "J"; associated nondetected results were qualified as estimated and flagged "UJ".

c. All soils reported on a dry weight basis?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No soil samples reported.

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

○ Yes ○ No ◉ NA (Please explain.) Comments:

For comparison to cleanup levels, see site-specific report.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as qualified.

6. QC Samples

a. Method Blank

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. All method blank results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Method Blank detects: Manganese, dissolved for SW6010B.

iii. If above PQL, what samples are affected?

Comments:

13Q3CG039-AP3747-GW-0, 13Q3CG039-AP3748-GW-0, 13Q3CG039-AP3748-GW-1, 13Q3CG039-AP4344-GW-0, 13Q3CG039-AP4353-GW-0, 13Q3CG039-AP5246-GW-0, 13Q3CG039-AP5683-GW-0

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

Associated sample detects less than five times the blank concentration were flagged 'B'. Associated sample detects greater than five times the blank concentration and non-detects were not qualified.

v. Data quality or usability affected? (Please explain)

Comments:

Some data qualified as estimated; usable as qualified.

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 ○ NA (Please explain.) Comments:

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

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 ○ NA (Please explain.) Comments:

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

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

○ Yes ○ No ◉ NA (Please explain.) Comments:

vii. Data quality or usability affected? (Please explain)
Comments:

All data are usable as qualified.

c. Surrogates - Organics Only

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

◉ Yes ○ No ○ NA (Please explain.) 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 ○ NA (Please explain.) Comments:

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

○ Yes ○ No ◉ NA (Please explain.) Comments:

No surrogate exceedances.

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

Comments:

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 ○ NA (Please explain.) 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 ○ NA (Please explain.) Comments:

iii. All results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Trip Blank detects: Methane for RSK-175.

iv. If above PQL, what samples are affected?

Comments:

13Q3CG039-AP3747-GW-0, 13Q3CG039-AP3748-GW-0, 13Q3CG039-AP3748-GW-1, 13Q3CG039-AP4344-GW-0, 13Q3CG039-AP4353-GW-0, 13Q3CG039-AP5246-GW-0, 13Q3CG039-AP5683-GW-0

v. Data quality or usability affected? (Please explain.)

Comments:

Associated sample detects less than five times the blank concentration were flagged 'B'. Associated sample detects greater than five times the blank concentration and non-detects were not qualified.

e. Field Duplicate

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Submitted blind to lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

$$RPD\ (\%) = \text{Absolute Value of: } \frac{(R1 - R2) \times 100}{((R1 + R2)/2)}$$

Where R1 = Sample Concentration

R2 = Field Duplicate Concentration

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

○ Yes ○ No ◉ NA (Please explain.) Comments:

No field duplicate Relative Percent Difference exceedences.

f. Decontamination or Equipment Blank (if applicable)

◉ Yes ○ No ○ NA (Please explain.) Comments:

i. All results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Equipment Blank detects: Methane for RSK-175.

These analytes had Equipment Blank detects: Iron,dissolved, Manganese, dissolved for SW6010B.

ii. If above PQL, what samples are affected?

13Q3CG039-AP3747-GW-0, 13Q3CG039-AP3748-GW-0, 13Q3CG039-AP3748-GW-1, 13Q3CG039-AP4344-GW-0, 13Q3CG039-AP4353-GW-0, 13Q3CG039-AP5246-GW-0, 13Q3CG039-AP5683-GW-0

iii. Data quality or usability affected? (Please explain.)

Associated sample detects less than five times the blank concentration were flagged 'B'. Associated sample detects greater than five times the blank concentration and non-detects were not qualified.

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

a. Defined and appropriate?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No other flags applied.

Laboratory Data Review Checklist

CompletedBy	Berney Kidd		
Title	Project Chemist	Date	11/12/2013
CS Report Name		ReportDate	9/27/2013
Consultant Firm	CH2M Hill		
Laboratory Name	Applied Sciences Laboratory	Laboratory Report Number	M2615
ADEC File Number		ADECRecKeyNumber	

1. Laboratory

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

◉ Yes ○ No ○ NA (Please explain.) 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 ◉ NA (Please explain.) Comments:

No samples transferred.

2. Chain of Custody (COC)

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Correct analyses requested?

◉ Yes ○ No ○ NA (Please explain.) Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Samples received at 5.7C.

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

Metals bottles received for samples AP-4414-14-0830-0, AP-4414-14-0830-0MS, AP-4414-14-0830-0MSD, AP-4414-14-0830-1 are mislabeled. All sample IDs start with 13Q3DA085 on bottle. Samples logged in and analyzed per the chain of custody.
Sulfide bottle received for sample AP-4414-14-0830-0 is mislabeled. Sample ID starts with 13Q3DA085 on bottle. Sample logged in and analyzed per the chain of custody.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as qualified.

4. Case Narrative

a.Present and understandable?

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

SW9060:
No items of interest.
E310.1:
No items of interest.
E376.2:
Holding Time(s):
E376.2: Samples were analyzed outside of holding time.
SW8260C:
No items of interest.
RSK-175:
No items of interest
SW6010B:
No items of interest.
E300.0M:
No items of interest.
E300.0:
No items of interest.
E353.2:
Matrix Spike/Matrix Spike Duplicate(s):
E353.2: MS recovery of Nitrate/Nitrite-N (88%) in AP-4413-13-0830-0MS did not meet acceptance criteria of 90-110%.

c. Were all corrective actions documented?

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

Comments:

All data are usable as qualified.

5. Samples Results

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. All applicable holding times met?

○ Yes ◉ No ○ NA (Please explain.) Comments:

Samples AP-4413-13-0830-0 and AP-4413-13-0830-1 were analyzed two days outside of holding time for Method E376.2. Associated detected results were qualified as estimated and flagged “J”; associated nondetected results were qualified as estimated and flagged “UJ”.

c. All soils reported on a dry weight basis?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No soil samples reported.

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

○ Yes ○ No ◉ NA (Please explain.) Comments:

For comparison to cleanup levels, see site-specific report.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as qualified.

6. QC Samples

a. Method Blank

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. All method blank results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Method Blank detects: Lactic Acid for E300.0M.

These analytes had Method Blank detects: Methane for RSK-175.

These analytes had Method Blank detects: Manganese, dissolved for SW6010B.

These analytes had Method Blank detects: Total Organic Carbon for SW9060.

iii. If above PQL, what samples are affected?

Comments:

13Q3DA085-AP4342-GW-0, AP-4413-13-0830-0, AP-4413-13-0830-1

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

Associated sample detects less than five times the blank concentrations were flagged 'B'. Associated sample detects greater than five times the blank concentration and non-detects were not qualified.

v. Data quality or usability affected? (Please explain)

Comments:

Some data qualified as estimated; usable as qualified.

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 ○ NA (Please explain.) Comments:

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

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 ○ NA (Please explain.) Comments:

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

Comments:

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

○ Yes ○ No ◉ NA (Please explain.) Comments:

vii. Data quality or usability affected? (Please explain)

Comments:

All data are usable as qualified.

c. Surrogates - Organics Only

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

◉ Yes ○ No ○ NA (Please explain.) 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 ○ NA (Please explain.) Comments:

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

○ Yes ○ No ◉ NA (Please explain.) Comments:

No surrogate exceedances.

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

Comments:

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 ○ NA (Please explain.) 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 ○ NA (Please explain.) Comments:

iii. All results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Trip Blank detects: Methane for RSK-175.

iv. If above PQL, what samples are affected?

Comments:

13Q3DA085-AP4342-GW-0, AP-4413-13-0830-0, AP-4413-13-0830-1

v. Data quality or usability affected? (Please explain.)

Comments:

Associated sample detects less than five times the blank concentrations were flagged 'B'. Associated sample detects greater than five times the blank concentration and non-detects were not qualified.

e. Field Duplicate

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Submitted blind to lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

$$RPD\ (\%) = \text{Absolute Value of: } \frac{(R1 - R2) \times 100}{((R1 + R2)/2)}$$

Where R1 = Sample Concentration
R2 = Field Duplicate Concentration

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

○ Yes ○ No ◉ NA (Please explain.) Comments:

No field duplicate Relative Percent Difference exceedences.

f. Decontamination or Equipment Blank (if applicable)

◉ Yes ○ No ○ NA (Please explain.) Comments:

i. All results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Equipment Blank detects: Chloride for E300.0.

These analytes had Equipment Blank detects: Methane for RSK-175.

These analytes had Equipment Blank detects: Manganese, dissolved for SW6010B.

These analytes had Equipment Blank detects: Acetone, Tetrachloroethene, Toluene for SW8260C.

These analytes had Equipment Blank detects: Total Organic Carbon for SW9060.

ii. If above PQL, what samples are affected?

13Q31W-01-4413-GW-0, 13Q3DA085-AP4342-GW-0, 13Q3DA085-ROI-4413-0, AP-4413-13-0830-0, AP-4413-13-0830-1

iii. Data quality or usability affected? (Please explain.)

Associated sample detects less than five times (10 times for acetone) the blank concentrations were flagged 'B'. Associated sample detects greater than five times the blank concentration and non-detects

were not qualified.

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)
   a. Defined and appropriate?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Matrix:

These samples were flagged for Matrix spike recovery less than the lower control limit: Nitrate/Nitrite-N (AP-4413-13-0830-0, %R = 88 LCL 90 UCL =110) for E353.2. Associated detected result flagged "J".

Laboratory Data Review Checklist

CompletedBy	Berney Kidd		
Title	Project Chemist	Date	11/12/2013
CS Report Name		ReportDate	9/20/2013
Consultant Firm	CH2M Hill		
Laboratory Name	Applied Sciences Laboratory	Laboratory Report Number	M2646
ADEC File Number		ADECRecKeyNumber	

1. Laboratory

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

◉ Yes ○ No ○ NA (Please explain.) 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 ◉ NA (Please explain.) Comments:

No samples transferred.

2. Chain of Custody (COC)

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Correct analyses requested?

◉ Yes ○ No ○ NA (Please explain.) Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Samples received at 2.1C.

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

Sample 13Q3DA085-AP3468-GW-0 for Method E376.1 was incorrectly preserved. Sample analysis was canceled.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as qualified.

4. Case Narrative

a.Present and understandable?

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

SW8260C:
No items of interest.
RSK-175:
No items of interest.
AK101:
No items of interest.
AK102/103:
No items of interest.
SW6010B:
No items of interest.
E300.0:
No items of interest.
E353.2:
No items of interest.

c. Were all corrective actions documented?

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

Comments:

All data are usable as qualified.

5. Samples Results

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. All applicable holding times met?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. All soils reported on a dry weight basis?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No soil samples reported.

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

○ Yes ○ No ◉ NA (Please explain.) Comments:

For comparison to cleanup levels, see site-specific report.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as qualified.

6. QC Samples

a. Method Blank

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. All method blank results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Method Blank detects: TPH-Diesel for AK102/103.

iii. If above PQL, what samples are affected?

Comments:

13Q3DA085-AP4341-GW-0, 13Q3DA085-AP4341-GW-1,

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

Associated sample detects less than five times the blank concentration were flagged 'B'.

v. Data quality or usability affected? (Please explain)

Comments:

Some data qualified as estimated.; usable as qualified.

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 ○ NA (Please explain.) Comments:

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

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 ○ NA (Please explain.) Comments:

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

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

○ Yes ○ No ◉ NA (Please explain.) Comments:

vii. Data quality or usability affected? (Please explain)
Comments:

All data are usable as qualfied.

c. Surrogates - Organics Only

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

◉ Yes ○ No ○ NA (Please explain.) 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 ○ NA (Please explain.) Comments:

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

○ Yes ○ No ◉ NA (Please explain.) Comments:

No surrogate exceedances.

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

Comments:

All data are usable as qualfied.

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 ○ NA (Please explain.) 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 ○ NA (Please explain.) Comments:

iii. All results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Trip Blank detects: Methane for RSK-175.

iv. If above PQL, what samples are affected?

Comments:

13Q3DA085-AP3468-GW-0, 13Q3DA085-AP3534-GW-0, 13Q3DA085-AP3774-GW-0, 13Q3DA085-AP3870-GW-0, 13Q3DA085-AP3871-GW-0, 13Q3DA085-AP3893-GW-0, 13Q3DA085-AP4341-GW-0, 13Q3DA085-AP4341-GW-1, 13Q3DA085-AP4411-GW-0,

v. Data quality or usability affected? (Please explain.)

Comments:

Associated sample detects less than five times the blank concentration were flagged 'B'. Associated sample detects greater than five times the blank concentration and non-detects were not qualified.

e. Field Duplicate

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. Submitted blind to lab?

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

$$RPD\ (\%) = \text{Absolute Value of: } \frac{(R1 - R2) \times 100}{((R1 + R2)/2)}$$

Where R1 = Sample Concentration

R2 = Field Duplicate Concentration

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

○ Yes ○ No ◉ NA (Please explain.) Comments:

No field duplicate Relative Percent Difference exceedences.

f. Decontamination or Equipment Blank (if applicable)

◉ Yes ○ No ○ NA (Please explain.) Comments:

i. All results less than PQL?

○ Yes ◉ No ○ NA (Please explain.) Comments:

These analytes had Equipment Blank detects: TPH-Diesel, TPH-Oil for AK102/103.

These analytes had Equipment Blank detects: Chloride, Sulfate for E300.0.

These analytes had Equipment Blank detects: Methane for RSK-175.

These analytes had Equipment Blank detects: Iron, dissolved for SW6010B.

These analytes had Equipment Blank detects: Acetone, Toluene for SW8260C.

ii. If above PQL, what samples are affected?

13Q3DA085-AP3468-GW-0, 13Q3DA085-AP3534-GW-0, 13Q3DA085-AP3774-GW-0, 13Q3DA085-AP3870-GW-0, 13Q3DA085-AP3871-GW-0, 13Q3DA085-AP3893-GW-0, 13Q3DA085-AP4341-GW-0, 13Q3DA085-AP4341-GW-1, 13Q3DA085-AP4411-GW-0

iii. Data quality or usability affected? (Please explain.)

Associated sample detects less than five times (10 times for acetone) the blank concentrations were flagged 'B'. Associated sample detects greater than five times the blank concentration and non-detects were not qualified.

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

a. Defined and appropriate?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No other flags applied.

Laboratory Data Review Checklist

CompletedBy	Berney Kidd		
Title	Project Chemist	Date	11/12/2013
CS Report Name		ReportDate	10/3/2013
Consultant Firm	CH2M Hill		
Laboratory Name	Applied Sciences Laboratory	Laboratory Report Number	M2839
ADEC File Number		ADECRecKeyNumber	

1. Laboratory

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

◉ Yes ○ No ○ NA (Please explain.) 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 ◉ NA (Please explain.) Comments:

No samples transferred.

2. Chain of Custody (COC)

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. Correct analyses requested?

◉ Yes ○ No ○ NA (Please explain.) Comments:

3. Laboratory Sample Receipt Documentation

a. Sample/cooler temperature documented and within range at receipt (4° ± 2° C)?

◉ Yes ○ No ○ NA (Please explain.) Comments:

Sample received at 4.2C.

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

E353.2:
COC handwritten.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as qualified.

4. Case Narrative

a.Present and understandable?

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

E353.2:
No items of interest.

c. Were all corrective actions documented?

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

Comments:

All data are usable as qualified.

5. Samples Results

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

b. All applicable holding times met?

◉ Yes ○ No ○ NA (Please explain.) Comments:

c. All soils reported on a dry weight basis?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No soil samples reported.

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

○ Yes ○ No ◉ NA (Please explain.) Comments:

For comparison to cleanup levels, see site-specfic report.

e. Data quality or usability affected? (Please explain)

Comments:

All data are usable as qualified.

6. QC Samples

a. Method Blank

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. All method blank results less than PQL?

◉ Yes ○ No ○ NA (Please explain.) Comments:

iii. If above PQL, what samples are affected?

Comments:

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

○ Yes ○ No ◉ NA (Please explain.) Comments:

v. Data quality or usability affected? (Please explain)

Comments:

All data are usable as qualified.

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 ◉ NA (Please explain.) Comments:

No organics reported.

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

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 ○ NA (Please explain.) Comments:

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

◉ Yes ○ No ○ NA (Please explain.) Comments:

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

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

○ Yes ○ No ◉ NA (Please explain.) Comments:

vii. Data quality or usability affected? (Please explain)
Comments:

All data are usable as qualified.

c. Surrogates - Organics Only

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

○ Yes ○ No ◉ NA (Please explain.) Comments:

No organics reported.

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 ◉ NA (Please explain.) Comments:

No organics reported.

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

○ Yes ○ No ◉ NA (Please explain.) Comments:

No organics reported.

iv. Data quality or usability affected? (Use the comment box to explain.).
Comments:

All data are usable as qualified.

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 ◉ NA (Please explain.) Comments:

No volatiles reported.

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 ◉ NA (Please explain.) Comments:

No volatiles reported.

iii. All results less than PQL?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No volatiles reported.

iv. If above PQL, what samples are affected?

Comments:

v. Data quality or usability affected? (Please explain.)

Comments:

No volatiles reported.

e. Field Duplicate

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

○ Yes ○ No ◉ NA (Please explain.) Comments:

No FD included, resample only.

ii. Submitted blind to lab?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No FD included, resample only.

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

$$RPD\ (\%) = \text{Absolute Value of: } \frac{(R1 - R2) \times 100}{((R1 + R2)/2)}$$

Where R1 = Sample Concentration
R2 = Field Duplicate Concentration

○ Yes ○ No ◉ NA (Please explain.) Comments:

No FD included, resample only.

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

○ Yes ○ No ◉ NA (Please explain.) Comments:

No FD included, resample only.

f. Decontamination or Equipment Blank (if applicable)

◉ Yes ○ No ○ NA (Please explain.) Comments:

i. All results less than PQL?

◉ Yes ○ No ○ NA (Please explain.) Comments:

ii. If above PQL, what samples are affected?

iii. Data quality or usability affected? (Please explain.)

7. Other Data Flags/Qualifiers (ACOE, AFCEE, Lab Specific, etc.)
   a. Defined and appropriate?

○ Yes ○ No ◉ NA (Please explain.) Comments:

No other flags applied.